

**First Workshop on the Development of Municipal Waste Management Strategy for
Mandalay,**

in collaboration with

Mandalay City Development Committee (MCDC),

**Ministry of Natural resources and Environment Conservation (MONREC) of the
Government of Myanmar,**

The United Nations Environmental Programme (UNEP) and

The Institute for Global Environmental Strategies (IGES)

16 – 17 June 2016, Mandalay Hill Resort, Mandalay



**Prepared
By**

Environmental Quality Management (EQM)

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ACRONYMS/ABBREVIATIONS

ADB	Asia Development Bank
AIT RRC.AP	Asian Institute of Technology Regional Resource Centre for Asia and the Pacific
BOD	Biological Oxygen Demand
CBOs	Community Based Organizations
CSOs	Communities Services Organizations
DOE	Department of Engineering
DISI	Department of Industrial Supervision and Inspection
ECD	Environmental Conservation Department
GMP	Good Manufacturing Practice
GSMI	Gaia Sustainable Management Institute
HW	Hazardous waste
INGOs	International Non-government Organizations
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
MCDC	Mandalay City Development Committee
MDY	Mandalay
MOE	Ministry of Educations
MOH	Ministry of Health
MONREC	Ministry of Natural Resources and Environmental Conservation
MRG	Mandalay Regional Government
MTU	Mandalay Technology University
MWF	Myanmar Women Federation
NGOs	Non-governmental Organizations
NHW	Non-hazardous waste
PPP	Polluter Pays Principles
UMFCCI	Union of Myanmar Federation of Chambers of Commerce and Industry
WWTS	Wastewater treatment system

Workshop Report on the Development of Municipal Waste Management Strategy for Mandalay

1 Report on the management of City Level Workshop

1.1 Background

Myanmar's first *Workshop on the Development of Municipal Waste Management Strategy for Mandalay*, organized in collaboration with the Mandalay City Development Committee, the Ministry of Natural Resources and Environment Conservation (MONREC) of the Government of Myanmar, the United Nations Environment Programme's International Environmental Technology Centre (UNEP-IETC) and the Institute for Global Environmental Strategies (IGES) – Centre Collaborating with UNEP on Environmental Technologies (CCET) brought together national and local policy makers, public waste management providers and related stakeholders to provide technical inputs towards formulating a waste management strategy at the city level.

Mandalay is not only Myanmar's second largest city but also a major trading and communications hub located in the central part of the country. Despite the city's increasing population (1.6 million as of 2016), economic growth and rapid urbanization and industrialization, all waste related responsibilities are held by Mandalay City Development Committee (MCDC). Institutional, resource and infrastructure gaps are contributing to insufficient waste management and resulting in adverse environmental impacts.

This workshop focused on identifying current waste management gaps and challenges to inform the preparation of a city level strategy based on a holistic waste management approach covering waste in all forms (solid waste, liquid waste / wastewater, and gaseous emissions), in accordance with the intention and capacity of respective city level waste management providers and stakeholders.

1.2 Planning meeting before the workshop

In preparation for the workshop, consultation meetings were held with the City Development Committees (Yangon, Mandalay and Nay Pyi Taw) and CCET to discuss the organization and agenda for city level dialogue on waste management.

The main outcomes of these meetings included:

- Further understanding on the holistic waste management approach by public waste management providers with commitments to improve current waste management practice
- Development of program agenda for the City level workshop

1.3 Quick study

A quick study/baseline report based on inputs and discussions with MCDC and other City Development Committees was prepared to review and assess the current waste management gaps and challenges at the municipal levels.

The findings of the study will serve to provide basic information for drafting the city level waste management strategy with a view to address waste issues in a holistic and integrated manner.

1.4 Selection of target audience / participants, venues

A number of participants including both government and non-governmental organizations involved in waste management were invited to the workshop. The workshop comprised a total of seventy-three (73) local participants and six (6) international participants. (Refer to Annex (I)).

1.5 Workshop methodology

(i) Policy maker's presentation (Chief Minister's speech)

At the opening ceremony, the Chief Minister Dr. Zaw Myint Maung representing Mandalay Regional Government delivered a speech emphasizing that the objective of the workshop would be to support a municipal waste management strategy in line with the priorities of Mandalay Regional Government. The main points of this speech are as follows:

- This workshop is very important for addressing the current mismanagement of waste.
- The new Union Government is tackling urban development as a first matter of priority.
- It is inevitable that people will migrate from their places of residence as job opportunities reduce in number, and relocate to places with greater likelihood of finding employment.
- The two job creation centres in Myanmar are largely Yangon and Mandalay.
- Both of these cities are administrated by their respective mayors.
- However, as public expenses typically exceed municipal budgets, many issues and criticisms often arise.
- Urban development cannot successfully be pursued without considering the need of migrant workers.
- According to recent data, there are currently 1.5 million migrant workers and this number is increasing in Mandalay.
- At present, responsible city-level administrators are involved in urban planning. Yet, waste management plans have been excluded from a number of urban planning projects taking place in Mandalay.
- It is important to also focus on grassroots level activities while supporting the operation of major projects.
- At the same time, principles of coordination and cooperation are frequently lacking in projects.
- Certain actors working in the development field are should be more closely supervised and requested to pay tax.
- Waste products identified in management plans should be analyzed with regard to where and how they are treated, as well as whether they could be used to produce energy.
- Accordingly, workshop discussion should examine ways to combine waste treatment and water management plans in line with the potential for generating electricity and seek to identify solutions on this basis.
- An intended milestone of the Mandalay Regional Government is to support Mandalay to become a modern developed city.
- A city development master plan survey of Mandalay is currently underway. It is my sincere hope the output of this workshop can contribute towards that plan.
- Municipal committees should be organized according to established laws and regulations.

- In closing, it is my wish that this two-day-workshop is a success and that the outcomes are in line with the priorities of the Regional Government.
- I will make a point of circulating the outcomes of the workshop among organizations which request such information.
- Please make a point of openly discussing how migrant workers and displaced persons residing in Mandalay can be considered in waste management plans.

DR. Ye Lwin, Mayor's Message

Excellencies, Distinguished Guests, Ladies and Gentlemen,

- As Mandalay is situated at the center of Myanmar and accessible both internally as well as to neighboring countries, the city has expanding economically based on the development of a number of key sectors including tourism. The population of Mandalay has also been growing in size because of an influx of migrants who are relocating in the city from other areas. Mandalay is now being driven by the two main currents of modernization and urbanization.
- MCDC has been working to meet the needs of its 1.5 million people. The booming of the city's economy has been accompanied by an increase in factory production together with vehicles used for cargo transportation, resulting in lifestyle changes as well as air, water and overall environment pollution. MCDC has also observed that Mandalay has been facing considerable challenges with the management of solid waste, which is why the city has renewed its focus on solid waste management. We are cooperating with international organizations in promoting solid waste collection, transportation and disposal. Today's workshop is such example of the city's cooperation with international organizations.
- Solid, liquid and air pollution issues will be discussed in today workshop and we hope the workshop will assist in formulating relevant strategies for supporting municipal waste management. It is my hope that participants will actively contribute in workshop discussions, providing valuable and useful suggestions so that city government departments, social and business organizations, as well as environmental advocates can work towards implementing supportive policies. In addition, participants are scheduled to visit a landfill site, waste water treatment area and recycling area. I hope these site visits will help to support your efforts in drafting the respective strategy.
- In addition, it is my wish that the outcomes of the previous Workshop for Developing the National Waste Management Strategies in Myanmar, held in Nay Pyi Taw on June 13 to 15 will be connected with the outcomes of today workshop which then will inform the preparation of action plans.
- I'd like to express my sincere thanks to the responsible persons from UNEP, IGES and Kitakyushu who contributed to the organization of today's workshop as well as the Ministry of Natural Resources and Environment, MCDC and representatives of social organizations working in association with Mandalay Regional Government.

- In conclusion, on behalf of Mandalay citizens, I'm very proud that this Workshop is being held here because it is beneficial for the city, aligned with our efforts to promote a "Clean and Green Mandalay" for the safety and welfare of its residents. I'd like to conclude by saying--let's continue to work together to support a sustainability, conserving the environment to make Mandalay a Green City.

(ii) Participants' Presentations

Presentations by MONREC as well as MCDC highlighted the main issues and challenges related to waste management in Mandalay at the national and municipal levels, respectively. In addition, international experts from UNEP, IGES and others presented on international experiences with regard to waste management as well as the primary objectives associated with developing a city level waste management strategy, including developing guidelines, setting targets, ensuring policy coherence, and coordinating stakeholder inputs and concerns, among others.

(iii) Group Discussions

Following the presentations, participants were organized into three groups based on their experience working with in different waste management fields (namely, solid, liquid and industrial waste). Group discussions served as a participatory exercise for examining waste issues and challenges and identifying potential interventions for consideration in proposed action plans (see Annex I).

(iv) Workshop materials /resources

- Presentations (please refer to Annex VI)
- Moderators, facilitators and interpreter assisted in guiding group discussion
 - IGES personnel led the workshop as moderators
 - 3-4 facilitators experienced with waste management assisted the participants
 - One interpreter communicated the workshop proceedings in Myanmar language

(v) Field visit to the waste water treatment site at Mandalay

Each group consisting of approximately twenty (20) participants chose the following site visits according to their interest and the relevant field of expertise.

(1) Solid Waste Group - Thaug Inn Myauk Inn Landfill Site

A field visit was conducted to Thang Inn Myauk Inn, an engineered landfill and one of the two designated dumping stations in Mandalay. The landfill comprises a total area up to 22 acres and receives wastes from the southern part of Mandalay. At present, plastic bags collected from the dumping site are being recycled into plastic bins (upwards of 40 bins per day). In addition, a medical waste incinerator is also situated on site, however; it is not currently well integrated in the landfill's overall waste management system.

(2) Liquid Waste Group- Thin Gazar Creek

Thin Gazar Creek is currently receiving domestic waste water (grey water) which is treated by a series of three (3) aeration processes: at present two (2) of these aeration systems are operational while one (1) remains idle.

(3) Industrial Waste Group- Aung United Industry (Recycling Enterprise), Aung Moe Thu (Producer of Recycled Plastic Rope).

Aung United Industry is a recycling enterprise which collects raw materials including various metals derived from the disassembly of a range of equipment and items collected across Myanmar. Recycling affects ambient air quality as a result of low stack emissions which also has consequences for laborers' health, particularly among those working at high temperatures.

Aung Moe Thu industry is producing recycled plastic ropes from the collection of raw materials, particularly plastic bags. The washing process has negative impacts on nearby water sources.

1.6 Main challenges identified and lessons learned

Apart from some minor logistical issues, such as having to accommodate additional participants due to the strong interest of local government and NGOs, no significant challenges were identified that impeded the delivery of the workshop.

1.7 Discussion proceedings

The workshop discussions will be used as a preliminary strategy outline which is applicable for implementing future city waste management action plans.

1.7.1 Municipal solid waste management group discussion

Dr. Thwin Kyaw Kyaw (MCDC), U Than Htut (MCDC), Dr Yi Yi Myint Mandalay University (Chemistry Dept), Dr. Su Yi Myo (MCDC), Daw Bauk Yar (DISI), Daw Theingi Soe (MCDC), Daw Myo Ei Ei Soe Win (MCDC), Daw Thin Thin Aye (GSMI), Dr. Chaw Su Su Hmwe (MTU) , Daw Khin Mar Aye (DOE), Daw Khin Thin (Byatmaso Social Association), U Tun Min Latt (Yadanapone newspaper), Daw Kyawt Kyawt Swe (Education), as well as Daw Kyal Sin Htun (ECD) actively participated in the discussion.

Regarding **regulations and policies** concerning solid waste management, it was noted that although some relevant laws have been published, awareness raising is still needed both in government departments and at the community level, including on issues related to weak regulatory enforcement and the need for advancing the polluter pays principle. The role of public education bodies in drawing attention to the importance of waste laws and regulations was emphasized.

On the subject of **institutional frameworks** dealing with solid waste management, a primary issue that was highlighted is the lack of effective cooperation between different administrative departments and levels. It was agreed that future interventions should focus on fostering collaboration between five key sectors including Education, Government Ministries, Media, Institutes/Universities and Communities.

With regard to **technology and infrastructure**, MCDC works to address basic community needs with relevant partners, and the example of MCDC collaborating with Mandalay University to introduce organic waste composting systems was discussed. Citing the issue of a nonfunctioning medical incinerator in Mandalay as a counterexample, it was explained that specific waste technologies require both effective capacity and skilled labor to ensure that they can function sustainably over the long term.

In terms of **financial mechanisms**, insufficient budget for upgrading infrastructure was pointed out as a major constraint in funding effective waste technologies. Specific examples, such as the tax revenue generated from community members being diverted to other social initiatives, and the difficulties involved in collecting waste collection fees to finance large-scale projects, was discussed. Another point raised concerned the lack of research grants for R&D on waste

options, including those carried out by Chemistry Departments; it was noted that many have tested biodegradable plastic, but they do not possess sufficient budgets to carry the findings forward.

Ideas on financing the design of waste treatment systems, as well as recycling and resource reduction initiatives were exchanged.

On the issue of **stakeholder participation**, it was widely agreed that currently government participation is favored more highly than community level engagement activities. Challenges with promoting cooperation and collaboration between public, private and civil society stakeholder was cited as an important concern. Currently, CSOs are also working on issues of solid waste management but these activities are primarily concerned with the provision of waste services and the awareness promotion on solid waste management.

Based on these views, the following was proposed as a potential way forward:

- Both CDCs and community-level actors shall be responsible for waste segregation
- CDCs will focus on waste collection whereas communities, working in partnership with CDCs and other government sectors, NGOs and CSOs will tackle gaps pertaining to regulations

The discussion on **guiding principles**, focused on three main points:

- Ensuring proper waste segregation practices and promoting quality municipal services
- Encouraging behaviour changes related to 3Rs and appropriate disposal
- Developing a comprehensive and holistic city development plan that emphasizes the landfill diversion of solid waste

On the topic of **goal setting**, it was suggested that goals should be based on short term objectives so that MCDC can work on their immediate implementation. Participants agreed that the target goal set over the long term would emphasize Zero Waste and would inform the city's waste management priorities. In the short term, there was consensus that the focus would include a 20% reduction in waste generation, 80% target waste reductions in the city's collection system, 60% reduction in terms of transportation of solid waste and 60% reduction in final disposal.

Looking at development of **actions plan for implementations**, three strategies were set up.

Strategy (1): implemented within 1 year from July 2016 July 2017 July, the aim of this strategy will be to develop comprehensive and holistic city development plans focusing on minimizing solid waste disposals, enhancing rules and regulations and enforcing specific guidelines on waste management in collaboration between MCDC, MRG, ECD- MONREC, the private sector and related ministries

Strategy (2), planned to be implemented in five(5) years, will focus on ensuring waste segregation practices and quality municipal services by conducting awareness and education programs not only targeting institutions but also community level actors to support waste

segregation and guide timely collection of waste. MCDC, MOE, Ministries, CSOs and NGOs were suggested as the main responsible agencies in this regard.

Strategy (3) seeks to achieve the goals set out by supporting behavioral changes related to 3Rs and appropriate disposal of waste. Key proposals on this strategy include the development of sustainable action plans, the promoting of source segregation, utilizing organic waste composters, supporting waste to energy, bin allocations and recycling activities, among others. Private sector, as well as community-level actors and MCDC were suggested as the main responsible stakeholders for advancing these initiatives.

1.7.2 Liquid waste management group discussion

In this group, U Khin Maung Thin (MCDC), U Ye Mon (MCDC), U Zaw Myo Lwin (MCDC), Daw Naing Naing Win (MCDC), Dr. Than Htike Soe (Eco Model School), Dr. Zar Ni Mya Hlaing (Dept of Public Health), U Min Thein (ECD, Mandalay), U Than Htut Ko(CBO, Same Yaung So), U Soe Tint Aung (MCDC) and others members offered their views, knowledge, idea and experiences to the discussion.

On the topic of **regulations and policies**, a lack of compliance among polluters due to weak enforcement of specific wastewater laws was pointed out. Strengthening bylaws and regulations by MCDC and ECD, as well as enhancing public awareness were considered the main factors to be considered in fostering a cleaner environment. The small scale chlorination treatment of hospital wastewater was deliberated upon and discussed as inadequate solution.

Regarding the **institutional framework** pertaining to liquid waste, it was agreed that MCDC, ECD, DISI, MOH, Ministry of Labor, and Industrial Zone committee members comprised the responsible bodies for wastewater management in Mandalay. Enhancing cooperation and coordination between these bodies was emphasized as the main consideration for future action, recognizing human resource constraints of required staff in ECD.

Concerning **technology and infrastructure**, the need to procure high technology, and to better monitor water and wastewater quality were highlighted as currently only aeration is practiced as a conventional method of wastewater treatment.

In terms of **financial mechanisms**, it was established that the budget constraints are primary bottleneck in terms of liquid waste management, and that international sources of financing should be identified.

Looking at the issue of **stakeholder participation**, the group assessed the need to improve cooperation between union government, local government, ECD, MCDC and the wider public on the issue of liquid waste management; challenges in promoting such collaboration from the union government and regional government perspectives were discussed.

Discussion on the development of an **action plan for wastewater management system** involved examining the current status of liquid waste treatment in the Mandalay region.

In this context, the need to address gray and black water across all sources was actively agreed upon. To meet this target, three (3) actions were proposed as an initial step:

- Constructing a systematic septic tank network
- Substituting Johkasou system in certain areas and
- Constructing a viable sewage treatment plant

In this step, MCDC, public and business people were recognized as the main responsible persons and the time frame for implementation was set within 5 years.

As a first target, there was consensus that that introduction of septic tanks, operation and maintenance of these units would be conducted among households, making use of their own budget within a 5 year time frame.

As a second target, treating high, medium and low concentration level industrial wastewater was proposed. In order to achieve this target, several actions were proposed:

- Establishing a regular inspection team
- Monitoring wastewater quality in final discharge points
- Constructing wastewater treatment plants
- Collecting wastewater tariffs (according to polluter pay system)
- Ensuring that all laws, rules, regulations and guidelines are followed

Responsible agencies for implementing this action plan include MCDC, industrial zone committees, private sector actors, especially those currently in violation of existing laws, and ECD/MONREC were suggested. It was agreed that time frame to implement this action plan would be five (5) years.

In addition, domestic wastewater treatment was discussed as a long term consideration which would be eventually managed by the construction of two to three (2 -3) sewage treatment systems in specific areas of Mandalay (e.g. southern part of the city). It was suggested that ECD and MCDC would work together to regularly monitor discharge points/receiving water bodies over the long term. .

1.7.3 Industrial waste management group discussion

In this group, U Min Maw (ECD) led the group and all participants, including U Tun Win (MCDC), U Min Aung Phyo (MCDC), Mr. Palash Kumar Saha (SINTEF), U HlaTun (Law), Dr.Thandar Phone Win (MWF), Daw Htar Htar Oo (MWF), U Myint Htay (Recycling Company) and Ma Phyo Phyo Aung (Recycling Company) engaged in discussion.

Regarding **regulations/policies**, it was noted that relevant policies, laws, rules, regulations and guidelines related to environmental conservation were initially developed by ECD. Subsequently, MCDC laws, rules, notifications and manuals were prepared and evaluated. It was recognized that a main weakness associated with implementing existing laws on industrial waste, includes the long lead time associated with the preparation of detailed instructions and guidelines for each sector as well as the updating of associated texts and manuals. All participants agreed that current laws should be enforced and industries should be expected to follow these laws accordingly.

In terms of the present **institutional framework**, the participants agreed that all relevant private and civil society organizations (resource recycling business association, NGOs including MWF etc.) should be consulted to increase the effectiveness of industrial waste management.

Concerning **technology/infrastructure**, participants discussed weaknesses related to the existing management of industrial waste including insufficient human resources and gaps in

capacities and skills to manage these types of wastes. The potential of engaging with recycling industries to promote diversion of waste from final disposal sites was discussed.

On the topic of **financial mechanisms**, it was noted that MCDC's current waste management funding relies on the Regional Government budget; disparities between income and service cost, and absence of polluter pays principle in managing industrial waste were also evaluated.

In terms of **stakeholder participation**, it was highlighted that currently only MCDC, Industrial Zone Management Committees and the Industrial Products Association are involved in promoting industrial waste management.

With regard to **setting targets for industrial waste management**, both a short term (5 years) and long term (10 years) time frame were agreed upon. As currently there exists no available data on the present state of industrial waste generation, the initial collection of baseline data would set the stage for future actions, although 100% management of industrial waste could not be agreed upon as a realistic target within 10 years. Instead, recycling of industrial waste was considered as a potential target.

In terms of **stakeholders and their concerns**, the identification of the main concerned stakeholders involved in industrial waste management in relation to defined waste targets was discussed.

Concerning **the development of action plans**, participants focused on evaluating how actions should be carried out respective to their targets and how to ensure practices were systematized effectively.

1.8 Outcome

The workshop provided an effective forum for engagement between city level officials, affording the opportunity for knowledge sharing on current waste management practices in Mandalay and discussion on future collaboration on designing and implementing the municipal waste management strategy with associated targets and action plans.

1.9 Potential future improvement

- Condensing workshop materials, including presentation documents for participants' ease of reference
- Further incorporating gaseous emissions data (as it becomes available) into the workshop discussion
- Disseminating workshop evaluation surveys with a view to better understand participants' perception of the workshop
- Circulating a communique document on key priorities and outcomes of the workshop among participants that will be finalized during the event
- Organizing a working group comprised of members from ECD/MONREC and City Development Committees and following up to advance the development of the city level strategy, in line with the objectives of the workshop

2. Report on the substantial outcomes from the city level workshop leading to the development of the strategy

2.1 First Workshop on the Development of Municipal Waste Management Strategy, Mandalay

The following report was prepared based on discussion proceedings and outcomes of the workshop as well as relevant information from the quick study survey conducted with Mandalay City Development Committee.

2.1.1 WASTE MANAGEMENT- WHERE ARE WE NOW

Overview

The existing waste management system in Mandalay

Population in Mandalay is about 1.6 million. Current per capita waste generation in 2016 is 0.64 kg/ day and waste generation rate is 896 tons per day. Waste collection methods currently being practiced are listed as follows:

(i) Solid waste

- Door-to-door waste collection
- Bell Ringing/Block Collection among households
- Collecting waste from curb side bins
- Road sweeping

(ii) Domestic waste water

Residential and commercial wastewater generation is estimated at 15,000 m³/ year which is directly disposed in waterways (eg. Thingazar creek, Shwe Ta Chaung creek, Ngwe Ta Chaung creek etc). Currently, there is no treatment for sewage and industrial wastewater. Gray water is treated only through aeration process.

(iii) Industrial waste

Currently 1,500 different industries are operating in the three industrial zones. Among these, approximately one hundred (100) different industries generate solid wastes approximating 1,500 -2,000 m³/day. Presently there is no segregation prior to the collection and management of industrial waste. In addition, presently no data that can be used to assess the quality industrial waste water was available. Hospital wastewater is treated with small scale chlorination treatment.

(iv) Recycling actions

These actions currently practiced in Mandalay are listed as follows:

- Paper recycling
- Plastic recycling
- Iron/Zinc/Metal (Copper & Bronze) recycling
- Lead recycling
- Reusable plastic market
- Metal export market

2.1.2 Existing policy and regulations

- MDCD Laws and Regulations (January 12, 2015)
- MDCD Rules (2015)
- Solid Waste Management by-law / Regulation (MDCD), 2015

- MCDC Environmental Conservation and Cleansing bylaws/Regulation May 14, 2015

2.1.3 Existing infrastructure for solid waste management

Existing solid waste management infrastructure in Mandalay is antiquated and inefficient, such that facilities including final disposal sites need to be upgraded. Although waste minimization and recycling efforts can be identified at the community level, the percentage remains quite low. Industrial waste is currently disposed together with household waste; incineration of medical waste is practiced but additional technical support is still required.

2.1.4 Highlighted waste management challenges are listed as follows:

- Insufficient budget for upgrading waste management infrastructure
- Weak implementation and enforcement of existing laws and regulations
- Need for updating manuals, detailed instructions and guidelines on waste management
- Poor institutional cooperation
- Low public awareness about good practices with regard to solid waste management
- Lack of proper vehicles for waste collection, Outdated waste management technology, including at landfill sites
- Lack of skilled labour for waste management particularly in industrial waste
- No segregation and pretreatment for of industrial waste
- No polluter pays principle enforced among industries
- Low revenues and high expenditures associated with the collection and management of industrial waste
- Absence of public private partnerships for industrial waste management
- Low levels of public acceptance for waste management technology and approaches (incinerator, waste to energy plant, composting, etc.)
- Low levels of support from Local and Regional Administrative bodies
- Behavioral challenges associated with encouraging good health and safety practices among workers
- Poor mobilization of informal waste workers

2.2.INTRODUCTION TO THE STRATEGY

Based on the discussion, the main responsible for the developing strategy are

- Mandalay City Development Committee (MCDC)
- Ministry of Natural Resources and Environmental Conservation (MONREC)
- Environmental Conservation Department
- NGOs and INGOs
- Private sector actors
- Research institutes and universities
- Ministry of Education
- Media
- Community members

2.3 STRATEGY DEVELOPMENT – THE PROCESS

2.3.1 Identification of critical stakeholders

The following government departments and organizations in Mandalay were selected as the primary stakeholders for city-level strategy development based on their roles and responsibilities associated with waste management.

Direct involved stakeholders such as MCDC, ECD (Mandalay), Industrial Zones Management Committee, and recycling associations were identified as those responsible for undertaking a leading role in the process. These stakeholders include:

- Environmental Conservation Department (Mandalay), Ministry of Natural Resources and Environmental Conservation (MONREC)
- Mandalay City Development Committee (MCDC)
- Directorate of Industrial Supervision and Inspection (DISI , Mandalay)
- Industrial Zone Management Committees
- Labour Organization (Mandalay)
- Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI, MDY)
- Ministry of Education, including Institutes and Universities
- Public (Community members)
- Private sector
- Other relevant government organizations
- Recycling associations
- INGOs & NGOs (including those focused on gender issues)
- Civil society institutions (CSO) and community based organisations (CBO)
- Media

Waste Management Committee

- MCDC
- Private waste recycling units

2.3.2 Development process

Each group contributed inputs with regard to the future development of waste management in Mandalay, listed as follows:

- Initiating an education and awareness program on the importance of waste segregation involving school children
- Promoting recycling actions at landfill site (e.g. Collection of plastic wastes at the land fill sites to be repurposed as garbage bins)
- Developing a sanitary landfill
- Implementing domestic wastewater treatment
- Implementing industrial wastewater treatment (central wastewater treatment project)

2.4 Setting city goals, objectives and targets
Targets / Goals for solid waste -

2.4.1 Goals

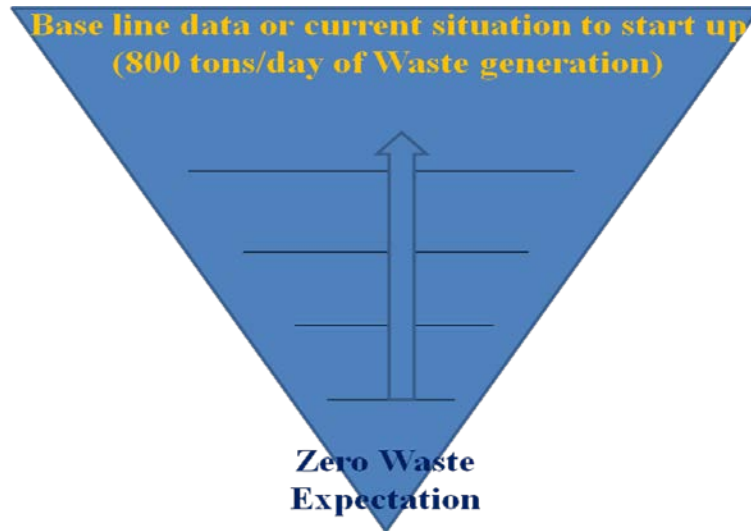


Figure 2.1 Basic modeling of zero waste expectation

Workshop discussion highlighted the four main steps of waste management include waste generation, collection, transportation, and final disposal.

Table 2.1 Goals of solid waste management system for short and long term

Goals	Short term (2016-2020)	Long Term
Waste Generation	20% of Solid waste	Zero waste
Collection	80% SW	100 %
Transportation	60%	100%
Final Disposal	60%	100%

The main long term objective associated with the development of solid waste management system is to reach zero waste at Mandalay’s final disposal site.

Regarding waste generation, a 20% reduction target for solid waste for the short term period and zero waste generation over the long term period was identified.

In terms of the collection system, it was agreed that a target of 80% of solid waste would be collected within 2016 to 2020 as a short term plan. Over the long term, participants agreed 100% of the waste from all the residential areas would be collected.

Concerning the transportation process, workshop discussion identified that waste collection vehicles are need to be upgraded and that transportation systems are also needed to be improved.

Accordingly, waste transportation will focus on collecting 60% of generated waste over the short term and 100% over the long term period.

Lastly, it was recognized that the city's final disposal site must be considerably improved. Workshop discussion identified that a landfill development project is planned for the near future which will also include promoting recycling activities at final disposal sites.

In this respect, 60% of the waste from the final disposal site would seek to be addressed over the short term period with 100% of the total waste managed over the long term period.

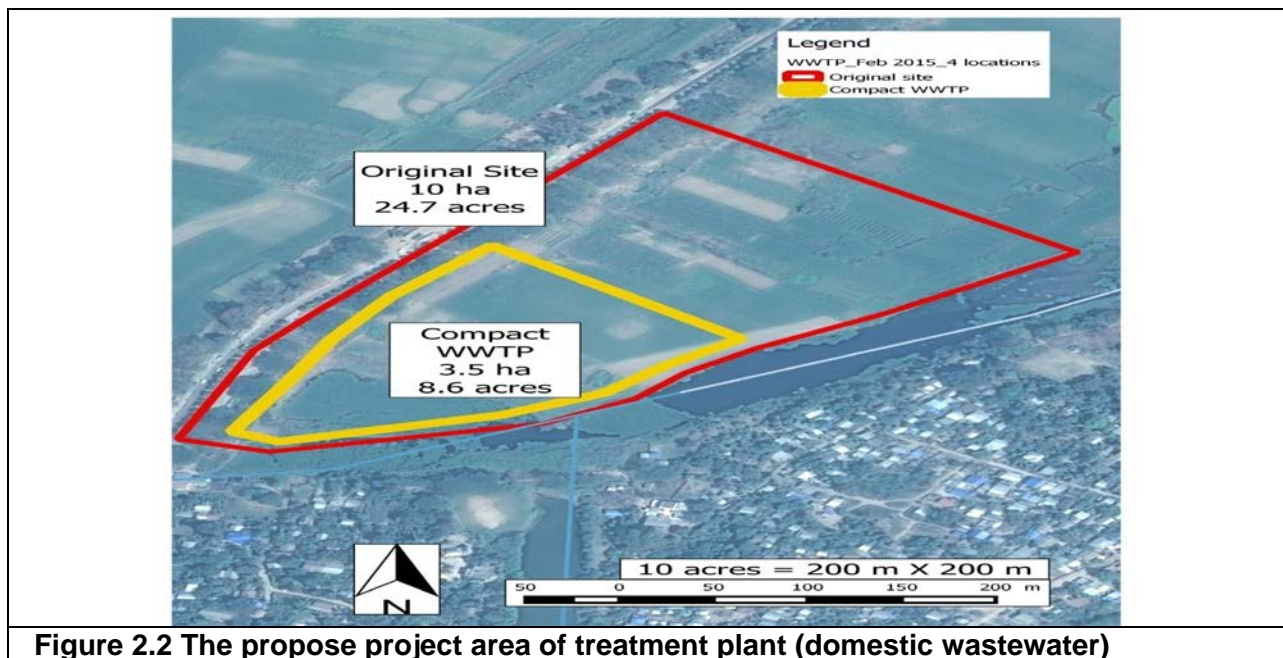




Figure 2.3 The propose project area of treatment plant (Industrial waste)

Annex (I)

Table 1. The list of local participants attended 1st City Workshop for Developing City Strategies in Myanmar (Mandalay)

No	Name	Position	Organization/ Department	Contact no./email address
1	U Shwe Win	Com; Member	MCDC	92015032
2	U Tin Mg Aye	Com; Member	MCDC	92050412
3	U YE Mon	EC-5	MCDC	943011219
4	U Zaw Myo Lwin	com 3	MCDC	92062238
5	U Tun Win	Head of Dept	MCDC	92009835
6	U Myo Aung	Head of Dept	MCDC	92003808
7	Dr Su Yi Myo	Medical officer Learning Dept	MCDC	92014599
8	U Hla Myo	DD	MCDC	9797497976
9	Daw Naing Naing Win	DD (finance)	MCDC	95343008
10	U Khin Aung	Head of Dept	MCDC	92009552
11	U Soe Tint Aung	Assistance Director	MCDC	92000314
12	U Than Htut	Assistance Director	MCDC	943160683
13	U Tin Kyi	Com. Member	MCDC	92001061
14	U Han Soe	Com. Member	MCDC	92001064
15	U Zaw Win	Head of Dept	MCDC	92019689
16	Daw Myo Ei Ei Soe Win	SAE	MCDC	92062430

17	U Htay Win	EE	MCDC	92027691
18	U Nyut Mg		MCDC	924804
19	Daw Khin Mar Aye	staff officer	DOE	979225530
20	U Ko Ko Aye		ECD	95164015
21	Daw Khin Thein	Assistance Director (nursing)	Byatmaso Social Association	943014436
22	Dr Than Htike Soe	Principle	BEHS.26(Eco Model School) Mdy	991015730
23	Dr Tandar Phone Win	secretary	Myanmar Women Federation	9976064721
24	U Hla Htun	Deputy Divisional Law Officer	Regional Law Office	254171341
25	Dr Zar Ni Mya Hlaing	As	Dept of Public Health	09 788122235
26	U Win Zaw Naing	Director	GAD	09 2000203
27	Daw Htar Htar Oo	Team leader of Env; Activities	Myanmar Women Federation	92005810
28	U Aung Ko Ko Htun	manager	Public Hospital	09 43058710
29	Daw Thaingi Soe	Assistance Director	Industrial Inspection and Supervision Dept	9402695525
30	Daw Bauk Yar	Deputy Director	DISI (Ministry of Industry)	9400477376
31	Dr Ni Lwin Aye	Associate prof	Technological University Mdy	943021444
32	Dr Chaw Su Su Hmwe	Associate prof	Technological University Mdy	9402591904
33	Dr Win Mg Mg		public Hospital	92012817

34	Dr Yi Yi Myint	Prof	Mandalay University (Chemistry Dept)	943062273
35	U Min Thein	Deputy Director	Mandalay CDE	9971114080
36	Dr Myint Thein	Rector	TU (MDY)	92001498
37	U Tun Min Latt	MDY	Yadanapone newspaper	9977862600
38	U Myint Htay	Member	Resource Recycling Business Association (Zone2)	9796800600
39	U Myat Min Kha	MDY	Moe Ma Kha Paper	92020247
40	Dr Nyo Nyo	Prof	Geography Department	943144109
41	Daw Myaing Myaing Aye		MCDC	92040103
42	Min Htet Nyein Chan	Team Leader	Green Activities (Same Yaung So)	92002135
43	U Than Htut Ko	Team Leader	Green Activities (Same Yaung So)	943182162
44	Daw Phyo Phyo Aung	Director	Aung United Family Recycling Co.ltd	09 794444443
45	U Hla Win	Charman	Resource Recycling Business Association	92025338
46	Kyal Sin Htun	D.S.O	ECD	09-2054148/ kyalsinhtun1992@gmail.com
47	Dr Kyaw Kyaw Swe	Deputy Director	LBVD	dr.kyawkyawser@gmail.com
48	Dr. Phyo Naing Zay	Consultant	E-guard	09 _____ 5065232/ phyo.mc@gmail.com
49	Daw Naw Thet Htar Win	Secretary	YMCA	67431320
50	U Min Maw	Director	ECD (NpT)	067 431320

51	Daw Thet Su Aung	Journalist	Mandalau Anlin	9796117944
52	Ko Kyaw Swar	Journalist	Yadanapone newspaper	9797150048
53	U Nyan Aung	Journalist	Industrial Zone	9797009100
54	U Khin Mg Thin	Assistance Director	MCDC (water and supply sanitation)	991004768
55	Daw Shwe War Lwin	Journalist	Tachilieik	9402764335
56	Ko Mg Mg Oo	leader	Sein Yaung So Activities	92024423
57	U Ye Win Naing	The Voice		940268730
58	Satt Maw		RMA	9480088847
59	Dr Phyo Zaw Aung	AGM	Mandalar Hospital	9975243749
60	Daw Thinn Thinn Aye	Zone Coordinator	GSMI	9793108419
61	Daw Mel Tint	Freelance Reporter		92131699
62	U Kyaw Saung	Officer	Agriculture	991043350
63	Dr Ohnmar May Tin Hlaing	Environmental consultant	EQM	ohnmarmay@gmail.com
64	Daw Thiri Tin Htut	Associate Environmental Consultant	EQM	thiritinhtut@gmail.com
65	Daw Phyo Thet Khaing	Associate Environmental Consultant	EQM	juiuenge@gmail.com
66	U Khin Zaw Win	Associate Environmental Consultant	EQM	khinzawwinglobe@gmail.com
67	U Thiha Kyaw			9.79112333
68	Dr Hla Min	Member	Green all	261313

69	Dr Thwin Kyaw Kyaw	committee member	Mandalay development committee	city 92051061
70	Daw Nu Nu Lwin	S.T	Education	9444032204
71	Daw Kyawt Kyawt Swe	S.T	Education	798654430
72	Ms Khin Su Myat Aung	Interpreter	Freelance	9402673830
73	Mr Min Aung Phyo	S.O	MCDC	991037885

Table 2. The list of local participants attended 1st City Workshop for Developing City Strategies in Myanmar (Mandalay)

No	Name	Position	Organization/ Department	Contact no./email address
1	Dr. Mushtaq Ahmed Memon	Programme officer	UNEP	MUSHTAQ.MEMra@UNEP.org
2	Dr D.G.J. Premakumara	Senior researcher	IGES	premakumara@iges.or.jp
3	Matthew Hengesbugh	Policy researcher	IGES	hengesbugh@iges.or.jp
4	Chuzo Nishizaki	IGES Fellow	IGES	chuzosan@iges.or.jp
5	Yuko Tsuda	Senior staff	City of Kitakyushu	yuuko-tsuda01@city.kitakyushu.lg.jp
6	Palash Saha Kumar	Researcher	SINTEF	palash.saha@sintef.com

Annex (II)

Final program

First City Workshop for Developing the City Waste Management Strategies in Mandalay

Mandalay City Development Committee (MCDC)

Ministries of Natural Resources and Environmental Conservations/ Environmental Conservation Department

UNEP

IGES Team

**Participants from different ministries /City Development Committees/Institutes and NGOs
Environmental Quality Management Co. Ltd Team members**

Target: First approach of holistic waste management system in Myanmar (City Level)

Date: 16-17, June, 2016

Venue: Mandalay Hill Resort (Mandalay)

Objectives

The first national/ city workshops for developing national/ city waste management strategies in Myanmar aims:

- To assess the extent and effectiveness of Myanmar's present waste management system, identifying constraints and areas for improvement at the national and city levels with a view to achieve an enhanced level of performance;
- To guide the formulation of draft national/ city level waste management strategies and action plans that addresses waste issues in a holistic and integrated manner, including by establishing a supportive institutional framework, proposing appropriate policy interventions, and addressing the awareness and training needs of the various stakeholders involved;
- To establish the necessary monitoring and feedback mechanisms for periodically reviewing the strategy and action plan and submitting the final version for approval by the responsible authorities.

Programme for the city workshop in Mandalay, 16-17 June 2016

In the workshop, it has been discussed about the issue on current situation of waste issue in Mandalay. Besides, it has been focused on group discussion and it was divided into three group, which are discussion group for solid waste, discussion group for liquid and discussion group for industrial wastes in Mandalay from different sectors.

Day 1, 16 June 2016

Section (1) Opening Ceremony

08:00-08:25- Registration

08:30-08:40- Welcome message from Dr. Zaw Myint Maung, Chief Minister of Mandalay Region

08:40-08:55- Welcome message from U Hla Maung Thein, Acting Director General, Environmental Conservation Department, Ministries of Natural Resources and Environmental Conservation

08:55-09:00- Welcome message from UNEP/IETC by Dr. Mushtaq Ahmed Memon, Programme Officer, International Environmental Technology Centre, United Nations Environmental Programme

09:00-09:55- Tea Brake and Photos Sections

Session 2: Discussions on Current Situation and Identification of Gaps

09:55-10:35 - Overview of Environmental Governance in Myanmar by U Hla Maung Thein, Acting Director General, Environmental Conservation Department, Ministries of Natural Resources and Environmental Conservation

10:35-10:55- Introduction of the Holistic Waste Management by UNEP/IETC by Dr. Mushtaq Ahmed Memon, Programme Officer, International Environmental Technology Centre, United Nations Environmental Programme

10:55-11:25- Overview of Solid Waste Management in Mandalay City by U Than Hutt, Assistance Director, Cleansing Department, Mandalay City Development Committee (MCDC)

11:25-12:00- Assessment of solid waste issue, water pollution and air pollution in Mandalay Region, by U Min Thein Deputy Director, Environmental Conservation Department, Ministries of Natural Resources and Environmental Conservation

12:00-12:15- Assessment of current waste management systems and Gaps therein by UNEP/IETC by Dr. Mushtaq Ahmed Memon, Programme Officer, International Environmental Technology Centre, United Nations Environmental Programme

12:15-12:30- What is the main topic for the group discussion by Mr. Matthew Hengesbugh, Policy Researcher, IGES

12:30-13:30- Lunch Break

13:30-15:40- Site Visit for three different groups
Thaung Inn Myauk Inn Landfill Site by Solid Waste Group
Water Treatment Plant by Liquid Waste Group
Recycling Business by Industrial Waste Group

15:40-16:00- Tea Break

16:00-17:20- Group Discussions on mission statement, vision statement, and guiding principles for respective groups.

17:20-18:00- Group Presentations and closed workshop

17:20-17:30- Group Presentation from Solid Waste Management Representative Person, Daw Yi Yi Myint, Prof, Chemistry Department, Mandalay University

17:30-17:45- Group Presentation from Liquid Waste Management, Representative Person, U Khin Maung Thin, Assistant Director, Water Supply and Sanitation, MCDC

17:45-18:00- Group Presentation from Industrial Waste Management, Representative Person, Daw Phyo Phyo Aung, Director, Aung United Family Recycling Co.ltd.

Day (2) 17 Tue June 2016

Session 3: Development of Draft National Strategy

08:00-08:30 - Registration time.

08:30-08:45- Reflection of the Day (1) and present of final list of key gaps by Mr. Matthew Hengesbugh, Policy Researcher, IGES

08:45-10:15- Experience of waste management in Kitakyushu city and potential technical cooperation with MCDC, by Mr.Yuji Aoyagi, Executive Director, International Environmental Strategies Department, Environment Bureau, City of Kitakyushu.

10:15:10:35- Master Plan for Hazardous Wastes in Myanmar, Mr Palash Saha Kumar, Researcher, Foundation for Scientific and Industrial Research, Norway (SINTEF)

10:35-11:00- Refreshment Tea Break

11:05-11:15- Issue on mission statement, vision statement, and guiding principles by Mr. Matthew Hengesbugh, Policy Researcher, IGES

11:15-11:30- The issue of explanation on how to make target setting by Dr. Mushtaq Ahmed Memon, Programme Officer, International Environmental Technology Centre, United Nations Environmental Programme

11:30-12:35- Group Discussion by three different groups.
Mission Statement
Vision Statement
Guiding Principles

12:35-12:40- Group Presentation by Industrial Waste Management Group's Representative Miss Phyo Phyo Aung, Director, Aung United Family Recycling Co.ltd.

12:40-12:45- Group Presentation by Liquid Waste Management group's representative U Khin Maung Thin, Assistant Director, Water Supply and Sanitation, MCDC

12:45-12:55- Group Presentation by Solid Waste Management group's representative Daw Theigi Soe, Assistant Director, (DISI), Mandalay

12:55- 14:00- Lunch Break

14:00 – 14:10- Waste Management System in Mandalay, by Dr. Thwin Kyaw Kyaw, Committee Member, Mandalay City Development Committee (MCDC)

14:10- 14:20- Mandalay Vision, Mission Statement, by U Than Hutt, Assistance Director, Cleansing Department, Mandalay City Development Committee (MCDC)

- 14:20-14:30- Integrated Solid Waste Management Stakeholder's Concern by Dr. Mushtaq Ahmed Memon, Programme Officer, International Environmental Technology Centre, United Nations Environmental Programme
- 14:30-15:30- Group Discussion
- 15:30-15:45- Solid Waste Management in Mandalay by Dr. Thwin Kyaw Kyaw, Committee Member, Mandalay City Development Committee (MCDC)
- 15:45-16:00- Group Presentations
- 16:00-16:15- Explain what should be included in actions plan Dr. Mushtaq Ahmed Memon, Programme Officer, International Environmental Technology Centre, United Nations Environmental Programme
- 16:15-16:30- Refreshment (Tea Break)
- 16:30-17:00- Group Presentation by representative
Group Presentation from Industrial Waste Management, Representative Person, Daw Phyo Phyo Aung, Director, Aung United Family Recycling Co.ltd.
Group Presentation from Liquid Waste Management, Representative Person, U Khin Maung Thin, Assistant Director, Water Supply and Sanitation, MCDC
Group Presentation from Solid Waste Management Representative Person, Dr. Su Ye Myo, Medical Officer Learning Department, Mandalay City Development Committee (MCDC)

Annex (III)

ACTION PLAN

Based on the above, the following actions plan at the city level can be considered

Table 3. Action Plan for solid waste management

Key Strategies	Targets to be achieved (more measurable)	Key Actions (More Practical)	Responsible Agencies or persons	Expected Budgets	Time frame
Strategy (1)	To develop a comprehensive and holistic city development plan that minimizes solid waste disposal	Enhance Rules and Regulations and specific guidelines for waste management	MCDC, MRG, ECD-MONREC, Private Sectors and all related ministries		2016 July – 2017 July
Strategy (2)	To ensure waste segregation practices in line quality municipal services	<ul style="list-style-type: none"> • Awareness and education programs not only for the institutions but also at the community level • Separate and timely Collection 	MCDC, MOE, Ministries, CSOs and NGOs		July 2016- July 2021

Strategy (3)	To enhance public behavioral changes related to 3Rs and appropriate disposal	<ul style="list-style-type: none"> • Source Segregation • Organic Waste Composting • Waste to Energy • Bins allocations • Recycling Practices 	Private Sectors Community MCDC		July 2016 – July 2021
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Table 4. Action plan of domestic and industrial wastewater

Strategies	Action Plan		Target/ indicators	Performance	Responsible Agencies	Budget	Timeframe
	Actions	Detailed Activities					
Domestic wastewater	Segregation	Gray and Black water segregation	<ul style="list-style-type: none"> • To reduce 50% (short term) • To collect tariff (long term) 		<ul style="list-style-type: none"> • Public • MCDC • Water and sanitation department • Cleansing department • Road and bridge department • Motor vehicle workshop and transportation department, • Small and medium scale business owner 		2017 – 2022 (short term) 2022 – 2030 (long term)
Industrial wastewater		High, medium and low concentration level wastewater	<ul style="list-style-type: none"> • To construct preliminary wastewater treatment system based on type of industry • To construct central wastewater treatment system. • To collect wastewater tariff • To educate all industrial owner 		<ul style="list-style-type: none"> • Industrial owner • ECD • MCDC • Industrial Zone committee • NGOs, INGOs and CBOs 		2017 – 2030

			<ul style="list-style-type: none"> to follow existing laws and regulations To reduce specified BOD level (after treated wastewater) 	<ul style="list-style-type: none"> Other donors (eg, JICA, KOICA and ADB) 		
Domestic wastewater	Treatment	To construct wastewater treatment plant	<ul style="list-style-type: none"> Activated sludge process (figure 1) 	<ul style="list-style-type: none"> MCDC Water and sanitation department Cleansing department 		
Industrial wastewater			<ul style="list-style-type: none"> Up flow Anaerobic sludge Blanket and activated sludge system Effluent BOD (after treatment) ≤ 20 mg/l (figure 2) 	<ul style="list-style-type: none"> MCDC Water and sanitation department Cleansing department, Private partner who gets permit (BOT system) 	USD\$ (12) million	

Table 5. Action plan for Industrial waste

Action	Responsibility	Budget	Time-frame
(i) Generation of Industrial waste			
Data collection shall be established (Regular data update)	Waste generators, Governmental Departments, Industrial Zone Management Committees, MCDC, General Affairs, DISI, Recycling factories	X \$	2016- 2020
Regulation update e.g, PPP, Guidelines			
Promote Cleaner production process e.g. using cleaner energy such as Electricity and gas instead of coals, woods, Bio mass , Introducing new Technology, New Technology update Mass Production eg, Ash Filter			
Recyclable packaging system			
Pre-treatment of waste			

Educational and Awareness raising on waste management strategy			
To promote Good Manufacturing Practised products			
Data collection shall be established (Regular data update)	Waste generators, Governmental Departments, Industrial Zone Management Committees, MCDC, General Affairs, DISI, Recycling factories	X \$	2020-2030
Regulation update e.g, PPP, Guidelines			
Promote Cleaner production process Eg.using cleaner energy such as Electricity and gas instead of coals, woods, Bio mass , Introducing new Technology, New Technology update Mass Production eg, Ash Filter			
Recyclable packaging system			
Pre-treatment of waste			
Educational and Awareness raising on waste management strategy			
To promote Good Manufacturing Practised products			
Action	Responsibility	Budget	Time-frame
(ii) Segregation of Industrial waste			
Establishing rules and regulations and ensuring enforcement Guidelines	Waste generators, Regulators	X \$	2016-2020
Educating about the benefits of segregation to encourage action			
Training I waste workers to operate according to guidelines			

Promoting incentives and penalties			
Establishing rules and regulation and enforcement	Waste generators, Regulators, Private sector, International cooperation	X \$	2020-2030
Guidelines			
Educating about the benefits of segregation to encourage action			
Training waste workers to operate according to guidelines			
Promoting incentives and penalties			
Action			
(iii) Collection/Transportation of Industrial waste			
Establishing temporary waste storage sites	Service provider, Government + private sector	X \$	2016-2020
Promoting and efficient logistical coordination			
Utilizing improved waste collection vehicles			
Establishing temporary waste storage sites	Service provider, Government + private sector	X \$	2020-2030
Promoting and efficient logistical coordination			
Utilizing improved waste collection vehicles Garbage Truck			
Action			
(iv) Recycling/ Treatment of Industrial waste			
Providing incentives (e.g reducing tax)	Waste generator, Recycling facilities	X \$	2016-2020
Promoting new recycling technology			
Providing incentives (e.g reducing tax)	Waste generator, Recycling facilities	X \$	2020-2030
Promoting new recycling technology			
Establishing a long term recycling zone			
Action			
Action	Responsibility	Time-	Budget

		frame	
(v) Final Disposal of Industrial waste			
Constructing a sanitary landfill	Service provider, Government	X \$	2016-2020
Procuring incineration technology (Waste to energy)	Service provider, Government	X \$	2016-2020

Annex (IV)
Group Photos



Chief Minister's speech



UNEP Presentation



DDG (ECD) presentation



Participants



Group discussions



Group presentation



Site visits



IGES and ECD wrap up conclusion

Annex (V)

Presentation Materials (attached) (Will be followed accordingly)

The first Workshop on
National/City level Waste Management Strategy
Mandalay

Overview on Environmental Governance
in Myanmar

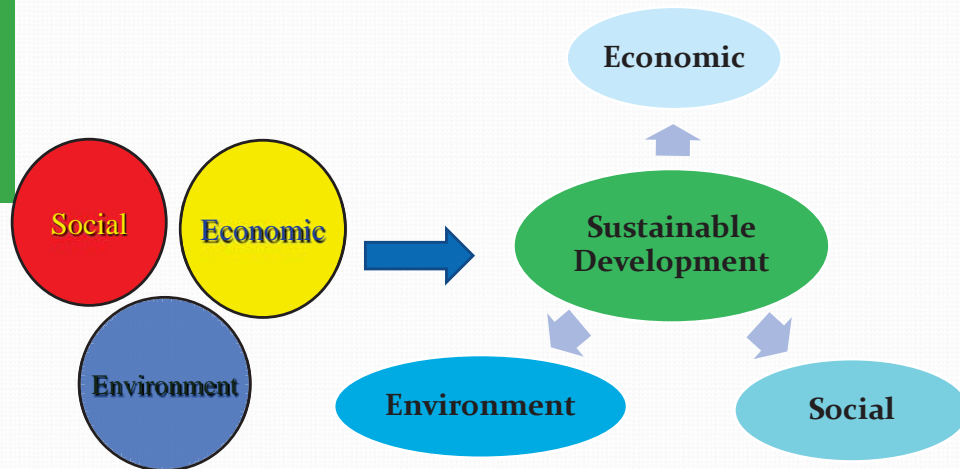
Hla Maung Thein
Acting Director General
Environmental Conservation Department
MONREC

16-6-2016

Outlines

- Policy Goal
- Mainstreaming
- Way Forward

Sustainable Development & Environment



Overall Goals

- To ensure environmentally sound development in all of relevant sectors
- To mainstream environment consideration into National/State & Region/Sector Development Policy and Development Planning

Environmental Policy 1994

- To harmony and balance between these through the **integration of environmental** considerations into **the development process** to enhance the quality of the life of all its citizens.
- It is the **responsibility of the State and every citizen** to preserve its natural resources in the interest of present and future generation.
- **Environmental protection** should always be the **primary objective** in seeking development."

Enabling policy guidance

- Environmental sustainability is recognized in the **National Constitution** and in the **National Comprehensive Development Planning** as a key prerequisite for sustainable economic development.
- Given the current stage of the country's political and policy development, **a comprehensive environmental related strategic framework** are needed to develop to integrate environment into National/State & Region/Sector Development Policy and Development Planning.

Environmental Governance in the past

❖ Institution

- NCEA (1990)
- Environmental Conservation Committee (2004)

❖ Policy

- Environmental Policy (1994)
- Agenda 21
- NSDS (2009)

Institutions for Environmental Governance

National Environment Conservation and Climate Change Committee led by Vice President

Policy, Law and Standards Working Committee

Climate Change Mitigation and Adaptation Working Committee

Land use and Culture /Heritage Working Committee

Urban and Industries Working Committee

Environmental Education Working Committee

Green Economy Development working Committee

Regions/States Environment and Climate Change Supervision Committee



Environmental Conservation Department



Policy & Laws and Rules

- Constitution (2008)
- Environmental Conservation Law (2012)
- Environmental Conservation Rules (2014)
- Environmental Quality Guidelines (2015)
- EIA Procedures (2015)
- MIC Law & Rules & Notification (2013)
- SEZ law (2014)
- Relevant Sectoral Laws and Rules
- NAPA (2012)
- INDC (2015)

Environmental Conservation Law (2012) Objectives

- to implement the Myanmar **National Environmental Policy**;
- to lay down the basic principles and give guidance for systematic **integration of the matters of environmental conservation** in the sustainable development process;
- to emerge a **healthy and clean environment** and to conserve **natural and cultural heritage** for the benefit of present and future generations;
- to reclaim **ecosystems** which are starting to degenerate and disappear;

Environmental Conservation Law (2012) Objectives

- to manage and implement for decrease and loss of **natural resources** and for enabling **the sustainable use** beneficially;
- to implement for **promoting public awareness and cooperation** in educational programmes;
- to promote **international, regional and bilateral cooperation**;
- **to cooperate with** Government departments, organizations, INGO, NGO and individuals.

Four key strategic approaches for the Environmental Safeguards (NCDP)

- **Managing the environment and natural resources**, such as land, forests, water and coastal ecosystems in a sustainable manner,
- **Promoting sustainable and transparent investments** in oil and gas production, mineral extraction, hydro-power, infrastructure and agriculture in ways that sustain the resource base and benefit the local and national population as a whole;
- **Reducing environmental health risks from air and water pollution** with improved access to energy, water and sanitation;
- **Reducing vulnerability to climate change** related disasters and impacts

Mainstreaming:

Enabling conditions



Political willingness

Public awareness

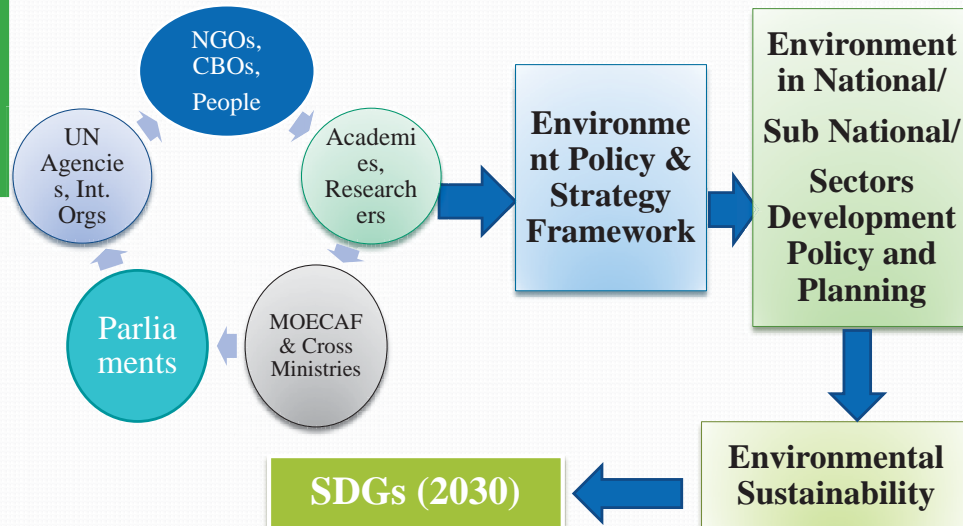
ECD Law/ Rules

MIC guidelines

FDI Law/Rules/Notification

Tools : EIA & SIA & EQGs

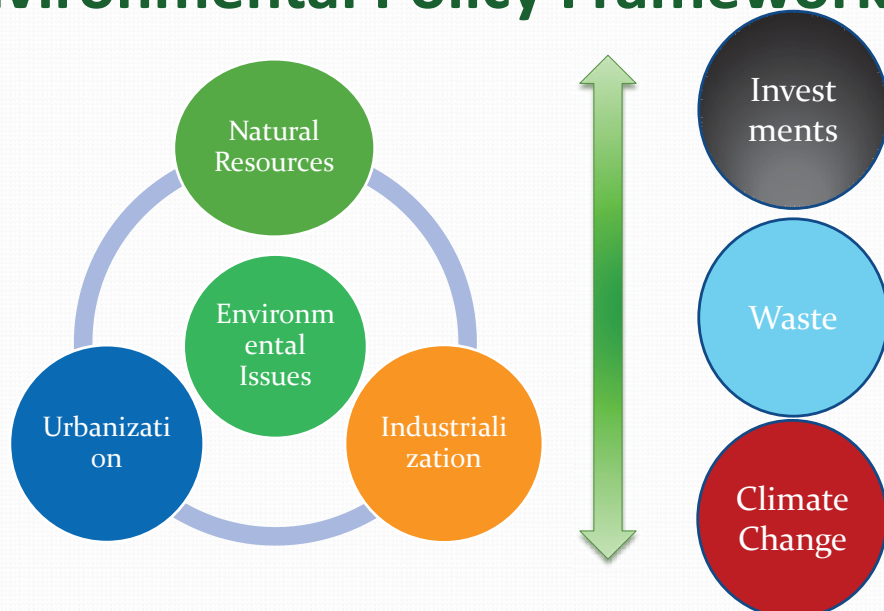
Integrated Approaches: Developing Policy and Strategic Framework



Key Policy Instruments



Key priority areas of Environmental Policy Framework



National Environmental Policy and Strategy Framework (Draft)

Vision: Economic development, social inclusion and environmental conservation come together in a new paradigm for sustainable development

Mission: Committed to leading integration of Environmental perspectives into socio-economic policies, laws, regulations, plans, across sectors

Policy Goals: To contribute to the SD of Myanmar through improved environmental Governance

Objectives: To integrate environmental perspectives into all relevant sectorial policy through the implementation of a mainstreaming mechanism

National Environmental Policy and Strategic framework & Master Plan

National Climate Change Policy & Strategy

National GE Policy Strategic Framework

National Waste Management Strategic Policy Framework

Action Plan for National Climate Change Adaptation and Mitigation

Green Economy Green Growth Action Plan

Waste Management Action Plan

Forest Biodiversity water EnviroQuality Land Marine Agric Indu.& Trans Health Tourism Culture Extracive Industries Urban/Infrastructure Energy

Environmental Policy

- Agenda 21
- NSDS
- Environmental Law
- Environmental Rule
- Sectoral policy and Laws

National Environmental Policy

National Waste Management Strategic Policy Framework

NEC and CCC/ Institution + Multi stateholders

National Waste Management Policy Framework & Action Plan

APPROACH

Disposal

Reduction

Reuse/Recycling

Sustainable Material Management

Solid Waste

Industrial Waste

E - Waste

Hazardous Waste

Plastic Waste

Industry

Special Economic Zone

City Development

Minig

Health

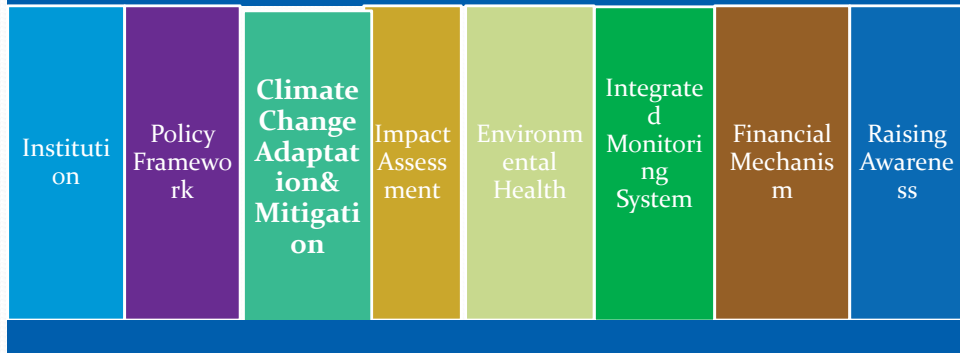
Land

Agriculture

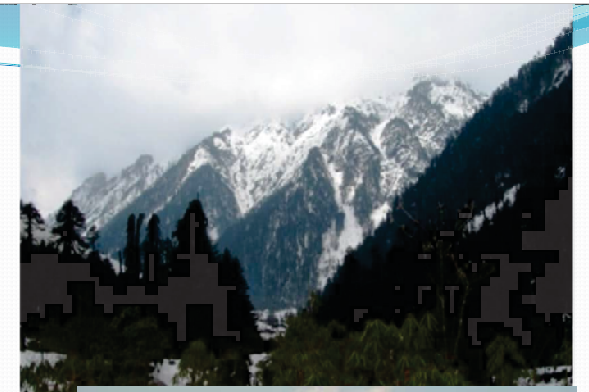
Marine

Future Plan (2016—2020)

Environmental Sustainability toward Sustainable Economic Development



Thank you



HOLISTIC WASTE MANAGEMENT APPROACH FOR ECO TOWNS



Mushtaq Ahmed MEMON, Ph.D
Programme Officer
 International Environmental Technology Centre (IETC)
 Division of Technology, Industry and Economics (DTIE)
 United Nations Environment Programme (UNEP)

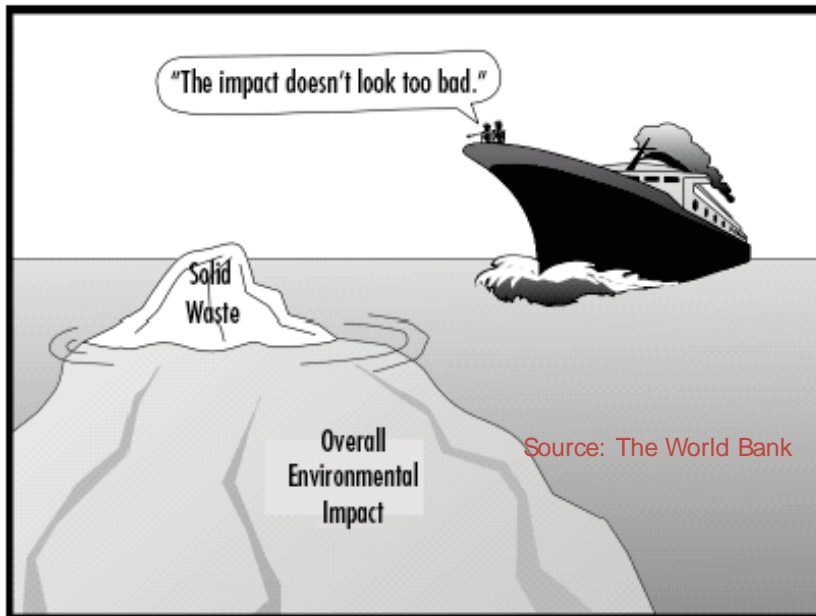


OVERVIEW

- Why waste?
- A holistic approach!
- UNEP support
- National and City Waste Management Strategies Guidelines

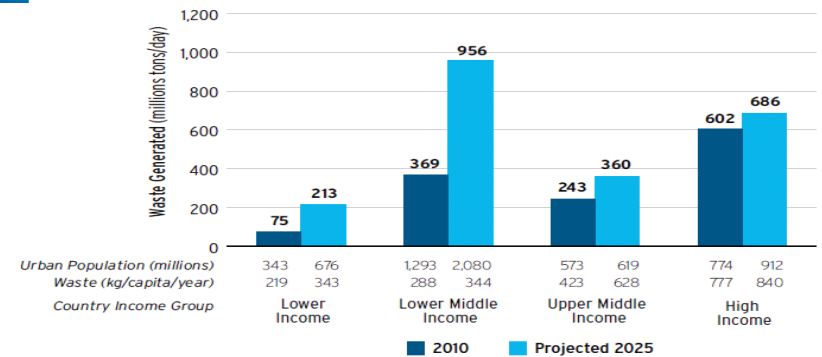


Challenge # 1: Waste Generation



Waste generation levels (1)

Current global MSW generation levels are approximately 1.3 billion tonnes per year, and are expected to increase to approximately 2.2 billion tonnes per year by 2025. This represents a significant increase in per capita waste generation rates, from 1.2 to 1.42 kg per person per day in the next fifteen years.



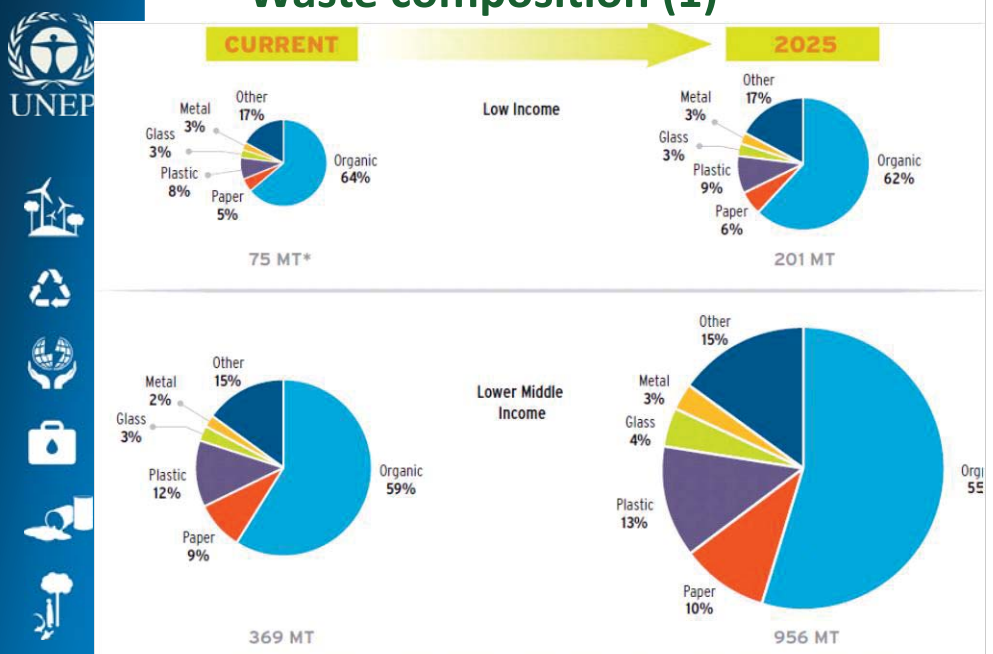
Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management
 United Nations Environment Programme
 Division of Technology, Industry and Economics
 International Environmental Technology Centre

Waste generation projections

Region	Current Available Data			Projections for 2025			
	Total Urban Population (millions)	Urban Waste Generation		Projected Population		Projected Urban Waste	
		Per Capita (kg/capita/day)	Total (tons/day)	Total Population (millions)	Urban Population (millions)	Per Capita (kg/capita/day)	Total (tons/day)
AFR	260	0.65	169,119	1,152	518	0.85	441,840
EAP	777	0.95	738,958	2,124	1,229	1.5	1,865,379
ECA	227	1.1	254,389	339	239	1.5	354,810
LCR	399	1.1	437,545	681	466	1.6	728,392
MENA	162	1.1	173,545	379	257	1.43	369,320
OECD	729	2.2	1,566,286	1,031	842	2.1	1,742,417
SAR	426	0.45	192,410	1,938	734	0.77	567,545
Total	2,980	1.2	3,532,252	7,644	4,285	1.4	6,069,703

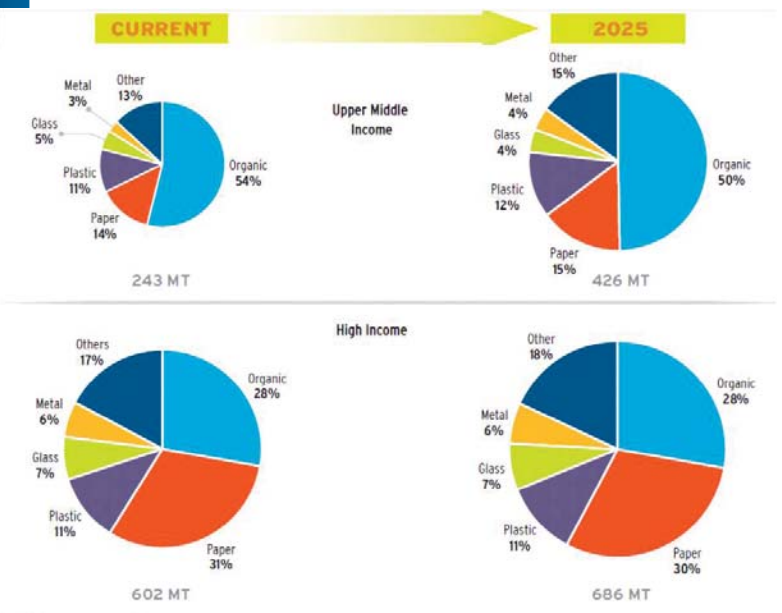
Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management

Waste composition (1)



Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management

Waste composition (2)



Source: Current data vary by country. *Total annual waste volume in millions of tonnes

Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management

UNCOLLECTED AND UNTREATED WASTE

Half of the world population without sound waste management



Source: World Bank

(RE)EMERGING WASTE STREAMS

Increase in hazardous waste and other (re)emerging waste streams



Source: World Bank



Water and sanitation Wastewater and sludge

Year	Population			Water Supply Coverage (%)				Sanitation Coverage (%)							
	Total ('000)	Urban (%)	Rural (%)	Total Access	Household Connections	Total Access	Household Connections	Total Access	House Connections	Total Access	Sewer Connections	Total Access	Sewer Connections	Total Access	Sewer Connections
Asia and the Pacific	1990 3,263,921	33	67	74	38	95	70	64	22	34	13	70	33	16	2
	2002 3,838,218	39	61	82	43	94	73	75	24	49	16	75	37	33	3
East and Northeast Asia	1990 1,349,962	33	67	74	55	99	85	62	40	32	10	71	28	12	1
	2002 1,502,315	42	58	80	64	94	92	70	43	50	20	73	43	33	3
North and Central Asia	1990 215,178	65	35	91	71	96	86	82	42	82	64	92	83	63	26
	2002 217,858	63	37	91	72	98	90	79	40	79	63	90	84	59	26
Pacific	1990 26,672	70	30	89	67	100	93	63	6	90	54	99	77	69	0
	2002 31,828	73	27	87	69	99	92	53	8	87	55	98	75	57	0
South and Southwest Asia	1990 1,232,183	28	72	71	21	90	56	64	7	23	9	58	29	9	1
	2002 1,550,605	31	69	85	26	94	54	80	13	39	10	69	27	25	3
Southeast Asia	1990 439,926	32	68	73	14	91	37	65	3	48	2	67	6	39	0
	2002 535,612	41	59	79	23	91	45	70	8	61	3	79	7	49	0

Source: Figures derived from data in Meeting the MDG drinking water and sanitation target: A mid-term assessment of progress. WHO and UNICEF. 2004. United Nations, New York.

Source: <http://www.adb.org/Water/Indicators/MDG-7/Table-02.pdf>

Challenge # 2: Severity of Impacts



- Severe health impacts particularly on communities in the vicinity of dumpsites.
- Pollution of surface and sub-surface water bodies due to leachate contamination.

Payatas, Philippines

Nairobi, Kenya



- Air pollution from emissions of spontaneous combustion in dumps.
- Adverse impacts on fauna and flora.

Challenge # 3: Increasing Costs

OECD countries:

Municipal waste – USD120 billion/year
Industrial waste – USD150 billion/year

Developing countries:

20-50% of recurring budget of municipalities is spent on solid waste management, although only 50% of urban population is covered. In low-income countries collection alone drains 80-90% of total waste management budget.

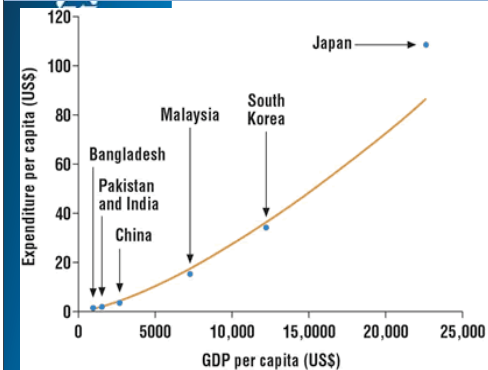


Figure 16: Municipal Urban Waste Services Expenditures

City, Country	Year	Per Capita Expenditure on SWM (US \$)	Per capita GNP (US \$)	% GNP Spent on SWM
New York, USA	1991	106	22,240	0.48
Toronto, Canada	1991	67	20,440	0.33
Strasbourg, France	1995	63	24,990	0.25
London, England	1991	46	16,550	0.28
Kuala Lumpur, Malaysia	1994	15.25	4,000	0.38
Budapest, Hungary	1995	13.80	4,130	0.33
São Paulo, Brazil	1989	13.32	2,540	0.52
Buenos Aires, Argentina	1989	10.15	2,160	0.47
Tallinn, Estonia	1995	8.11	3,080	0.26
Bogota, Colombia	1994	7.75	1,620	0.48
Caracas, Venezuela	1989	6.67	2,450	0.27
Riga, Latvia	1995	6	2,420	0.25
Manila, Philippines	1995	estimate 4	1,070	0.37
Bucharest, Romania	1995	2.37	1,450	0.16
Hanoi, Vietnam	1994	predict 2	250	0.80
Madras, India	1995	1.77	350	0.51
Lahore, Pakistan	1985	1.77	390	0.45
Dhaka, Bangladesh	1995	1.46	270	0.54
Accra, Ghana	1994	0.66	390	0.17

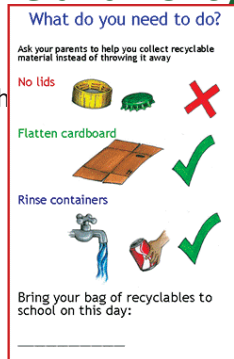
(MacFarlane, 1998)



Challenge # 4:

Limited Infrastructure and Policy Framework

- Rely on end-of-pipe solutions with focus on collection and disposal with coverage of collection is around 50%
- Safe disposal
 - 30% practised only in middle-income developing countries
 - 5% practised only in low-income developing countries
- Lack of extensive policy framework, especially to address emerging and re-emerging waste streams
- Limited implementation of policies at best in selected big cities



Challenge # 5: Lack of Political Priority

- Waste management and resource recovery still a low priority area
- Lack of national initiatives and fund allocation particularly in low-income countries
- Lack of comprehensive programme at national/local level



Challenge #6: Climate Change and Air Pollution

1. Rotten waste
2. Open burning
3. Landfills
4. Thermal treatment (e.g. incineration)
5. Biological treatment (e.g. composting)
6. Collection and transportation
7. Lost energy to offset fossil fuels

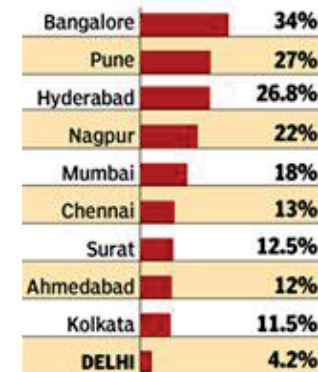


Gaseous emissions

Waste related air emissions

THE AIR WE BREATHE

Air pollution rise in Indian cities between 2002-10, compared to other nations



Rise in air pollution	
India's neighbours	
Dhaka (Bangladesh)	6.2%
Lahore (Pakistan)	2.3%
Karachi (Pakistan)	2.1%
Elsewhere	
Shanghai (China)	13.7%
New York (US)	13.0%
Seoul (S. Korea)	9.5%
London (UK)	5.6%

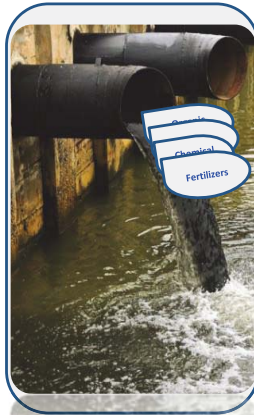
Source: <http://www.hindustantimes.com/india-news/newdelhi/india-tops-china-in-air-pollution-level-increase/article1-966208.aspx>



'Silo' Approach to Waste Management



Air Pollution



Water Pollution

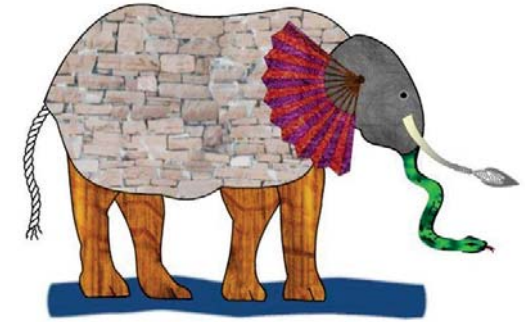


Soil/Land Pollution



From 'Silo' to 'Holistic' Approach to Waste Management

- Silo Approach facilitates the "Sector" Specific Specialist Technology Development
- It may be good for one stream or form of waste, but might not be the optimal solution
- **Holistic Waste Management** = Breaking the "Silo"
- **Holistic Waste Management** = Integrated Waste management + Interlinkages with waste forms
- **Holistic Waste Management** = putting the pieces together



Looking at the big picture can lead to a new way of seeing the problem.

Let us "see" the whole elephant.

Holistic Approach: Breaking the 'Silo'



Holistic Waste Management

Holistic system approach here means the

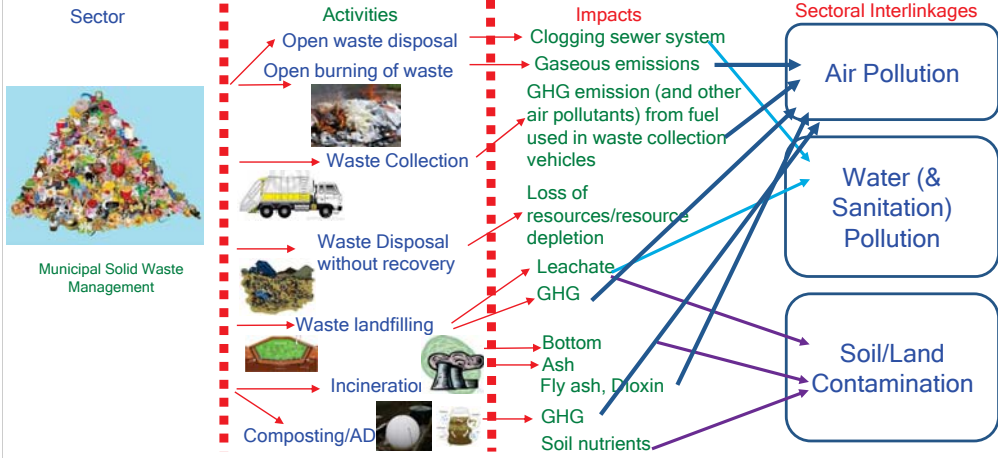
Inter-sectoral waste interlinkages (solid, liquid and gaseous), and

Multi-media pollution issues arising from waste handling of one form or one waste sector



Holistic Waste Management

EXAMPLE



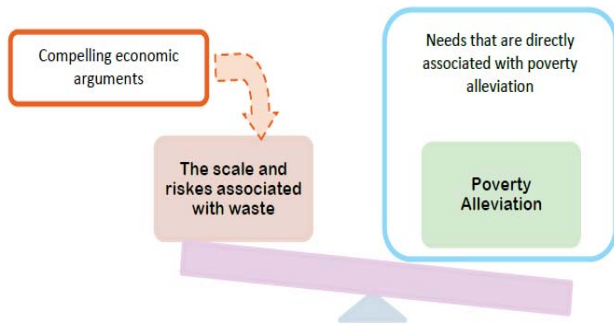
Solid, Liquid, Gaseous Nexus – Mercury waste

「水俣条約」採択 2013年10月10日 in 熊本



WHY SHOULD DEVELOPING COUNTRIES MAKE WASTE A PRIORITY ?

なぜ途上国は、廃棄物問題を優先的に取り組むべきなのか



The policy and budget attention in developing countries regarding waste management and other higher prioritized problems

WHY SHOULD DEVELOPING COUNTRIES MAKE WASTE A PRIORITY ?

なぜ途上国は、廃棄物問題を優先的に取り組むべきなのか



IETC's task of urging countries to manage their waste better and to move from words to action in the development of more effective waste management systems

WASTE HIERARCHY AND 3R



Paradigm Shift

20th CENTURY

WASTE
MANAGEMENT

"How do we get rid of our waste efficiently with minimum damage to public health and the environment?"

21st CENTURY

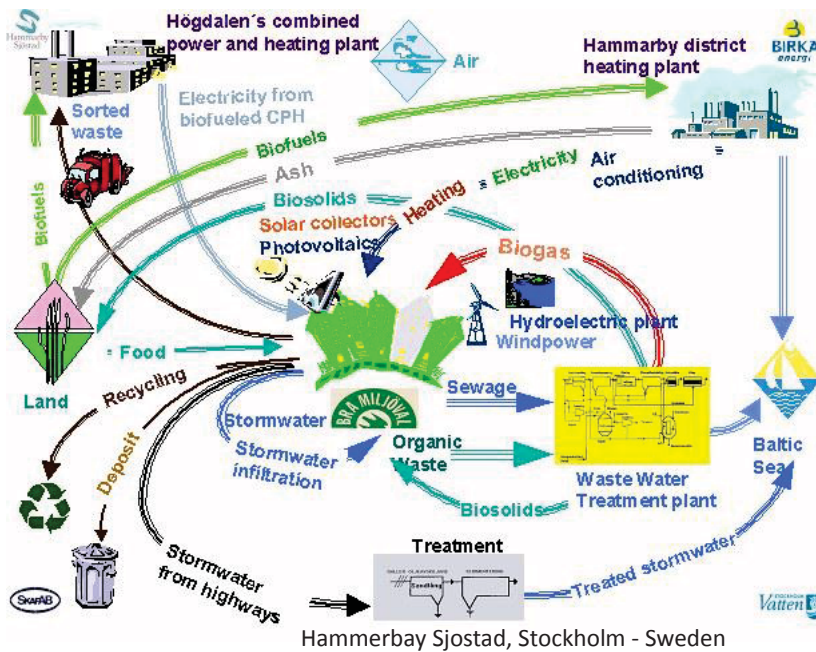
RESOURCE
MANAGEMENT

"How do we handle our discarded resources in ways which do not deprive future generations of some, if not all, of their value?"

Source: Dr. Paul Connett, Zero Waste, Power Point



CIRCULAR ECONOMY / 3R – CLOSING THE LOOP

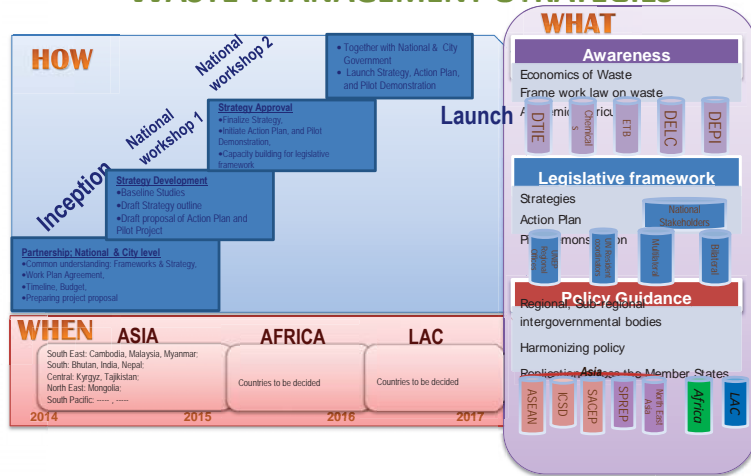


UNEP ITC: HOLISTIC WASTE MANAGEMENT

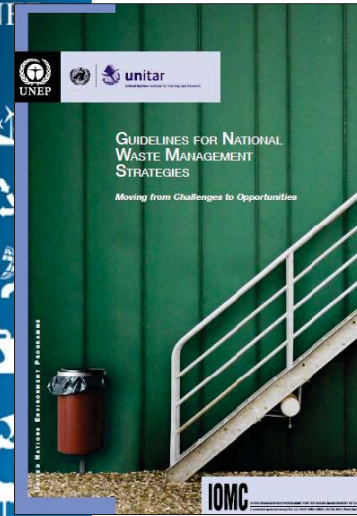
- Holistic approach to waste
- Waste → Resource (From linear to closed-loop material cycle)
- Promote Prevention Policies: Anchor 3R



IETC SUPPORT FOR NATIONAL AND CITY WASTE MANAGEMENT STRATEGIES



Guidelines for NWMS



- Provide a **conceptual and methodological framework** for national planning that countries may adapt to their particular circumstances.
- Establish a clear **rationale** for making waste management a national priority.
- The guidelines, while focused on **strategy development**, also encompasses **implementation, review and updating** of the strategy.

Guidelines for NWMS



Content of the guidelines



Part I:

- Presents the **background** on the guidance document and set up the scene for waste management
- Provides an **overview** of the content of the guidelines and reinforces the need for implementation of the strategy once developed
- Clarifies the **scope** of the guidelines – waste streams
- Presents the **waste management hierarchy** and other concepts as the cornerstones of waste management policy across the globe
- Outlines the **reasons** for a national waste management strategy

Content of the guidelines (cont)

Part II:

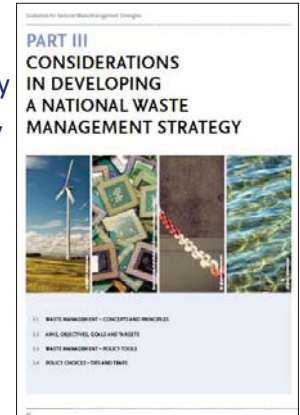
- Presents the **contributions of sound waste management** to sustainable development
- Details the **benefits** for each of the three **pillars of sustainability**: economic, environmental and social; and acknowledges the interactions among and between the pillars
- Outlines the **governance challenges**, recognizes the many interests from the different stakeholders and the need for policy and legislative infrastructure.



Content of the guidelines (cont)

Part III:

- Deals with **concepts and principles** related to waste management that will be drawn when developing the strategy
- Highlights the importance of inclusivity for **engaging the stakeholders**
- It reviews the **policy tools** centrally important to waste management
- Takes account of major **considerations influencing policy choices** involved in the process of strategy development, implementation and monitoring.



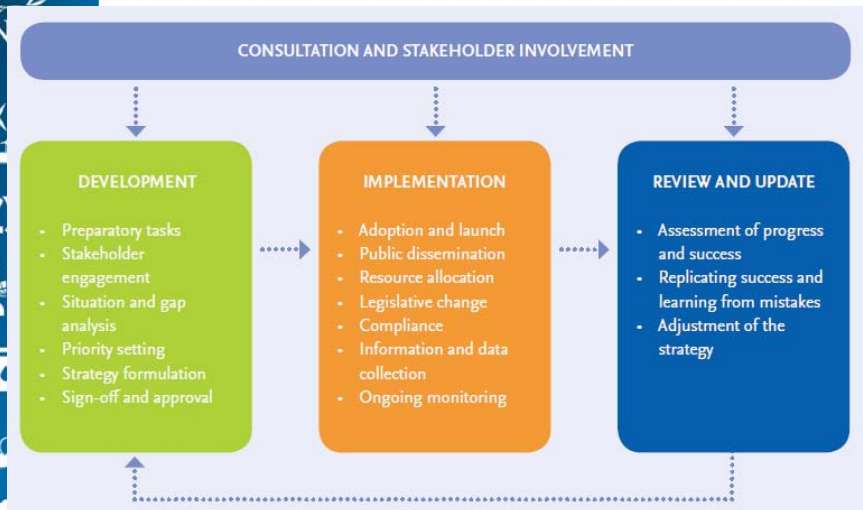
Content of the guidelines (cont)

Part IV:

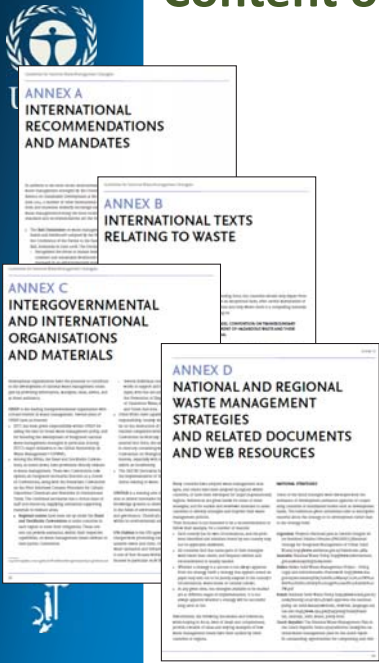
- Presents a **possible process** and defines the actions a country can take in order to develop a strategy, then to implement, review and update it.
- Ask a number of **questions** that countries may wish to consider as they developed their strategy.
- Raises **considerations** that the countries will need to take into account
- Identifies the **steps** that every country will have to go through



Content of the guidelines (cont)



Content of the guidelines (cont)



Annexes:

- **Annex A:** International recommendations and mandates
- **Annex B:** International text relating to waste
- **Annex C :** Intergovernmental and International organizations
- **Annex D:** National and regional waste management strategies and related documents and web resources

City Waste Management Strategy

Developing Integrated Solid Waste Management Plan
Training Manuals

Volume 1

Waste Characterization and Quantification with Projections for Future

Compiled by



Training Manuals on How to Develop Integrated Solid Waste Management Plan

Part 2

Assessment of Current Waste Management System and Gaps therein

Compiled by



Extension of NWMS

- **Detailed baseline studies for implementation plan**
- **Target setting for tangible results**
- **Stakeholder engagement**
- **City Strategy and Action Plan**
- **Implementation**
- **Monitoring and review**

Training Manuals on How to Develop Integrated Solid Waste Management Plan

Part 3

Targets and Issues of Concern for ISWM

Compiled by



Part 4

ISWM Plan and Detailed Schemes

Compiled by




International Environmental Technology Centre
2-110 Ryokuchi Koen
Tsurumi-ku, Osaka 538-0036 Japan
Tel : +81 (0) 6 6915 4581
Fax : +81 (0) 6 6915 0304
E-mail : ietc@unep.org
Web: <http://www.unep.org/ietc>


Conclusion
結論


**Partnership,
Partnership and
Partnership
Thank You...**





 REPUBLIC OF THE UNION OF MYANMAR
Mandalay Regional Government
MANDALAY CITY DEVELOPMENT COMMITTEE





Overview on Solid Waste Management in Mandalay City

PRESENTED BY
Than Hutt
Assistance Director
Cleansing Department
Mandalay City Development Committee

16th , June, 2016

Abstract

- Brief History of Mandalay
- Micro Environment of MSWMS
- Macro Environment of MSWMS
- Problem Statement
- Conclusion

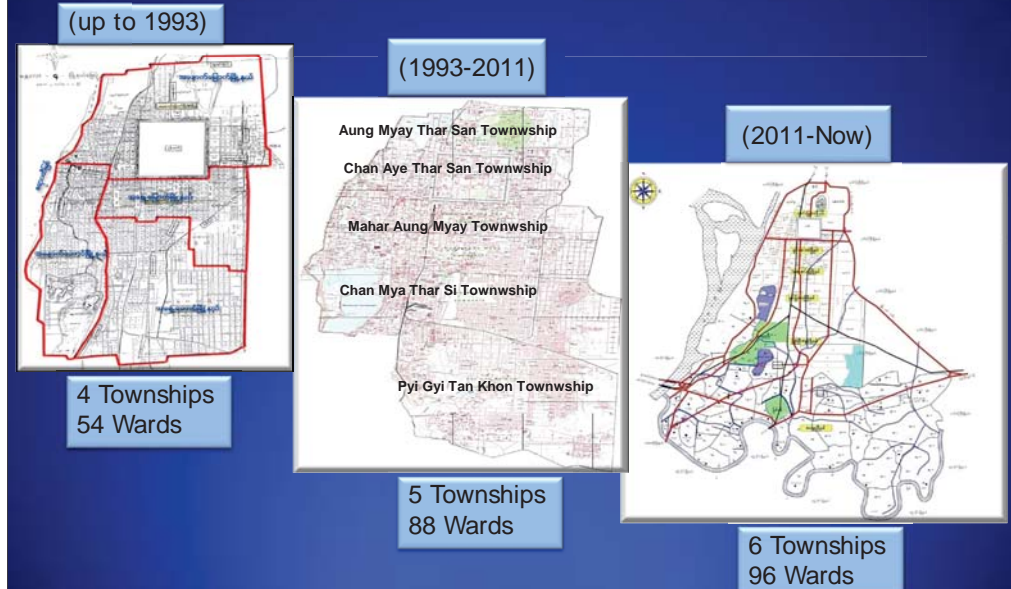
Brief History of Mandalay



- Last Royal Capital of Myanmar
- The 2nd Last King of Konbaung Dynasty King Mindon
- Established in (1857-1859)
- In 2007, The 150th Anniversary of Mandalay City was held
- Now Our City is about 159 years old



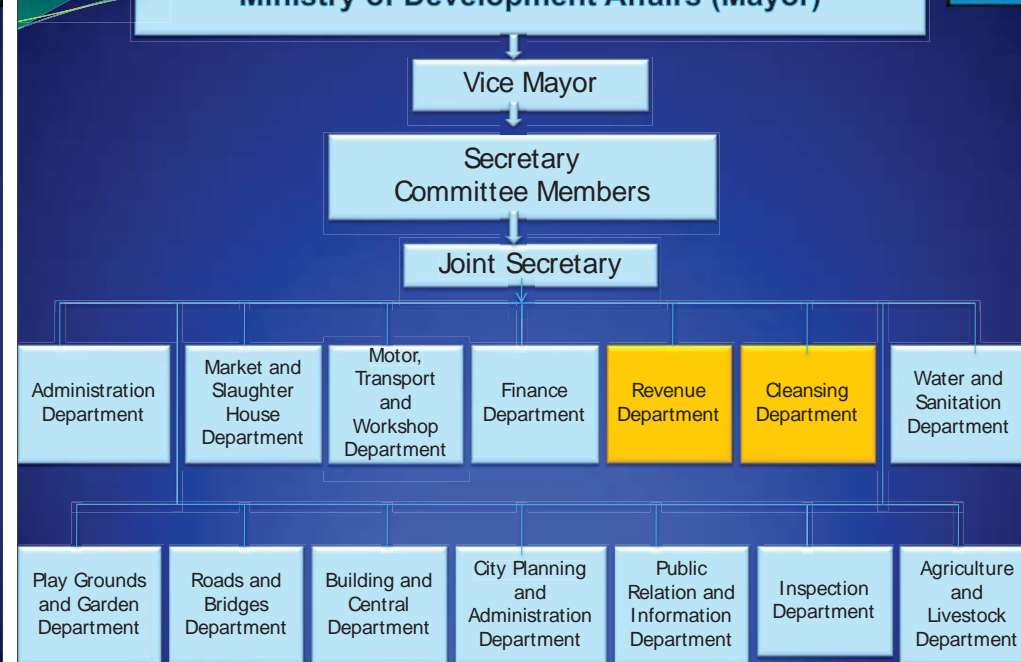
Extension of Mandalay City Territory



Mandalay Region Government



Minister of Regional Government, Ministry of Development Affairs (Mayor)



Micro Environment

Vision

- To keep the City Clean
- To make the City Beautiful and Pleasant
- To enable the City Dwellers to enjoy the Pleasant lives

Micro Environment

Missions

- To manage the Municipal Solid Waste
- To maintain the Drainage System Cleaned
- To conserve the Urban Environment
- To take care the Public Health

Organizing Work Force

TSP	Officer	Super visor	Work chart	Collec tor	Sweep er	Drain	Night	Total
Aung Zan	1	7	17	193	137	53	101	509
Chan Zan	-	10	7	162	155	67	117	518
Mahar	1	7	8	174	75	41	59	365
Chan Se	1	7	5	123	62	15	30	243
Pyigyi	1	7	4	125	64	23	40	264
Amara	-	3	1	73	54	22	27	178
Total	4	41	42	850	547	221	374	2078




Current Solid Waste Management System

Main Functions of SWM System

- On site Handling & Storage
- Collection
- Transportation
- Final Disposal
- Refuse Analysis



On Site Storage

- Communal Storage
- Household Storage
- Industrial Storage
- Medical Waste Storage
- Use Dustbin
- Temporary storage

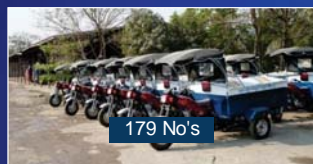


Collection Facilities & System

- Door to Door Collection with bell ringing & song warning system
- Road sweeping & Collection
- Roadside dumping collection
- Inappropriate discharge dumping collection
- Improper discharge cleaning & collection



350 No's



179 No's



180 No's



167 Nos



31 Nos



20 Nos



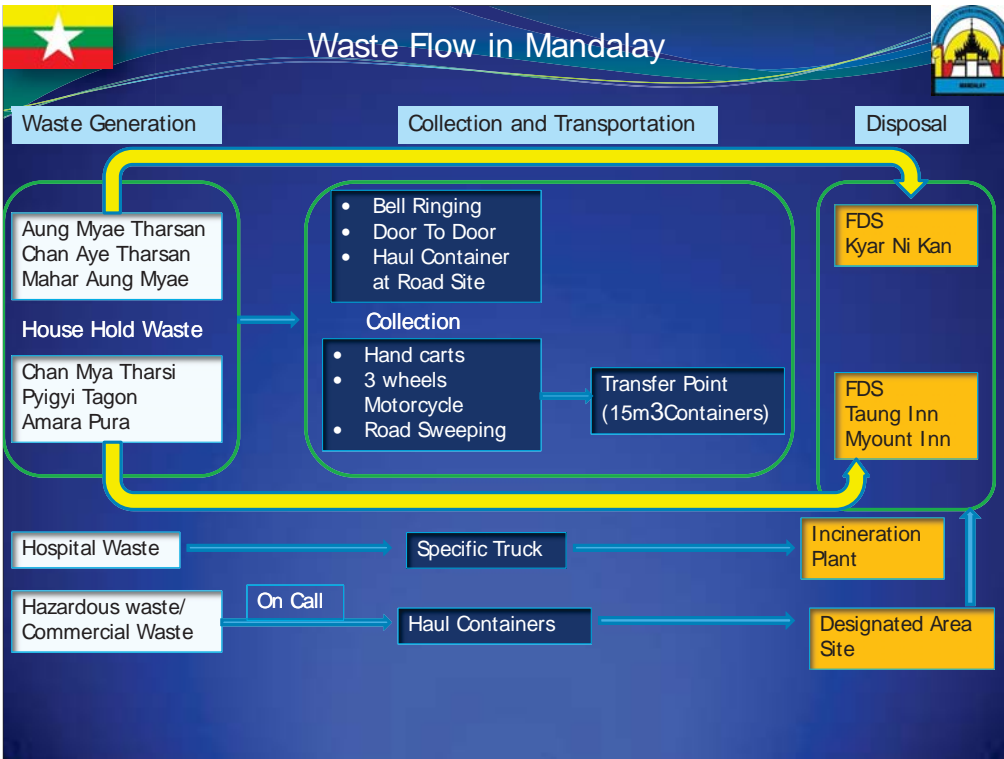
7 Nos





Refuse Analysis & Measurement

- Solid waste composition is analyzed annually at Secondary Collection Points
- Waste collected per day is measured by daily weighing



Collection System

- Door to Door Collection
- Roadside dumping & Transfer Collection
- Final Disposal Site



Hospital Waste Management

State

- Ø Hospital - 9 Units Manage by Gov
- Ø Special Clinic- 24 Units
- Ø Private clinic- 329 Units



Temporary Storage

- Specific Places
- Specific Bags
- Specific Containers



Types of Hospital Waste

- Infectious Waste Yellow Colour Plastic Bag
- Sharps Red Colour Plastic Bag
- General Waste Black Colour Plastic Bag
(Non-hazardous Household Waste)

The average daily hospital waste generations are as follows:

- Infectious Waste - 414 bags - 1780 kg/day
- Sharps - 100 bags - 46 kg/day
- General Waste - 136 bags - 309 kg/day

- Total waste generation - 2.135 Tons/day

Transportation and Disposal

Main Drains

- Shwe Ta Chaung mile - 7.14
- Ngwe Ta Chaung mile - 4.7
- Mingalar Cannel mile - 0.96
- Colombo Cannel mile - 3.57
- Nadi Cannel mile - 5.78
- Payantaw Creek mile - 7.01
- Thingazar Creek - 2.95





Existing Dump Sites

Kyar Ni Kan Disposal Site

- 17.5 km far from City Hall
- 12.5 Acres collected by purchasing from private owners.
- 450 Tons/day of MSW
- 1.Feb.2010 to 6.Jan.2012 is first time used and dumped 309600Tons of MSW.
- 24.Dec.2013 is the starting date of second time.

© 2013 Google
Image © 2013 DigitalGlobe

Google earth

South inn North inn Disposal site

Remaining Area

Incinerator

2.04 Acres

Existing Dump Site

2 Acres

Remaining area

© 2014 Google
Image © 2010 DigitalGlobe

Taung Inn Myount Inn Disposal Site for Waste to Energy Project (Yellow Area)

Waste Water treatment plant

Fulfilled Area (6.1876Hector)

21°50'2.18"N and 96° 6'21.79"E

© 2014 Google
Image © 2014 DigitalGlobe

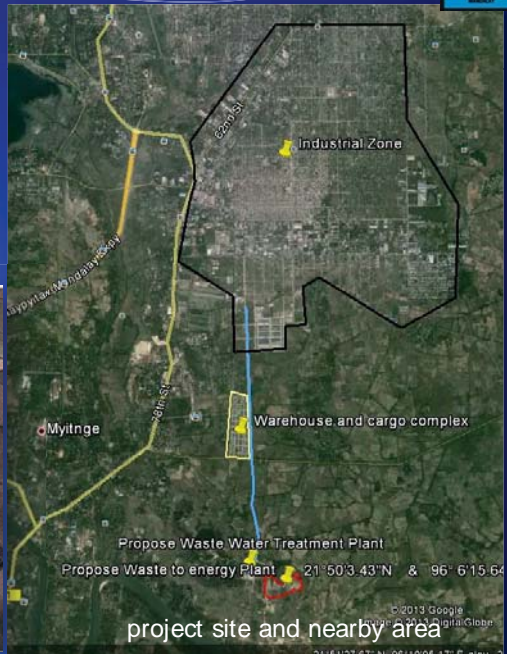
Google earth



Location of WTE Project and Nearby



- Southern Outpost of the City.
- Sauk Taw Wa Village, Amarapura Township
- Started at 2.2.2011
- 29.32 Acres for project area
- Organic Asia Group (Thailand) will be implement.
- 14.8 MW/h of electricity can be generate.



Macro Environment

• Population & Waste Generation

1. Population	1.24 million
2. Floating Population	50,000 /day
3. Household	281818
4. Waste Generation	0.64Kg/ capita/day
5. Total Waste Generation	793.6 tons/day
6. Hospital Waste Generation	2.13 tons/day

Behavioral Factors

- Separate the waste before discharge.
- Re-usable & Recyclable Waste can be sold .
- Just final refuses remain to discharge.
- Some are weak in awareness to cooperate with MSWMS.
- Be used to in negligence discharge.
- Weak to obey the local rules in discharging.



Mandalay City

Comparative Statement of Cleansing Department By Year



Year	Waste Collection Tons/day	Workers/Employee	Collection Vehicles	3 wheel Motorcycle
2007	259.93Tons	911	71 Nos	-
2008	288.06Tons	1172	71Nos	-
2009	277.34Tons	1196	73Nos	-
2010	262.75Tons	1085	73Nos	-
2011	281.46Tons	1021	76Nos	-
2012	473.61Tons	1140	86Nos	20 Nos
2013	404.23Tons	1083	116Nos	90 Nos
2014	550.54Tons	1244	173Nos	150Nos
2015	779.04Tons	1942	183Nos	153Nos

Current Solid Waste Composition

Categories	Sep/2012	July/2014
Plastic	22.09%	14%
Paper	1.03%	5.1%
Wood/Bamboo pieces	17.68%	3%
Rubber	1.29%	0.3%
Metal	0.09%	5%
Glass	2.29%	5.7
Vegetables/leafs/ Kitchen	37.36%	55%
Drainage sludge/ Clay/dust	17.80%	8.3%
Clothes/textile	0.37%	3.6%
Total	100%	100%



Resource Recovery Business

Reuse & Recycle Waste Flow



Resource Recovery Business

- Recycle Paper Production
- Recycle Plastic Production
- Recycle Iron/Zinc/Metal Production
- Recycle Copper & Bronze Production
- Recycle Lead Production
- Reuse Bottle Market
- Plastic & Metal Waste Export Market
- About 400 small & medium size businesses

REUSE

-reuse bottles in factories (private business)



- RECYCLE (Tin and Can) – Private business



Collecting



Compressing



Smelting



Modeling



Products (iron rods)



Community Participations



- Weekly Donation Groups
- Youth Volunteers Groups
- Health and Social Service Groups



Meeting With Ward leaders and Community

Get to know the difficulties encountered by the community. Negotiate the gaps in understanding of the regulation by the public..
Public Participation in development works.



Activities for the Public Awareness

Educational Program for Waste Separation at Source



Essay Competition for Environmental Conservation and Solid Waste Management



Eco Model School Activities



MDCD choose 3 Basic Education High Schools as Eco-Model School,

Problem Statement

- Lack of public awareness and cooperation in SWMS.
- No practice in waste segregation.
- Weakness in collection and transportation facilities.
- Insufficient budget allotment due to small amount of garbage tax.
- Weak in law enforcement on SWMS.
- Weak in final disposal management.

Consequences

- Direct Health Hazard for community & workers
- Environmental contamination due to improper management of final disposal site.

Conclusion

- Sound Management on Waste Management is still needed to conserve our Urban Environment
- Stakeholder cooperation & collaboration is still needed to achieve
- Need to set the goals and find out the proper way



Thank You

သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန
 ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန
 မန္တလေးတိုင်းဒေသကြီး

စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု၊ ရေထုညစ်ညမ်းမှု၊ လေထုညစ်ညမ်းမှုနှင့်
 ပတ်သက်၍ အကြံပြုဆွေးနွေးခြင်း



ဦးမင်းသိန်း
 ဒုတိယညွှန်ကြားရေးမှူး

ဆွေးနွေးမည့် အကြောင်းအရာများ

- အမျိုးသားပတ်ဝန်းကျင်ရေးရာမူဝါဒ (၁၉၉၄)
- မြန်မာနိုင်ငံပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ ၂၁ ရာစု အစီအစဉ်
- အမျိုးသားစဉ်ဆက်မပြတ်ဖွံ့ဖြိုးရေးမဟာဗျူဟာ
- စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု
- ရေထုညစ်ညမ်းမှု
- လေထုညစ်ညမ်းမှု
- စွန့်ပစ်ပစ္စည်းပြဿနာများ
- စွန့်ပစ်ရေပြဿနာများ

အမျိုးသားပတ်ဝန်းကျင်ရေးရာမူဝါဒ (၁၉၉၄)

- စီးပွားရေးနှင့် လူမှုရေးဖွံ့ဖြိုးမှုများတွင် ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးကို ထည့်သွင်းပေါင်းစပ်၍ ဥပဒေနှင့်အညီ အကောင်အထည်ဖော်ဆောင်ရွက်ရန်၊
- ရည်မှန်းချက်မှာ ပြည်သူတစ်ရပ်လုံး၏ လူနေမှုအဆင့် အတန်းမြှင့်တင်ရေးအတွက် ဖွံ့ဖြိုးရေးလုပ်ငန်းစဉ်များ တွင် ပတ်ဝန်းကျင်ရေးရာကိစ္စများကို ထည့်သွင်းပေါင်း စပ်ခြင်းဖြင့် ပတ်ဝန်းကျင်နှင့် သဟဇာတဖြစ်မှု၊ ဟန်ချက် ညီမျှမှုတို့ကို ရရှိစေရေးဖြစ်၊
- ဖွံ့ဖြိုးရေးလုပ်ငန်းများဆောင်ရွက်ရာတွင် ပတ်ဝန်းကျင် ရေးရာကာကွယ်စောင့်ရှောက်မှုကို ပါဝင်ကျသော ရည် မှန်းချက်အဖြစ် ထာဝစဉ်ထားရှိရမည်။

မြန်မာနိုင်ငံပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ ၂၁ ရာစုအစီအစဉ်(၁၉၉၇)

ရည်ရွယ်ချက်မှာ မြန်မာနိုင်ငံ၏ ဖွံ့ဖြိုးမှုလုပ်ငန်းစဉ် များတွင် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး လုပ်ငန်းများကို စနစ် တကျ ပေါင်းစပ်ဆောင်ရွက်သွားခြင်းဖြင့် ရေရှည်စဉ်ဆက် မပြတ် ဖွံ့ဖြိုးမှုရရှိရန်၊

မြန်မာနိုင်ငံပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ ၂၁ ရာစုအစီအစဉ်တွင် ပါဝင်သည့်လုပ်ငန်းများ

- (၁) လူဦးရေနှင့် နိုင်ငံဖွံ့ဖြိုးမှုအခြေအနေဟန်ချက်ညီရေး၊
- (၂) ပတ်ဝန်းကျင်ညစ်ညမ်းမှုကာကွယ်ရေး၊ ကောင်းမွန်သန့်ရှင်းသော ပတ်ဝန်းကျင်ဖန်တီးရေး၊ ကျန်းမာရေတိုးတက်စေရေး၊
- (၃) ဆင်းရဲမှုပျောက်ရေး
- (၄) ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးရှုထောင့်မှ ထည့်သွင်းစဉ်းစား၍ လူနေအိမ်ရာများ စီစဉ်ချထားရေး၊

- (၅) စိုက်ပျိုးရေး၊ စွမ်းအင်၊ စက်မှုပို့ဆောင်ရေး၊ ဆက်သွယ်ရေး၊ ခရီးသွားလုပ်ငန်းစသည့် စီးပွားရေးကဏ္ဍအသီးသီး၌ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးလုပ်ငန်းများ ပေါင်းစပ်ဆောင်ရွက်ရေး၊
- (၆) မြေ၊ ရေ၊ သစ်တော၊ အဏ္ဏဝါ၊ သတ္တုသယံဇာတအရင်းအမြစ်များနှင့် ဇီဝမျိုးစုံမျိုးကွဲများ ထိန်းသိမ်းကာကွယ်ရေး၊ စဉ်ဆက်မပြတ်အသုံးပြုနိုင်ရေး၊
- (၇) ယဉ်ကျေးမှုအမွေအနှစ်များ ထိန်းသိမ်းကာကွယ်ရေး၊
- (၈) မူဝါဒ၊ ဥပဒေ၊ အဖွဲ့အစည်း၊ ပြည်သူ့လူထုပူးပေါင်းပါဝင်ရေး၊ ပညာပေးရေး၊

အမျိုးသားစဉ်ဆက်မပြတ်

- လူမှုရေးဖွံ့ဖြိုးရေးမဟာဗျူဟာကျင့်ထိန်းသိမ်းရေး စသည့် အဓိကကဏ္ဍ(၃)ရပ် လွှမ်းခြုံပါဝင်သည့် အမျိုးသားအဆင့် ရေရှည်စဉ်ဆက်မပြတ် ဖွံ့ဖြိုးတိုးတက်မှုမဟာဗျူဟာ၏ မျှော်မှန်းချက်မှာ မြန်မာပြည်သူများ ကျန်းမာပျော်ရွှင်စေရေး (Well being and Happiness) ဖြစ်၊
- ရည်မှန်းချက်(၃)ရပ်မှာ သဘာဝသယံဇာတများ စဉ်ဆက်မပြတ်စီမံထိန်းသိမ်းရေး၊ စီးပွားရေးဘက်စုံဖွံ့ဖြိုးရေးနှင့် လူမှုရေးဆိုင်ရာစဉ်ဆက်မပြတ်ဖွံ့ဖြိုးတိုးတက်ရေးတို့ဖြစ်၊

စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု

အဓိကစွန့်ပစ်အမှိုက်များ

- မြို့တော်ဧရိယာမှထွက်ရှိသော စွန့်ပစ်အမှိုက်များ၊
- စက်မှုလုပ်ငန်းများမှ ထွက်ရှိသော စွန့်ပစ်အမှိုက်များ၊
- စိုက်ပျိုး၊ မွေးမြူရေးလုပ်ငန်းမှ ထွက်ရှိသော အမှိုက်များ၊
- ဘေးအန္တရာယ်ရှိ ဓါတုဗေဒစွန့်ပစ်ပစ္စည်းများ၊
- လျှပ်စစ်စွန့်ပစ်ပစ္စည်းများ၊

နိုင်ငံတကာ၌ အသုံးပြုနေသော နည်းလမ်းများ

- အမျိုးအစားခွဲ၍ စွန့်ပစ်ခြင်း (Reduce)
 - ပြန်လည်အသုံးပြုခြင်း (Reuse)
 - ပစ္စည်းများ အဖန်တလဲလဲ ပြန်လည် ပြုလုပ်သုံးစွဲခြင်း (Recycle)
 - မီးရှို့ခြင်း (Incineration)
 - မြေမြှုပ်ခြင်း (Landfill)
- မှတ်ချက်။ (၁) ဖွံ့ဖြိုးပြီးနိုင်ငံများ - Landfill နည်း
(၂) ဖွံ့ဖြိုးဆဲနိုင်ငံများ - Landfill များ

- စွန့်ပစ်အမှိုက်များအတွက် အမှိုက်အိတ်ဝယ်ပြီး စွန့်ပစ်သော စနစ်၊
- Extended Producer Responsibility စနစ်၊
- Allbaro စနစ်၊

Extended Producer Responsibility စနစ်

- ကုန်ပစ္စည်းထုတ်လုပ်သည့် ကုမ္ပဏီအနေဖြင့် မိမိ၏ ထုတ်ကုန်ပစ္စည်းများကို Recycle လုပ်ပြီး ပြန်သုံး၍ရအောင် ထုတ်လုပ်ထားခြင်းဖြစ်၊
- Recycle မလုပ်နိုင်ပါက ထုတ်လုပ်သည့်ကုမ္ပဏီအနေဖြင့် အစိုးရထံ ဒဏ်ငွေပေးဆောင်ရ၊

Allbaro စနစ်

- ကိုရီးယားတစ်နိုင်ငံတည်း ကျင့်သုံးဆောင်ရွက်လျက်ရှိ၊
- မိမိ၏ ထုတ်ကုန်ပစ္စည်းမည်မျှ ထုတ်လုပ်သည်၊ မည်မျှ ရောင်းချသည်၊ မိမိထုတ်ကုန်ပစ္စည်းများ စွန့်ပစ်အမှိုက်များ မည်သို့ဖျက်ဆီးသည်ဆိုသည်ကို အစိုးရထံ Update Online မှ တင်ပြရ၊

World Cup Park

- ကြီးမားကျယ်ပြန့်သည့် eco-park တစ်ခုဖြစ်
- (၃၄၇၁.၀၉) စတုရန်းမီတာကျယ်
- ၁၉၇၈ ခုနှစ် ၁၉၉၃ ခုနှစ်ကာလ
- အမှိုက်ပုံ၏အမြင့် (၉၆)မီတာ
- ၁၉၉၆ခုနှစ်မှ ၂၀၀၂ ခုနှစ်အတွင်း တည်ဆောက်ခဲ့
- ကုန်ကျစရိတ် အမေရိကန်ဒေါ်လာ သန်း(၂၀၀)





Beautiful Store

- မိမိတို့နေအိမ်များတွင် ပိုလျှံနေသော ပစ္စည်းအသစ်၊ အဟောင်းများအား Beautiful Store သို့ လာရောက် လှူဒါန်းလျက်ရှိ၊
- သင့်တင့်သောတန်ဖိုးဖြင့် ပြန်လည်ရောင်းချပြီး နဂိုသည့် ငွေအား ပြည်တွင်း၊ ပြည်ပရှိ လူထုအတွက် လိုအပ်သော ထောက်ပံ့မှုများ ဆောင်ရွက်လျက်ရှိ၊



Seoul Resource Centre

- လူတို့အသုံးပြုပြီးဖြစ်သော လျှပ်စစ်ပစ္စည်းအဟောင်းများအား Recycle ပြုလုပ်သည့် နေရာဖြစ်၊
- အလုပ်လက်မဲ့အများစုကို အလုပ်ခန့်ထား၊
- အကျိုးအမြတ် (၇၀%)အား ပြည်သူလူထုအတွက် အသုံးပြု၊
- သတ္တု၊ ရွှေ၊ ကြေးတို့ကို ပြန်လည်ထုတ်ယူ၊
- မြေကြီးတစ်တန်မှ ရွှေ (၅)ဂရမ်သာ ထွက်ပြီး ဖုန်းဟောင်းအလေးချိန် (၁)တန်မှ ရွှေ (၄၀၀)ဂရမ်ထိ ထွက်
- မြို့လယ်ခေါင်မှ ရွှေတွင်းကြီးများဟု တင်စားခေါ်ဝေါ်၊



Food Waste Factory

- မြို့တွင်းရှိ စွန့်ပစ်စားနွယ်ကုန်များအား သယ်ယူကာ တိရစ္ဆာန်အစာနှင့် မြေဩဇာအဖြစ် ပြန်လည်ထုတ်လုပ်၊
- (၁)ရက်လျှင် မြေဩဇာ တန်(၅၀)အထိ ထုတ်လုပ်နိုင်၊
- (၁)ရက်လျှင် တိရစ္ဆာန်အစာ တန်(၁၆၅)ထုတ်လုပ်နိုင်၊
- အခြားကုန်ကြမ်းများမှ ထုတ်လုပ်ကြတ်စားနှင့် Food Waste မှ ထုတ်လုပ်ကြတ်စားကို ခြောက်စွဲ ဥနှုန်း အတူတူဖြစ်၊



ဗာဆယ်ကွန်ဗင်းရှင်း

- အာဖရိကနှင့် ကမ္ဘာ့ဖွံ့ဖြိုးဆဲနိုင်ငံများသို့ ဘေးအန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများ၊ နိုင်ငံဖြတ်ကျော်သယ်ဆောင်ခြင်းကို ထိန်းချုပ်ရန်အတွက် ၁၉၈၉ခုနှစ်၊ မတ်လ (၂၂)ရက်နေ့တွင် ဆွစ်ဇာလန်နိုင်ငံ၊ ဗာဆယ်မြို့၌ ကျင်းပသော အပြည်ပြည်ဆိုင်ရာနိုင်ငံကိုယ်စားလှယ်များ ညီလာခံမှ ဗာဆယ်ကွန်ဗင်းရှင်းအား အတည်ပြုခဲ့၊
- ၁၉၉၂ ခုနှစ်တွင် တရားဝင်အာဏာသက်ရောက်ခဲ့ပြီး အဖွဲ့ဝင်နိုင်ငံပေါင်း ၁၈၂ နိုင်ငံရှိ၊
- (၆.၄.၂၀၁၅)ရက်နေ့တွင် မြန်မာနိုင်ငံသည် ဗာဆယ်ကွန်ဗင်းရှင်းအဖွဲ့ဝင်နိုင်ငံဖြစ်လာခဲ့၊

ဗာဆယ်ကွန်ဗင်းရှင်း၏ ရည်ရွယ်ချက်များ

- ဘေးအန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများ စွန့်ပစ်မှုကိုလျော့ချရန်နှင့် ဘေးအန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများ စွန့်ပစ်ခြင်းနှင့် ပတ်သက်၍ ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှုကို တိုးမြှင့်ဆောင်ရွက်ရန်၊
- ပတ်ဝန်းကျင်ထိခိုက်မှုဆိုင်ရာ အခြေခံစည်းမျဉ်းများနှင့်အညီ ဘေးအန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများကို သတ်မှတ်ထားသည့် နေရာများသို့ သယ်ဆောင်ခြင်းမှတစ်ပါး နိုင်ငံ့ ဖြတ်ကျော်သယ်ဆောင်ခြင်းများကို ကန့်သတ်ထိန်းချုပ်ရန်၊
- နိုင်ငံ့ဖြတ်ကျော်သယ်ဆောင်မှုများအပေါ် စည်းမျဉ်းစည်းကမ်းများနှင့် ထိန်းချုပ်သည့်စနစ်ဖြင့် ခွင့်ပြုနိုင်ရန်နှင့် အကောင်အထည်ဖော်ဆောင်ရွက်ရန်။

စတော့ဟုမ်း ကွန်ဗင်းရှင်း

- သဘာဝပတ်ဝန်းကျင်ညစ်ညမ်းမှုကိုဖြစ်စေပြီး ကြာရှည်စွာမပျောက်မပျက်တည်ရှိနေသော အော်ဂဲနစ်ဒြပ်ပစ္စည်းများ (Persistent Organic Pollutants-POPs)ကြောင့် ဖြစ်ပေါ်လာသည့် ရောဂါများနှင့် ၎င်းဒြပ်ပစ္စည်းများကြောင့် သဘာဝပတ်ဝန်းကျင်ပိုမိုညစ်ညမ်းလာ၍ ကုလသမဂ္ဂပတ်ဝန်းကျင်ထိန်းသိမ်းရေးအစီအစဉ် (United Nations Environmental Programme-UNEP) မှ ကြီးမှူး၍ ၂၀၀၁ခုနှစ် မေလ(၂၂)ရက်နေ့တွင် ဆွီဒင်နိုင်ငံ၊ စတော့ဟုမ်းမြို့၌ ချမှတ်ခဲ့သော သဘောတူညီချက်ဖြစ်။
- အဖွဲ့ဝင်နိုင်ငံပေါင်း (၁၇၉)နိုင်ငံရှိပြီး မြန်မာနိုင်ငံသည် (၂၀၀၄)ခုနှစ်၊ ဇူလိုင်လတွင် အဖွဲ့ဝင်နိုင်ငံဖြစ်ခဲ့။



မြန်မာနိုင်ငံနှင့်ပတ်သက်၍ လိုက်နာဆောင်ရွက်သင့်သည့် စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု

Education

- အမှိုက်များခွဲခြမ်းစွန့်ပစ်ရေး နေ့စဉ် FM Radio၊ နေ့စဉ် ထုတ်သတင်းစာများမှ ဖော်ပြပေးခြင်း၊
- ကလေးသူငယ်များအတွက် စာသင်ကျောင်းများ၌ အသိပညာပေးလုပ်ငန်းများ ဆောင်ရွက်ခြင်း၊

- မန္တလေးမြို့တော်စည်ပင်သာယာရေးကော်မတီအနေဖြင့် Sanitary Landfill ဆောင်ရွက်ပြီး Air Pollution၊ Water Pollution မဖြစ်အောင် ဆောင်ရွက်ပေးခြင်း၊
- အိမ်ရာစီမံကိန်းများနှင့် စက်မှုဇုန်များ တည်ဆောက်ပါက မဆောင်ရွက်မီစွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲသည့်စနစ် စွန့်ပစ်ရေး ဆိုး စီမံခန့်ခွဲသည့်စနစ်များ၊ မြို့တွင်း ရေမြောင်းစနစ်နှင့် မိလ္လာစနစ်တို့ စနစ်တကျရေးဆွဲထားမှသာ အိမ်ရာစီမံကိန်းအား ခွင့်ပြုခြင်း၊

- မိမိနိုင်ငံ၊ မိမိလူမျိုး စရိုက်နှင့်ကိုက်ညီမည့် နည်းလမ်းများ လိုက်နာကျင့်သုံးခြင်း၊
- ဥပဒေသက်ရောက်မှုရှိအောင် ဆောင်ရွက်ခြင်း၊

ရေထုညစ်ညမ်းမှု

ရေထုညစ်ညမ်းမှု

ရေထုညစ်ညမ်းမှုဆိုသည်မှာ ရေအရင်းအမြစ်ထဲ၌ ရူပဗေဒဆိုင်ရာ၊ ဓါတုဗေဒဆိုင်ရာ၊ ဇီဝဗေဒ ပြောင်းလဲမှုဆိုင်ရာ တစ်ခုခုဖြစ်ပေါ်ကာ ၎င်းရေကို သောက်သုံးသော လူနှင့် သက်ရှိ သတ္တဝါများကို အန္တရာယ်ဖြစ်စေခြင်းကို ခေါ်ပါသည်။

ရေထုညစ်ညမ်းမှု၏ ဖော်ပြချက်များ

- အိမ်သုံးစွန့်ပစ်ပစ္စည်းများ
- စက်မှုလုပ်ငန်းသုံးစွန့်ပစ်ပစ္စည်းများ
- စိုက်ပျိုးရေးသုံး စွန့်ပစ်ပစ္စည်းများ
- သဘာဝစနစ် (ရေကြီးခြင်း၊ မီးတောင်ပေါက်ကွဲခြင်း၊ တောမီးလောင်ခြင်း)

ရူပဗေဒဆိုင်ရာ ဖော်ပြချက်များ

- Suspended Solid
- Turbidity
- အရောင်
- အနံ့
- အရသာ
- အပူချိန်

ဓါတုဗေဒဆိုင်ရာ ဖော်ပြချက်များ

- Total Dissolved Solid
- Alkalinity
- Hardness
- Fluoride
- Metals
- Organics
- Nutrients

ရေဆိုးသန့်စင်နည်း၏ အဓိကလုပ်ငန်းစဉ်များ

- (၁) အခြေခံသန့်စင်မှု (Primary Treatment)
 - (က) Screening
 - (ခ) Grid Collection
 - (ဂ) Grease & Oil Removal
 - (ဃ) Sedimentation
 - (င) Sludge Digestion

- (စ) Sludge Drying
- (ဆ) Sludge Incineration
- (ဇ) Gas Utilization
- (ည) ဓါတုဗေဒဆိုင်ရာ သန့်စင်ခြင်း
 - (က) Coagulation
 - (ခ) Precipitation

(၃) Secondary Treatment

- (က) Biological Filtration
- (ခ) Activated Sludge
- (င) Chlorination

ရေထုညစ်ညမ်းမှုဖြစ်စေသော အဓိကအရာများ

- Disease causing agents
- Oxygen demanding waste
- Water-soluble inorganic pollutants
- Water-soluble radioactive compound
- Suspended sediment

Point Sources

- Come from single source
- Sewage Treatment plants
- Underground mines
- Oil wells
- Oil tanker
- Agriculture
- ထိန်းချုပ်ရန်လွယ်ကူ

Non Point Sources

- Come from many sources
- ၎င်းထဲတွင် Acid deposition, Traffic Factories
Ships တို့မှ ထွက်သော ညစ်ညမ်းရေးများ ပါဝင်
- ထိန်းချုပ်ရန် ခက်ခဲ

ရေထုညစ်ညမ်းမှုအား သိရှိနိုင်မည့် နည်းလမ်းများ

- Chemical indicator (ခါတ်ခွဲခန်း၌ ရေ၏ရူပဗေဒနှင့် ဓါတုဗေဒဆိုင်ရာ အညွှန်းကိန်းများအား စစ်ဆေးခြင်း)
- Biological indicator (ရေအတွင်းရှိ ငါးနှင့် ရေသတ္တဝါ ရှင်သန်ပေါက်ဖွားမှု အား စစ်ဆေးခြင်း)

စက်မှုလုပ်ငန်းသုံး စွန့်ပစ်ပစ္စည်းများ

- စက်ရုံ၊ အလုပ်ရုံများမှ ရုပ်ကြွင်းလောင်စာအသုံးပြု၍ Lead, mercury, sulphur, asbestos , nitrates နှင့် အခြား ဘေးအန္တရာယ်ဖြစ်စေသော ဓါတ်ငွေ့များထုတ်လွှတ်
- ၎င်းဓါတ်ငွေ့များသည် လေထုညစ်ညမ်းမှုကို သာမက ရေခိုးရေငွေ့နှင့် ဓါတ်ပြု၍ အက်ဆစ်မိုးအဖြစ် ရွာသွန်းကာ ရေထုညစ်ညမ်းမှုကိုပါ ဖြစ်ပေါ်စေပြီး အပင်များ သက်ရှိများ ထိခိုက်ပျက်စီးနိုင်

သတ္တုတူးဖော်ရေးလုပ်ငန်းများ

- ကမ္ဘာမြေကြီးအတွင်းမှ ကျောက်မီးသွေးနှင့် အခြားသတ္တုများ ရရှိရေးအတွက် တူးဖော်လျက်ရှိ
- တူးဖော်ထားသော ကျောက်တုံး၊ ကျောက်ခဲများတွင် ပါရှိသော အန္တရာယ်ရှိ ဓါတုပစ္စည်းများသည် ရေနှင့်ခါတ်ပြု၍ ပိုမိုအန္တရာယ် ကြီးမားလာခဲ့။
- သတ္တုတူးဖော်ရာမှ ထွက်ရှိသည့် မြောက်များစွာသော သတ္တုအညစ်အကြေးများနှင့် Sulphides တို့သည် ရေနှင့် ပူးပေါင်းခါတ်ပြုကာ Acid mine drainage ကိုဖြစ်ပေါ်စေ။

Marine Dumping

- မြေနေရာကျဉ်းသော ကမ္ဘာပေါ်ရှိ နိုင်ငံအချို့သည် စွန့်ပစ်ပစ္စည်းများအား ပင်လယ်ကမ်းစပ်မှ ပင်လယ်ထဲသို့ မြေနေရာရရှိရေး စွန့်ပစ်လျက်ရှိ။
- ထိုသို့ စွန့်ပစ်မှုကြောင့် ရေထုညစ်ညမ်းမှုကို ဖြစ်ပေါ်စေရုံမက ရေနေသတ္တဝါများကိုလည်း သေကြေပျက်စီးစေ။

ပင်လယ်ပြင်၌ ရေနံယိုဖိတ်မှုများ

- ပင်လယ်ပြင်တွင် သင်္ဘောအချင်းချင်းမတော်တဆ တိုက်ခိုက်မိခြင်းကြောင့်ဖြစ်။
- ရေနံယိုဖိတ်မှုကြောင့် ရေမျက်နှာပြင်နှင့် ပင်လယ်ကမ်းစပ်တို့တွင် ညစ်ညမ်းမှုဖြစ်ပေါ်

အဝေးပြေးလမ်းမကြီးများနှင့် ရေထုညစ်ညမ်းမှု

- မော်တော်ယာဉ်များ၏ တာယာပွန်းစားမှု၊ အင်ဂျင်ပိုင်း၊ ဘရိတ်ဆီယိုစိမ့်မှုများသည် မိုးရေနှင့် ခါတ်ပြုစီးဆင်းမှုဖြစ်ပြီး နီးစပ်ရာ မြစ်၊ ချောင်းများ ညစ်ညမ်းမှုဖြစ်ပေါ်။
- လေ့လာသူများ၏ အဆိုအရ မြို့ကြီးတစ်ခု၏ အဝေးပြေးလမ်းမကြီးပေါ်မှ စက်ဆီများ တစ်နှစ်ယိုစိမ့်မှုသည် အလယ်အလတ်ဆီတင် သင်္ဘောတစ်စီး၏ ဂါလံအရေအတွက်နှင့် ညီမျှသည်ဟုဆိုထား။

Chemical Waste

- Electronic Circuit Board
- Heavy Metal
- Lead
- Mercury

- Cadmium
- ၁၉၇၈ ခုနှစ်၊ ဂျပန်နိုင်ငံ Minimata Bay မှာ ဖြစ်ခဲ့တဲ့ စက်ရုံတစ်ခုက mercury ပါသည့် စွန့်ထုတ်အရည်များကြောင့် ပင်လယ်ရေညစ်ညမ်းမှုဖြစ်ပေါ်ကာ အဆိပ်သင့်သော ငါးများအား လူတို့စားသုံးမိ၍ (၂၀၀၀)ခန့် အဆိပ်သင့်ပြီး တစ်ရာခန့် သေဆုံးခဲ့။



စွန့်ပစ်ရေ၊ စီးဆင်းရေ၊ ထုတ်လွှတ်အရည်နှင့် မိလ္လာရေစွန့်ထုတ်မှု (Wastewater, Storm Water Runoff, Effluent and Sanitary Discharges (General Application))^၉

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chlorine (total residual)	mg/l	0.2
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1

^၉ Pollution prevention and abatement handbook. 1998. Toward cleaner production. World Bank Group in collaboration with United Nations Environment Programme and the United Nations Industrial

ရေထုညစ်ညမ်းမှု ကာကွယ်ရန်နည်းလမ်းများ

- စက်မှုလုပ်ငန်းရှင်များ၊ ပြည်သူလူထုနှင့် ကလေးသူငယ်များအား အသိပညာပေးလုပ်ငန်းများဆောင်ရွက်ခြင်း၊
- ဥပဒေ၊ နည်းဥပဒေ၊ လမ်းညွှန်ချက်များအား လိုက်နာစေခြင်း၊
- ရေဆိုးသန့်စင်သည့် နည်းစနစ်များကို အသုံးပြုစေခြင်း၊
- ဥပဒေ၊ နည်းဥပဒေ၊ လမ်းညွှန်ချက်များအား လိုက်နာမှု ရှိ/မရှိ စောင့်ကြပ်ကြည့်ရှုခြင်း၊

လေထုညစ်ညမ်းမှု

လေထုညစ်ညမ်းမှု

လေထုညစ်ညမ်းမှုဆိုသည်မှာ လေထဲတွင် အန္တရာယ်ဖြစ်စေသည့် ဓါတုပစ္စည်းနှင့် အမှုန်များ ပါဝင်နေခြင်းကြောင့် လေထုအရည်အသွေးကျဆင်းကာ လူနှင့် သက်ရှိသတ္တဝါများ၏ ကျန်းမာရေးကို ထိခိုက်စေခြင်းဖြစ်ပါသည်။

လေထဲရှိ ပါဝင်သော ဓါတ်ငွေ့များ

- နိုက်ထရိုဂျင် (၇၈ ရာခိုင်နှုန်း)
- အောက်စီဂျင် (၂၀.၉ ရာခိုင်နှုန်း)
- အာဂွန် (၀.၉၃ ရာခိုင်နှုန်း)
- အခြား (CO₂, CH₄, O₃, Hydrogen, Helium, Krypton, Xenon, Neon)
- စက်ရုံ၊ အလုပ်ရုံများမှ (SO₂ , CO₂, NO) ထုတ်လွှတ်
- မော်တော်ယာဉ်များမှ CO₂, CO, NO
- ဆေးလိပ်မီးခိုးများတွင် CO₂, CO ပါဝင်၊

လေထုညစ်ညမ်းမှု၏ ဇစ်မြစ်များ

- လူသားတို့၏ဆောင်ရွက်ချက် (သယ်ယူပို့ဆောင်ရေးကဏ္ဍ၊ ကုန်ထုတ်လုပ်မှု ကဏ္ဍ)
- သဘာဝစနစ် (မီးတောင်ပေါက်ကွဲခြင်း၊ တောမီးလောင်ခြင်း)

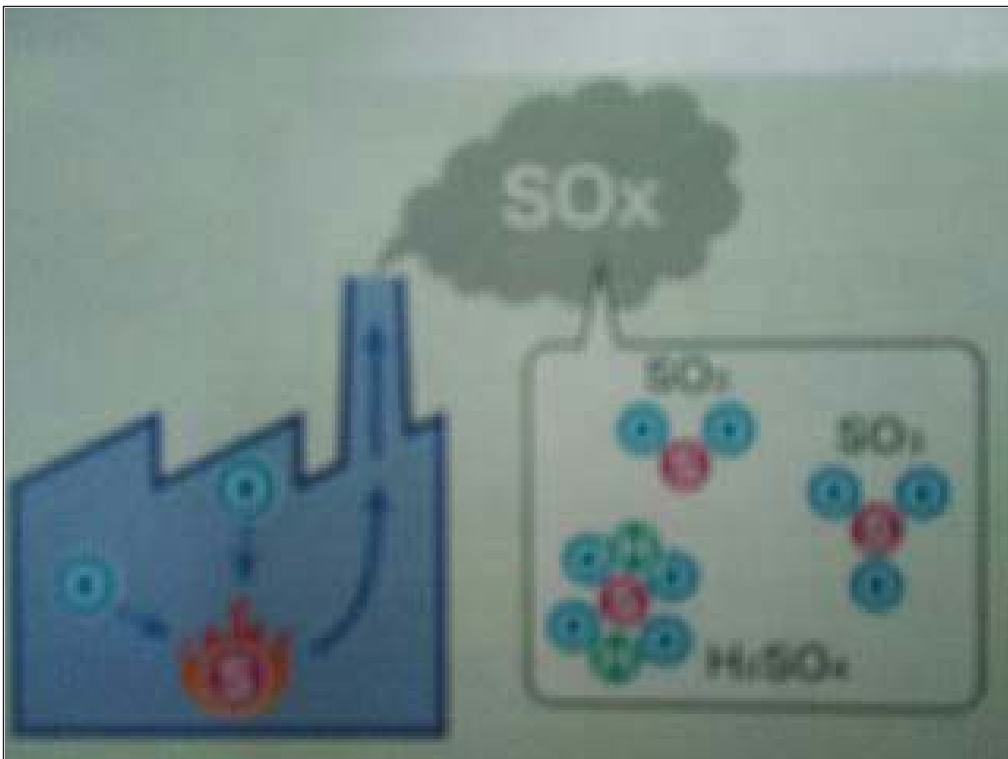
လေထုညစ်ညမ်းမှုဖြစ်စေသည့် အရာများ

- ဆာလဖာအောက်ဆိုဒ်
- နိုက်ထရိုဂျင် အောက်ဆိုဒ်



ဆာလဖာအောက်ဆိုဒ် (SO_x)

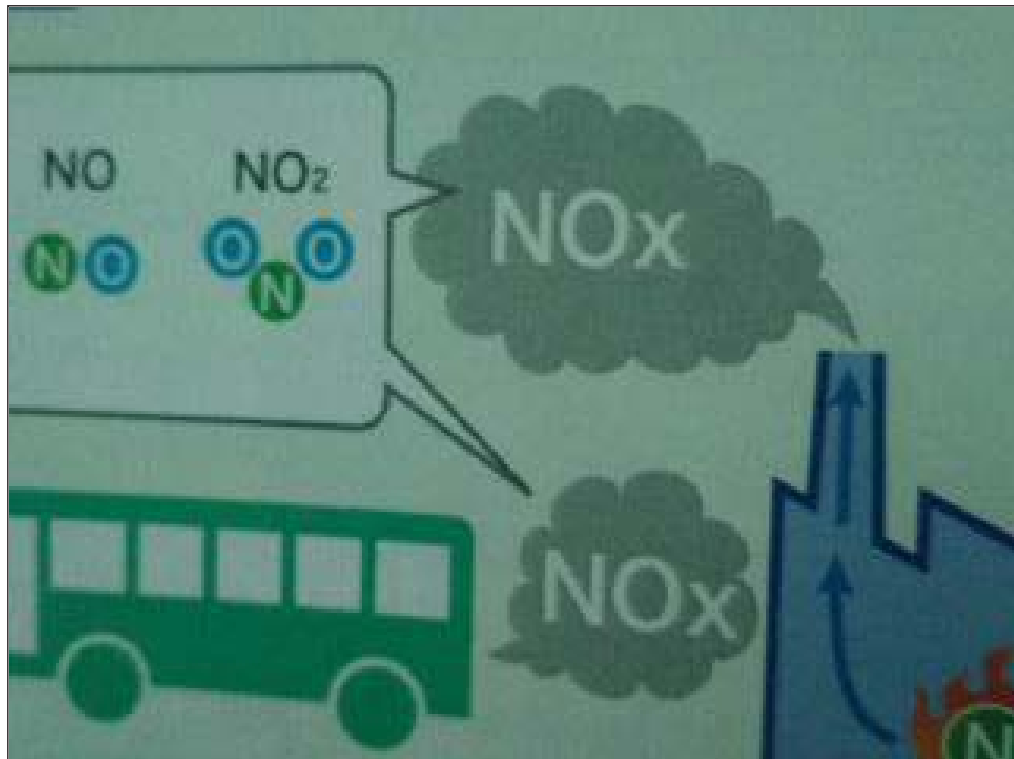
- ဆာလဖာပါဝင်သော ရေနံ၊ ကျောက်မီးသွေး စသည့် လောင်စာများ လောင်ကျွမ်းသည့်အခါ ထွက်ပေါ်၊
- ဆာလဖာပါဝင်သည့် အရာဝတ္ထုများကို လောင်ကျွမ်းစေသောအခါ ဓာတ်ပြောင်းသွားပြီး ဆာလဖာဒိုင်အောက်ဆိုဒ် ထွက်ပေါ်၊
- သိပ်သည်းဆမြင့်မားသော ဆာလဖာဒိုင်အောက်ဆိုဒ်သည် လူသားများ၏ လေပြန်ယောင်ရမ်းခြင်းနှင့် အခြားရောဂါလက္ခဏာများကို ဖြစ်ပေါ်စေ၊
- SO₂ သည် ရေခိုးရေငွေ့များနှင့် ပူးပေါင်းဓာတ်ပြုပြီး H₂SO₄ အဖြစ် ဓာတ်ပြောင်းသွားပြီး အက်ဆစ်မိုးအဖြစ် ရွာချ၊



နိုက်ထရိုဂျင်အောက်ဆိုဒ် (NO_x)

- လောင်စာကို အပူပြင်းပြင်းပေးပြီး လောင်ကျွမ်းစေသော အခါ လေထုထဲရှိ O₂ နှင့် N₂ တို့နှင့် ဓါတ်ပြုကာဖြစ်ပေါ်။
- လောင်စာအတွင်းမှ ပါရှိသော N₂ သည် O₂ နှင့်ဓါတ်ပြုကာ NO_x ထွက်ပေါ်။ ၎င်းကို Fuel NO_x ဟုခေါ်။ Fuel NO_x ကို လျှော့ချမည်ဆိုပါက N₂ ပါဝင်မှုနည်းသော လောင်စာကို အသုံးပြုခြင်း၊ O₂ သိပ်သည်းဆကို လျှော့ချခြင်းတို့ ပြုလုပ်သင့်။
- လေထုအတွင်းရှိ N₂ သည် O₂ တို့သည် မြင့်မားသော အပူချိန်တွင်ဖြစ်ပေါ်လာသော NO_x ကို Thermal NO_x ဟုခေါ်။ Thermal NO_x ကိုလျှော့ချမည်ဆိုပါက အပူချိန်ကို လျှော့ချခြင်း၊ လောင်ကျွမ်းမှုကြာချိန်ကို လျှော့ချခြင်း၊ O₂ သိပ်သည်းဆကို လျှော့ချခြင်းတို့ ပြုလုပ်သင့်။

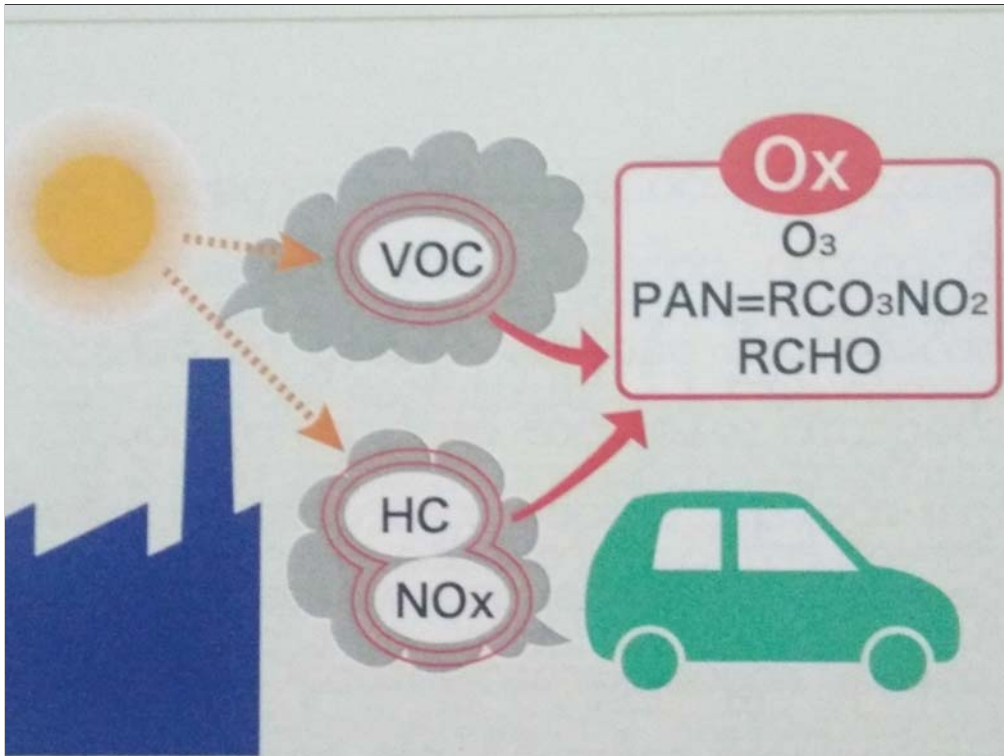
- ဓါတ်ပြုနေချိန်တွင် NO အဖြစ် တည်ရှိနေသော်လည်း လေထုအတွင်းရောက်ရှိသွားပါက O₂ နှင့်ပေါင်းပြီး နီညိုရောင်ရှိ NO₂ အဖြစ်ပြောင်းလဲ။
- သိပ်သည်းဆမြင့်မားသော NO₂ သည် လူသားများအား လည်ချောင်းနာစေခြင်း၊ ရင်ကြပ်ခြင်း၊ အဆုတ်နှင့် အသက်ရှူလမ်းကြောင်းဆိုင်ရာ ရောဂါများကို ဖြစ်ပေါ်စေ။ ထို့ပြင် NO₂ သည် ရေခိုးရေငွေ့နှင့်ပေါင်းကာ နိုက်ထရစ်အက်ဆစ် (HNO₃) အဖြစ်ပြောင်းလဲပြီး အက်ဆစ်မိုးအဖြစ် ရွာချ။



အငွေ့ပြန်လွယ်သော အော်ဂဲနစ်ဒြပ်ပေါင်း (VOCs)

- သုတ်ဆေး၊ မှင်၊ ကော်အစရှိသည့် ပျော်ဝင်မှုကို အားပေးသော အရည်များပါဝင်သည့် အငွေ့ပြန်လွယ်သည် အော်ဂဲနစ်ဒြပ်ပေါင်း (VOC) သည် အငွေ့ပြန်လွယ်ပြီး လေထုအတွင်းသို့ အလွယ်တကူဝင်ရောက်နိုင်သော အရာဖြစ်။ VOC သည် Photochemical Smog ကို ဖြစ်ပေါ်စေသည့်အပြင် Photochemical Oxidant (O_x) Suspended Particulate Matter (SPM)ကို ဖြစ်ပေါ်စေ။

- သိပ်သည်းဆများသော အမှုန်များသည် အသက်ရှူလမ်းကြောင်းဆိုင်ရာ၊ သွေးလှည့်ပတ်မှုနှင့် ဆက်စပ်သော ရောဂါများဖြစ်ပွားစေ။
- လေထုအတွင်းရှိ အငွေ့ပြန်လွယ်သော အော်ဂဲနစ်ဒြပ်ပေါင်း (VOCs) က Photochemical Reaction ဖြစ်ပေါ်လာသော PM 2.5 သည် လူ့ခန္ဓာကိုယ်အတွင်းသို့ ဝင်ရောက်ပါက အဆုတ်နှင့် လေပြန်ထဲတို့တွင် အနည်ထိုင်ပြီး ပန်းနာရင်ကြပ်နှင့် လေပြန်ယောင်ရမ်းခြင်းတို့ကို ဖြစ်စေပြီး ကင်ဆာရောဂါအမျိုးမျိုးကိုပါ ဖြစ်ပွားစေ။



Photochemical Oxidant (Ox)

- Ox သည် မော်တော်ကားနှင့် စက်ရုံများမှထွက်လာသော Nox, VOC တို့သည် နေမှလာသော ခရမ်းလွန်ရောင်ခြည်နှင့်ထိတွေ့ပြီး Photochemical Reaction ဖြစ်ကာ ထွက်ပေါ်။
- Photochemical Oxidant ၏ အဓိကပါဝင်သည့်အရာမှာ O₃ ဖြစ်။

ကာဗွန်ဒိုင်အောက်ဆိုဒ် (CO₂)

- CO₂ သည် လောင်စာများလောင်ကျွမ်းသည့်အခါတွင် ဖြစ်ပေါ်။
- လောင်စာဆီအသုံးပြုရာနေရာများသည် CO₂ ဖြစ်ပေါ်ရာ အရင်းအမြစ်များဖြစ်။

အခြားအရာများ

- ဂျပန်နိုင်ငံတွင် ရှေးယခင်က မော်တော်ကားလောင်စာဆီဖြစ်သော Octane ကို အဆင့်မြှင့်တင်ရန်အတွက် ခဲ(Pb) ကိုအသုံးပြုခဲ့။
- ဓါတ်ဆီတွင်ပါဝင်သည့် ခဲသည် ညစ်ညမ်းဓါတ်ငွေ့ကို ထိန်းချုပ်သည့်ကိရိယာ၏ လုပ်ဆောင်မှု စွမ်းရည်ကို အနှောင့်အယှက်ဖြစ်စေကာ ခဲဓါတ်ပါဝင်သည့် သိပ်သည်းဆမြင့်မားသော ညစ်ညမ်းဓါတ်ငွေ့ထုတ်လွှတ်မှုကို ဖြစ်ပေါ်စေ။
- လူသည် ခဲဓါတ်ပါဝင်သော အရာကို အနည်းငယ်ရှူရှိုက်မိရုံဖြင့် တစ်ကိုယ်လုံးအဆိပ်သင့်နိုင်။ ပမာဏများပါက အလွန်လျှင်မြန်စွာအဆိပ်သင့်နိုင်ပြီး ဗိုက်နာခြင်း၊ အော့အန်ခြင်းတို့ ဖြစ်ပေါ်ပြီး သေဆုံးသည်ထိအန္တရာယ်ရှိ။

Coal Plants

- SO₂, CO₂, NO, Arsenic, Lead, Mercury နှင့် Cadmium တို့ ပါဝင်သော ဓါတ်ငွေ့များ ထုတ်လွှတ်။

Cement Plants

- Aluminum, Zinc နှင့် Copper တို့ ပါဝင်သော ဓါတ်ငွေ့များ ထုတ်လွှတ်။

Clean Fuels

- Compressed Natural Gas (CNG) နှင့် Liquid Petroleum Gas (LPG) တို့သည် ၎င်းတို့တွင်ပါဝင်သော ရူပနှင့် ဓါတုဗေဒဆိုင်ရာ ဂုဏ်သတ္တိများကြောင့် ဓါတ်ဆီနှင့် ဒီဇယ်တို့ အသုံးပြုမှုများထက် လေထုကို ပိုမိုသန့်စင်စေ၊
- ဥပမာ - Ethanol, Methanol , Propane, Natural Gas နှင့် Hydrogen Gas တို့ဖြစ်

Particulate Matter (PM)

- PMသည် အစိုင်အခဲ(သို့မဟုတ်)အရည်အမှုန်အစက်ဖြစ်၊
- စက်ရုံများ၏ မီးခိုးမှထွက်လာသော ပြာမှုန်များနှင့် သတ္တု ဓါတ် ပမာဏများစွာပါဝင်သော နေရာများမှထွက်ပေါ်လာသော အမှုန်များသည် ထင်ရှားသော ဥပမာများဖြစ်၊
- ဒီဇယ်ကားများမှ ထွက်လာသော အမည်းရောင်မီးခိုးငွေ့များသည်လည်း PM ထဲတွင် ပါဝင်၊
- ထို့ပြင်မီးတောင်များမှထွက်လာသော ပြာများ၊ လေထုက သယ်ဆောင်လာသော ပင်လယ်နှင့် ဒီရေမှလာသော ဆား ဓါတ်ပါဝင်သည့် အမှုန်များသည်လည်း PM ထဲတွင်ပါဝင်၊

Carbon Footprint

- Primary Carbon Footprint
(သယ်ယူပို့ဆောင်ရေးကဏ္ဍ)
- Secondary Carbon Footprint
(ကုန်ထုတ်လုပ်မှုကဏ္ဍ)

Fly Ash

- Arsenic, Lead နှင့် Cadmium တို့ပါဝင်
- လူသားများ၏ ကျန်းမာရေးကို ဆိုးရွာစွာထိခိုက်
- လေထုညစ်ညမ်းမှုဖြစ်သလို ရေခိုးရေငွေ့နဲ့ ပေါင်းပြီး ရေထုညစ်ညမ်းမှုပါဖြစ်စေ၊

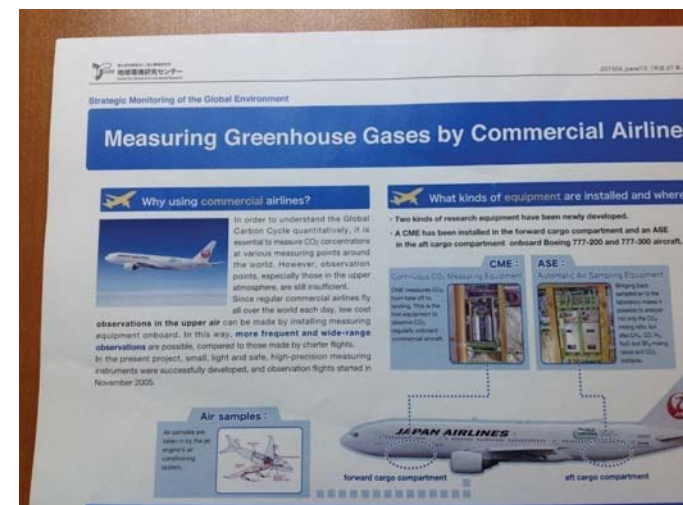
လေထုညစ်ညမ်းမှုစောင့်ကြည့်တိုင်းတာရေးနှင့်ပတ်သက်၍ ဆောင်ရွက်မှုများ

- မှန်လုံအိမ်ဓါတ်ငွေ့ထုတ်လွှတ်မှုနှင့် ပတ်သက်၍ (CO₂, CH₄, NO) စသည့် ဓါတ်ငွေ့ထုတ်လွှတ်မှုများအား ၁၉၆၀ ခုနှစ်မှ ၂၀၁၅ ခုနှစ်အထိ သုတေသနပြုလုပ်ခဲ့။
- သတင်းအချက်အလက်များရရှိရေး IBUKI အသုံးပြုခဲ့။
- တိမ်ထူခြင်းနှင့် ညအချိန်၌သတင်းအသေးစိတ်မရခဲ့။

- သို့ဖြစ်၍ JAL မှ လေယာဉ်များဖြင့် နိုင်ငံတကာသို့ ပျံသန်းစဉ် ASE (Automatic Air Sampling Equipment) နှင့် CME (Carbondioxide Measuring Equipment) ကဲ့သို့ စက်ပစ္စည်းများအား လေယာဉ်ပေါ်တွင်တပ်ဆင်ကာ သုတေသနလုပ်ငန်းများ ဆောင်ရွက်ခဲ့။
- တစ်ကမ္ဘာလုံးအတွက် လေယာဉ်များ၌ စက်(၉)လုံးတပ်ဆင်ထားပြီး (၃)လုံးမှာ လေထဲ၌ အမြဲရှိ။

- ပင်လယ်ရေသည်လည်း အပူစုပ်ယူနိုင်မှုကျဆင်းလာသောကြောင့် ပင်လယ်ရေအား သုတေသနပြုလုပ်ရန် လိုအပ်ခဲ့။
- သို့ဖြစ်၍ ဂျပန်နိုင်ငံပိုင် ဂျပန်-မြောက်အမေရိက၊ ဂျပန်-ဩစတြေးလျ၊ ဂျပန်-နယူးဇီလန်၊ ဂျပန်-အရှေ့တောင်အာရှ ခရီးစဉ်များသို့သွားသော သင်္ဘောများတွင် သုတေသနပြုလုပ်သည့် စက်ကိရိယာများ တပ်ဆင်အသုံးပြုလျက်ရှိ။

National Institute for Environmental Studies (1.2.2016)

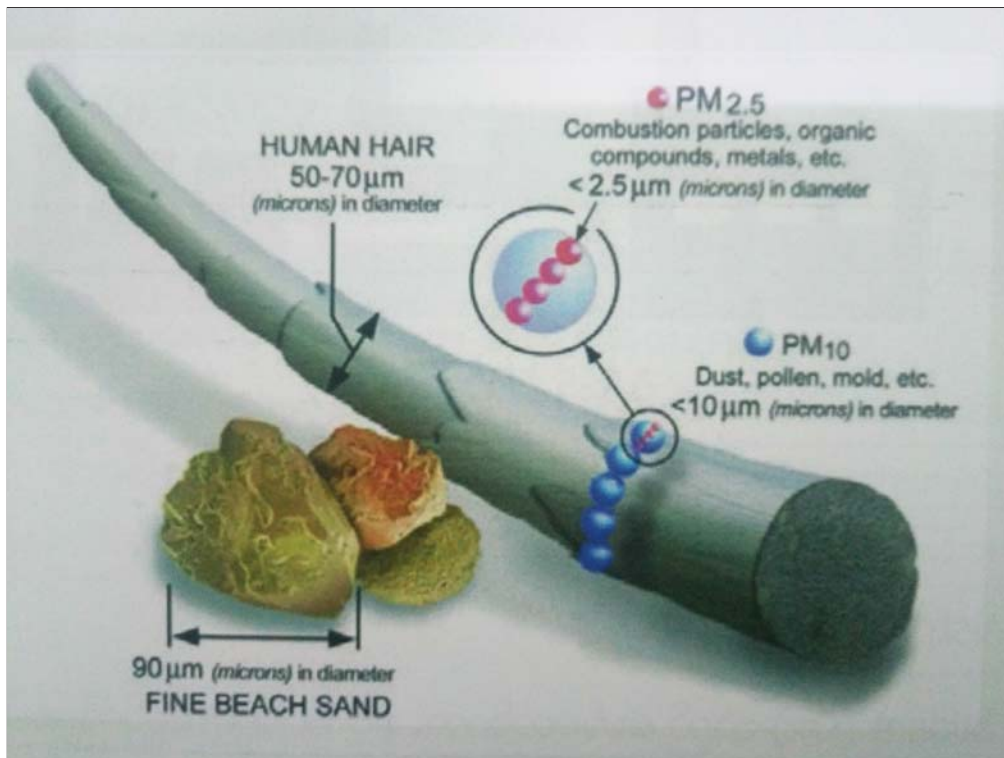


Tokyo Metropolitan Research Institute (2.2.2016)



What are **aerosols**?

Aerosols are **microscopic airborne particles**. Their size vary from a few nanometers (1 nanometer=1 billion of a meter) to micrometers (1 micrometer=1 million of a meter). The diameter of a human strand of hair is roughly 50,000 to 100,000 nanometers.



London Smog (1952)

(The worst air pollution in history)

- ၁၉၅၂ ခုနှစ်၊ ဒီဇင်ဘာလ (၅)ရက်
- လန်ဒန်မြို့ကြီးတစ်ခုလုံး အအေးခတ်လွန်ကဲနေ
- နေအိမ်များ အနွေးခတ်ရရှိရန် မီးဖိုများဖို၍ အသုံးပြု၊
- မီးခိုးများ တစ်မြို့လုံးအနှံ့အပြားထွက်ရှိ၊
- ကျောက်မီးသွေးလောင်စာမှ SO_2 အဆက်မပြတ်ထွက်ပေါ်၊

- ထိုအချိန်တွင် PM₁₀ လေထဲပါဝင်မှုနှုန်းသည် ပုံမှန်ထက် (၁၀)ဆခန့်ရှိ
- မြေကြီးနှင့် အနီးဆုံးကပ်လျက်ရှိသည့် လေထုအတွင်း အအေးခါတ်ပိုကာ Temperature Inversion ဖြစ်ပေါ်လျက်ရှိ၊
- ထူထဲသော မီးခိုးငွေ့ပြင်ကြီးသည် လန်ဒန်မြို့ကြီးတစ်ခုလုံးအား လွှမ်းခြုံထား၊

- (၅)ရက်ကြာ လေထုညစ်ညမ်းမှုကြောင့် အသက်အရွယ်ကြီးရင့်သော လူများနှင့် ခံနိုင်ရည်နည်းသောလူပေါင်း (၄၀၀၀) ခန့် အသက်ရှူလမ်းကြောင်းဆိုင်ရာ ရောဂါများ ခံစားရပြီး အသက်ဆုံးရှုံးခဲ့၊
- နောက်လများမှလည်း စုစုပေါင်းလူ(၈၀၀၀)ခန့် London Smog ကြောင့် ထပ်မံအသက်ဆုံးရှုံးခဲ့၊

Parameter	Averaging Period	Guideline Value $\mu\text{g}/\text{m}^3$
Nitrogen dioxide	1-year	40
	1-hour	200
Ozone	8-hour daily maximum	100
Particulate matter PM ₁₀ ^a	1-year	20
	24-hour	50
Particulate matter PM _{2.5} ^b	1-year	10
	24-hour	25
Sulfur dioxide	24-hour	20
	10-minute	500

^a Particulate matter 10 micrometers or less in diameter
^b Particulate matter 2.5 micrometers or less in diameter

Results of Air Quality(MEI)

Sampling Location	MAQN-1						WHO, 2005			Myanmar
	Nov.	Dec.	Jan.	Feb.	March	April	Guideline	Interim target 2	Interim target 1	
SO ₂ ($\mu\text{g}/\text{m}^3$)	84.65	193.34	143	200.2	28.6	56.6	20	50	125	20
NO ₂ ($\mu\text{g}/\text{m}^3$)	64.86	35.53	56.4	94	112.8	93.4	200 (1 hr)	NA	NA	200
CO (ppm)	0.85	2.99	0.4	0.67	0.68	0.56				
PM 2.5 ($\mu\text{g}/\text{m}^3$)	86.60	204.12	140.23	223.19	69.4	78.4	25	50	75	25
PM 10 ($\mu\text{g}/\text{m}^3$)	98.20	217.72	145.28	227.77	91.96	94.5	50	100	150	50

MAQN-1 (Industrial Zone – 2)

Results of Air Quality(MEI)

Sampling Location	MAQN-2						WHO, 2005			Myanmar
	Nov.	Dec.	Jan.	Feb.	March	April	Guideline	Interim target 2	Interim target 1	
SO ₂ (µg/m ³)	70.93	80.08	114.4	57.2	143	28.6	20	50	125	20
NO ₂ (µg/m ³)	64.86	48.5	131.6	150.4	94	150.4	200 (1 hr)			200
CO (ppm)	0.80	0.52	0.41	0.71	1.5	0.62				
PM 2.5 (µg/m ³)	87.80	87.3	69.54	106.45	64.74	71.23	25	50	75	25
PM 10 (µg/m ³)	94.10	99.3	75.3	118.18	96.71	99.74	50	100	150	50

MAQN-2 (Nursery Garden)

Results of Air Quality(MEI)



Sampling Location	MAQN-3						WHO, 2005			Myanmar
	Nov.	Dec.	Jan.	Feb.	March	April	Guideline	Interim target 2	Interim target 1	
SO ₂ (µg/m ³)	64.06	114.4	85.8	171.6	143	143	20	50	125	20
NO ₂ (µg/m ³)	69.37	76.89	75.2	75.2	94	94	200 (1 hr)			200
CO (ppm)	1.76	5.16	0.93	0.65	1.92	1.9				
PM 2.5 (µg/m ³)	47.70	78.3	93.7	106.67	130	46.76	25	50	75	25
PM 10 (µg/m ³)	94.10	82.5	97.45	115.82	172	47.1	50	100	150	50

MAQN-3 (Inside MOEP Compound ,78th Street between 26th and 27th Road)

PM 2.5 Monthly Report (May)

Date	Per.Conc ug/m ³	MNREC guideline 25 ug/m ³	WHO Standard guideline 25 ug/m ³
1.5.2016	27.2	+	+
2.5.2016	29.8	+	+
3.5.2016	21.2	-	-
4.5.2016	27.4	+	+
5.5.2016	38.1	+	+
6.5.2016	41.6	+	+
7.5.2016	44.5	+	+
8.5.2016	49.9	+	+
9.5.2016	47.9	+	+
10.5.2016	51.3	+	+
11.5.2016	49.7	+	+
12.5.2016	44.4	+	+
13.5.2016	34.3	+	+
14.5.2016	23.6	-	-
15.5.2016	33.0	+	+



 Maximum
 Minimum

 Higher than WHO standards/
MNREC guideline
 Lower than WHO standards/
MNREC guideline

PM 2.5 Monthly Report (May)

Date	Per.Conc ug/m ³	MNREC guideline 25 ug/m ³	WHO Standard guideline 25 ug/m ³
16.5.2016	28.6	+	+
17.5.2016	34.5	+	+
18.5.2016	22.3	-	-
19.5.2016	16.5	-	-
20.5.2016	9.2	-	-
21.5.2016	9.8	-	-
22.5.2016	6.6	-	-
23.5.2016	12.7	-	-
24.5.2016	13.0	-	-
25.6.2016	10.6	-	-
26.5.2016	15.3	-	-
27.5.2016	19.3	-	-
28.5.2016	21.1	-	-
29.5.2016	25.0	-	-
30.5.2016	18.8	-	-
31.5.2016	16.4	-	-

 Maximum
 Minimum

 Higher than WHO standards/
MNREC guideline
 Lower than WHO standards/
MNREC guideline

**THANK YOU FOR YOUR
ATTENTION**

Integrated Solid Waste Management

Assessment of Current Waste Management System and Gaps therein

Division of Technology, Industry and Economics

International Environmental Technology Centre
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1

Assessment of Solid Waste Management

Regulations	Institutions	Financial Mechanisms	Technology & Infrastructure	Stakeholder participation
Regulatory and economic policies for various waste streams / sources	Institutional framework, resources and jurisdiction to manage various waste streams / sources	Financing provisions including subsidies, levies, charges and private sector participation	Collection and transportation Treatment and disposal Recycling and recovery	Role of Waste generators Role of private sector for waste management services and for recycling and recovery

Challenges and Opportunities

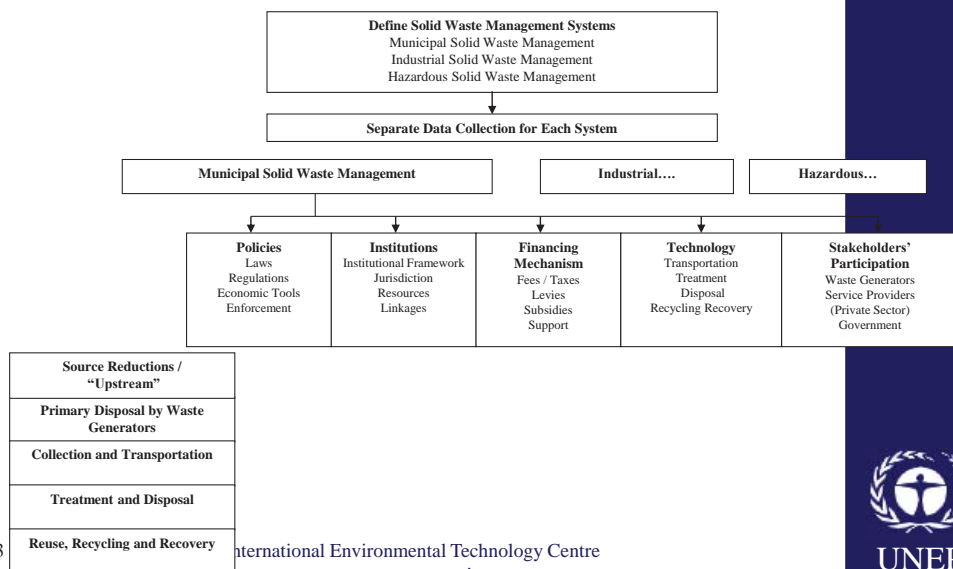
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2. Assessment of Waste Management & Gaps Analysis



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Assessment Report



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Institutions?

1. National, provincial and local Institutions
2. Conventional roles
3. Emerging roles

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National Institutions

1. Regulators
2. Financing
3. Implementation
4. Complex web

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Provincial Institutions

1. Regulators at provincial level
2. Bridge between national and local institutions
3. Support for local institutions

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Local Regulations

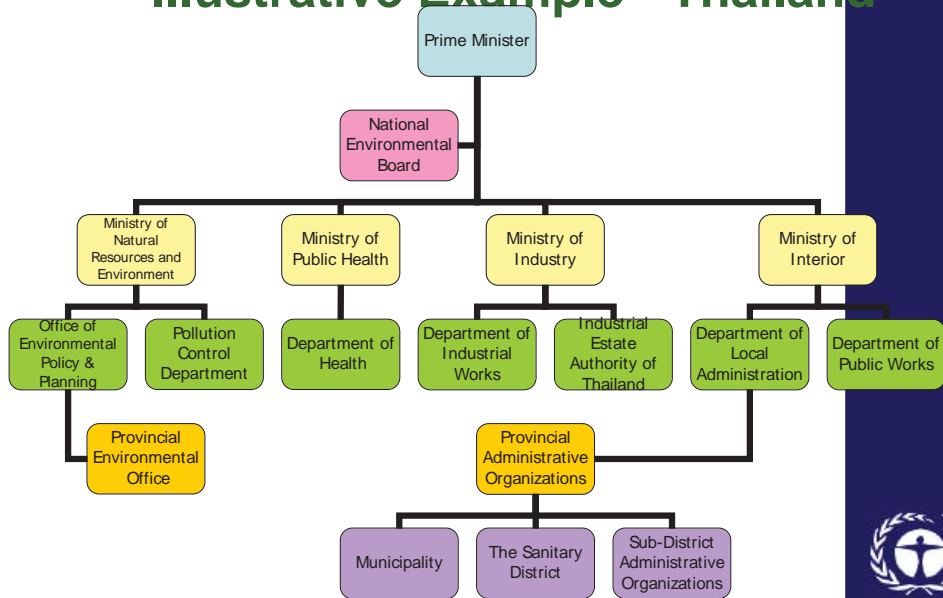
1. Regulators at local level
2. Implementation and enforcement
3. Direct responsibility

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Illustrative Example - Thailand

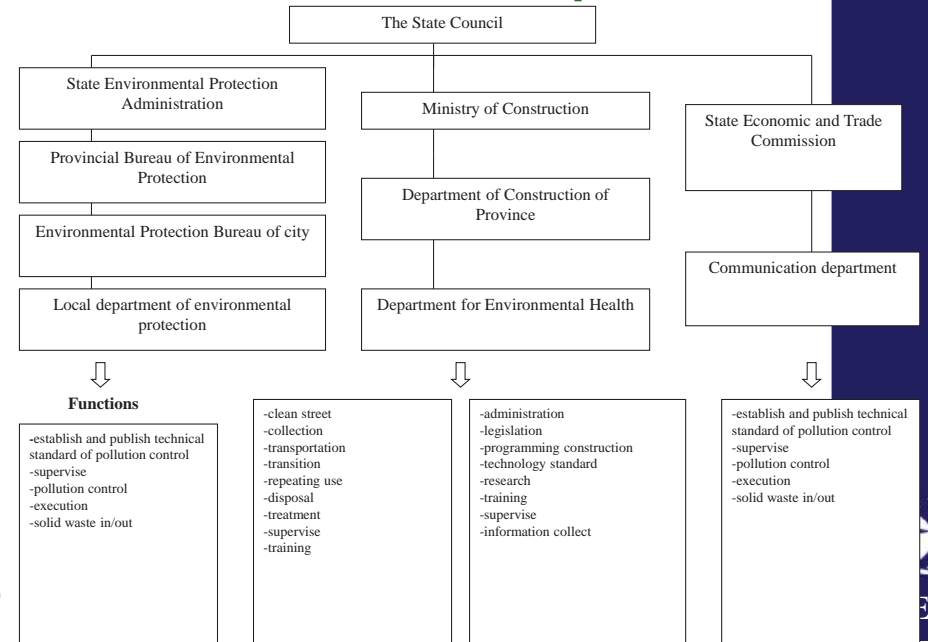


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Illustrative Example - China



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Conventional Role

- 1.Regulator and enforcement
- 2.Service provider
- 3.Financing / subsidies

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Emerging Role

- 1.Facilitator & regulator for PSP
2. Investment in waste business
- 3.Promoting waste as a resource – 3R

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Regulations?

- 1.Regulatory versus Economic Instruments
- 2.National, provincial and local regulations
- 3.Direct regulations
- 4.Indirect regulations

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Regulatory Instruments

- 1.Input based
- 2.Output based
- 3.Technology based
- 4.Relevance with waste management
 - Segregation and primary disposal
 - Collection and transportation
 - Treatment and disposal
 - Recycling

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Economic Instruments

- 1.Forms of economic instruments
 - Fines
 - Levy
 - Charges / Tax
 - Incentives
- 2.Relevance with waste management
 - Segregation and primary disposal
 - Collection and transportation
 - Treatment and disposal
 - Recycling

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National Regulations

- 1.Laws, Acts, Decrees
 - 2.Pros: to resolve inter-city or cross boundary issues (e.g. combined landfill)
 - 3.Cons: across the board irrespective of different local characteristics
- Takes time to get new/modified regulations

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Provincial Regulations

- 1.Laws, Acts, Decrees?
- 2.Pros: to resolve inter-city or cross boundary issues within a province
- 3.Corns: Better than national regulations to address local characteristics; however, still bigger and smaller cities may require different regulations for certain issues

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Local Regulations

- 1.Laws?
- 2.Pros: Takes less time to get new/modified regulation to resolve more direct and local issues
- 3.Corns: Requires support and capacity for implementation and sometimes may be in conflict with national and provincial regulations

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Direct Regulations

- 1.Source segregation and primary disposal
- 2.Collection and transportation
- 3.Treatment and disposal
- 4.Recycling

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Indirect Regulations

- 1.Environmental and public health regulations (air pollution, water pollution, noise and odour, etc.)
- 2.Economic and fiscal regulations (wages, tariffs, investment – equity vs. debt, etc.)
- 3.Organizational regulations (private sector participation, local versus national or multinational organizations, etc.)

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Illustrative Examples

1. General regulations
2. Specific regulations
3. Indirect regulations

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General Regulations

Policies	Laws/ Acts	Regulations/Standards/ Guidelines
National Solid Waste Management Policy	The Constitution of the Kingdom of Thailand B.E.2550 (2007)	None
Framework for Country's Environmental Quality	The Enhancement and Conservation of National Environmental Quality Act (NEQA), 1992	<ul style="list-style-type: none"> • Ministerial Regulation: # 9 (1998) Issued in the Royal Gazette Dated 25 December 1998. • Notification of the Ministry of Science, Technology and Environment, Issued under the NEQA, and published in the Royal Gazette Dated 7 August, 1997. • Notification of the Ministry of Science, Technology and Environment # 3, Issued under the NEQA, and Published in the Royal Gazette Dated 13 February, 1996. • Notification of the Ministry of Science, Technology and Environment, Re: Specifying Conditions, Procedures and Guidelines for Preparing Reports on Environmental Impact Assessment.

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Household Waste

Public Cleanliness and Orderliness Act (PCOA), 1992	<ul style="list-style-type: none"> • BMA Ordinance: Disposal of Garbage, Refuse and Unclean Thing 1978 • BMA Ordinance: Disposal of Garbage, Refuse and Unclean Thing 1978 • BMA Ordinance: Specifying Requirements for Construction of Building and Public Utilities 1996 • BMA Ordinance: Control of Waste Collection, Haulage, or Elimination Business which is made for Consideration as Service Fee 1998
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Industrial & Hazardous Waste

Factory Act, 1992	• Notification of the Ministry of Industry Concerning Factory Wastes 1988
Hazardous Substance Act, 1992	<ul style="list-style-type: none"> • Notification of Ministry of Industry Concerning Storage and Disposal of Toxic Substances 1982 • Poisonous Substances Act 1967, amended in 1973 • Notification of Ministry of Industry Concerning Industrial Effluent Standards 1982
Hazardous Substance Act, 2001	<ul style="list-style-type: none"> • Notification of Ministry of Industry concerning manufacture and use of toxic substances 1982 • Notification of Ministry of Industry Re: Hazardous waste manifest system B.E. 2547 (2004)

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Source Segregation & Recycling

Strategic Plan on Packaging and Packaging Waste Management	Industrial Estate Act, 1979
None	Construction Building Control Act, 1979
None	City Planning Act 1975
Garbage Classification	①. Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste. Article 42, Chapter 3

- ①.Environment Protection Act of Jiangsu Province. Article 34
- ②.Technical Policy of Municipal Solid Waste Treatment and Pollution Prevention. No. 120

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Collection & Transportation

Collection and Storage	①. Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste. Article 40, 41, Chapter 3
Transportation and Administration	①Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste. Article 23, Chapter 3 ②.Regulations on the Control over Safety of Dangerous Chemicals. Article 4 ③. Environmental Protection Law of the People's Republic of China. Article 33
Collection and Storage (Technical Standards)	①Sanitary standard for the design of industrial enterprise. Article 5 ②.Standard for location of urban environment sanitation facilities. CJJ27—89

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Treatment & Disposal

- ①.Urban special refuses management rule of Wuxi City. Article 14
- ②.The regulations on franchising for civil public utilities. No.126
- ③.The documents on franchising for the License of Municipal Waste Treatment. No.162
- ④.Measures for the License Administration of Qualification for Operation of Environmental Pollution Control Facilities. No. 23
- ⑤. The notion for enhancing the construction and management of municipal solid waste disposal plants. No. 225, 2004
- ⑥. The notice of implement charge system for municipal solid waste disposal to facilitate industrialization on solid waste disposal.
- ⑦. The notice of facilitate industrialization on developing municipal wastewater and solid waste disposal. No. 1591, 2002
- ⑧. The notion of facilitate marketization on municipal and public industries. No. 272, 2002

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Landfill & Incineration

- ①National Standard of the People's Republic of China.
- ②Standard for pollution control on the landfill site for domestic waste

INCINERATION

- Notification of the Ministry of Science, Technology and Environment B.E.2540 (1997) dated June 17, B.E.2540, published in the Royal Government Gazette, Vol. 114 Part 63, dated August 7, B.E. 2540 (1997)
- Notification of the Ministry of Science, Technology and Environment B.E.2540 (1997) dated June 17, B.E.2540, published in the Royal Government Gazette, Vol. 114 Part 63, dated August 7, B.E. 2540 (1997)
- Notification of Ministry of Natural Resource and Environment : Emission Standard for Infected Waste Incinerator published in the Royal Government Gazette, Vol. 120 Special Part 147 D, dated December 25, B.E. 2546 (2003)
- Notification of Ministry of Natural Resource and Environment : Infected Waste Incinerator is designated as Pollution Point Source which its emission must be controlled published in the Royal Government Gazette, Vol. 114 Special Part 147 D, dated December 25, B.E. 2546 (2003)

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Hazardous & C&D Waste

①. Management Licenses for Hazardous Waste. Article 7, Chapter 3

①. Safety and protection acts for radioactive isotope radial facility. Article 7, 23, Chapter 2; Article 32, 39, Chapter 3

① Management Licenses for Hazardous Waste. Article 24, Chapter 2; Article 55, Chapter 6

①. Identification standard for hazardous wastes — Identification for corrosivity.

②. Identification standard for hazardous wastes — Identification for extraction procedure toxicity.

③. Standard on polychlorinated biphenyls for wastes.

④. Standard for the designing of industrial enterprises. Article 26

⑤. Pollution control standard for hazardous wastes incineration.

①. Identification standard for hazardous wastes — Identification for corrosivity.

②. Identification standard for hazardous wastes — Identification for extraction procedure toxicity.

③. Standard on polychlorinated biphenyls for wastes.

①. Identification standard for hazardous wastes — Identification for corrosivity.

②. Identification standard for hazardous wastes — Identification for extraction procedure toxicity.

③. Standard on polychlorinated biphenyls for wastes.



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Indirect

1. Air pollution act in the Philippines affected the operation of incinerators

2. Water pollution act affecting designing and location of landfills

3. Emissions and noise levels affecting operation of the vehicles

4. Policies on private sector participation



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Financing Mechanisms

1. Direct

2. Indirect

3. Private Sector Participation



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Direct

1. User charges (tariff calculations)

2. Fine

3. Levy



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Indirect

1. Property tax or income tax – cross subsidies
2. National subsidies
3. International support - payback

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Private Sector Participation

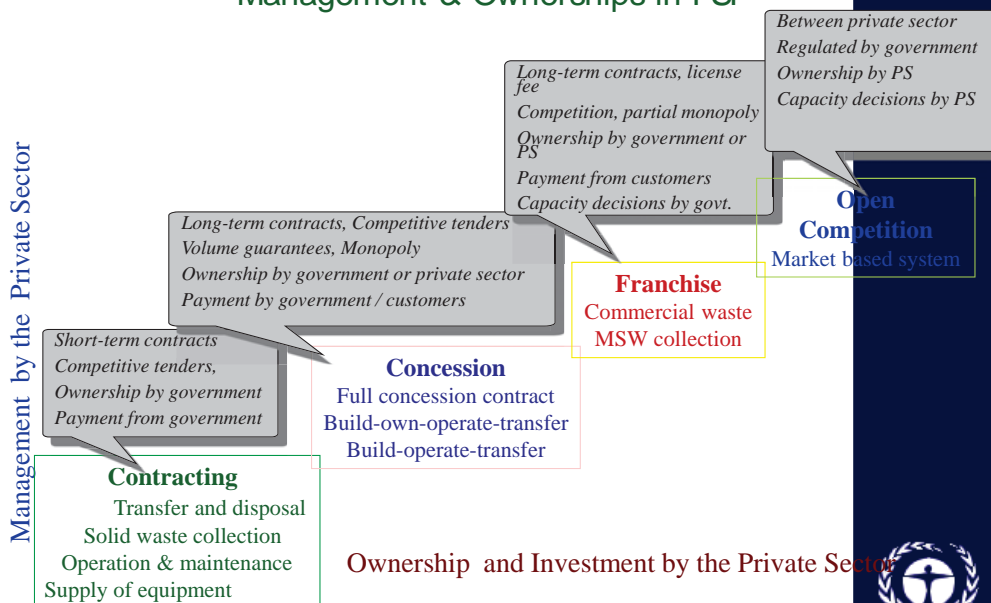
1. Solid waste management chain easy to break – more opportunities for local PSP
2. Different forms of PSP
3. Business based approach leading to resource recovery

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Management & Ownerships in PSP



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Illustrative Example - Thailand

Fiscal Year	Waste Collection Costs (Baht)	Waste Disposal Costs (Baht)	Collected Fee (Baht)	Difference between cost and income (Baht)
1995	1,057,331,868	484,104,434	65,156,323	1,476,279,979
1996	1,154,404,828	486,137,830	56,633,017	1,583,909,641
1997	1,276,433,233	443,236,427	62,162,593	1,657,507,067
1998	1,290,026,455	509,308,644	50,772,161	1,748,562,938
1999	1,797,153,361	429,482,309	57,335,158	2,269,300,512
2000	1,535,005,733	574,877,529	72,163,269	2,037,719,993
2001	1,719,180,122	96,950,028	106,806,811	2,581,873,339
2002	1,448,226,145	1,029,184,526	125,871,034	2,351,539,637
2003	1,386,889,003	1,124,191,263	138,330,212	2,372,750,054
2004	1,797,910,678	1,142,318,792	273,182,516	2,667,046,954
Average	1,446,256,142	729,234,178	100,841,309	2,074,649,011

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Illustrative Example - China

street	financial budget (× 1000 RMB yuan)	financial expense (× 1000 RMB yuan)
Wangzhuang street	1200	1200
Fangqian street	136	136
Meicun town	65	65
Shuofang town	265	265
Hongshan town	262	262
Nanzhan street	65	65



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Illustrative Example – PSP Macao, PR China

Since 1992, two private companies are handling collection & disposal. Companhia de Sistemas de Residuos, Limitada (CSR) carries out collection, cleaning and maintenance of public garbage containers (380 staff, with 25 refuse compacted collection truck, 4 high pressure water jet vehicles, 6 sweeping vehicles)

Another company manages incineration of 36 tons/per hour, 283,800tons/per year and generated 12MW of power for its own consumption

The private sector's motivation for profit has led to the efficient conduct of activities to consistently improve returns

The incineration is the major method to dispose the waste. This also helps to generate electricity



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Illustrative Example – PSP Kuala Lumpur, Malaysia

Alam Flora Sdn Bhd, a private company, is responsible for the management of solid waste covering a total area of 72,263 km²

Such extensive coverage enables the company to undertake more efficient and effective management due to economies of scale

With better scheduling, and human resources and equipment, collection trips and collection rate have significantly improved

The turnaround time for each garbage truck is severely hampered by the worsening traffic conditions in the city. The possible measures collection times at night or very early in the morning, and the number and location of transfer stations



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Illustrative Example – PSP Dhaka, Bangladesh

In Kalabagan, a densely populated and typical of many inner city areas, residents remained hostage to the refuse that they themselves produced regularly

In 1987, a community group purchased two rickshaws and modified them into waste collection vans to start door-to-door collection of domestic waste

To meet the running costs and bit of a profit, they charges nominal fee from each house

The success of the operation led to the formation of another four community based organization (CBO) for waste collection

Under a pilot activity of Kitakyushu Initiative, DCC has established a mobile transfer station to coordinate with these door-to-door collection activities of CBO



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Illustrative Example – PSP Phnom Penh, Cambodia

Municipality of Phnom Penh (MPP) through its department of Phnom Penh Waste Management (PPWM), was responsible for overall SWM, is still in charge of operating the existing landfill site

The private company CINTRI (Cambodia) Ltd., a member of the Canadian CINTEC Group, was given a 57 year franchise-contract in 2002 for collecting communal waste and cleaning of streets

The only source of income for CINTRI is based on the right to collect fees from urban households and small businesses. MPP is the client of CINTRI and the applicable tariffs are negotiated between these two parties without the involvement of PPWM

The costs of street cleaning must be covered by the collected fees for household waste. The current tariff structure, which is based on fixed fees, is seen as unfair by many citizens

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Waste Management Chain

1. Source segregation & primary disposal
2. Collection & transportation
3. Transfer stations and MRF
4. Treatment & disposal

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Primary Disposal

1. Communal collection
2. Block collection
3. Kerbside collection
4. Door-to-door collection

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Collection Vehicles

1. Handcarts, animal carts, small vehicles
2. Compactor trucks
3. Fore and aft tipper
4. Container hoist
5. Open/closed top trailers

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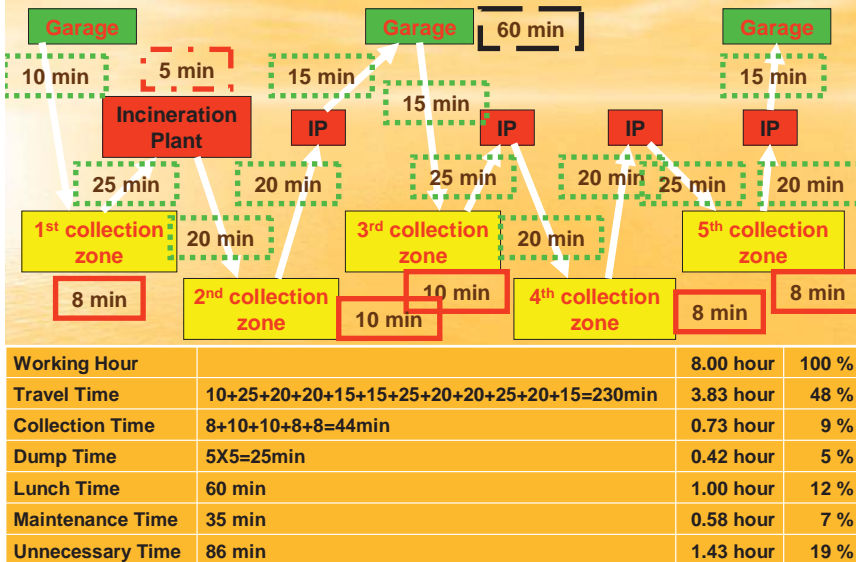
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Operations

Time Count Study in Osaka

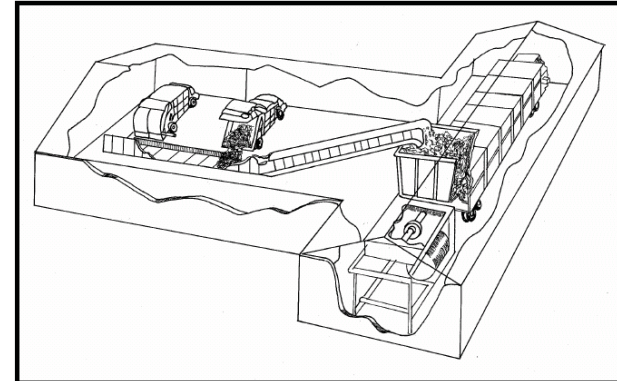


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Transfer Stations & MRF

1. Manual separation
2. Mechanical separation
3. Smaller to bigger vehicles for long-haul



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Biological Treatment

1. Compost
2. Biogas

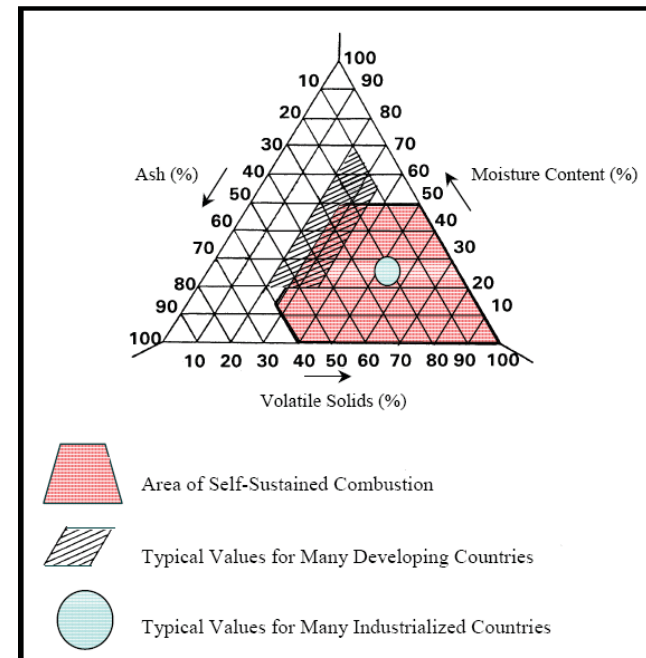


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Inter



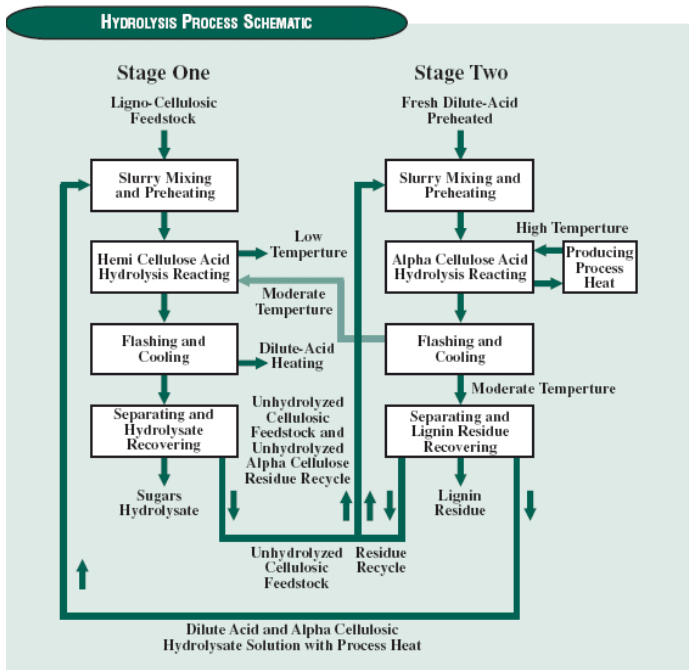
Thermal Treatment



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Chemical Treatment

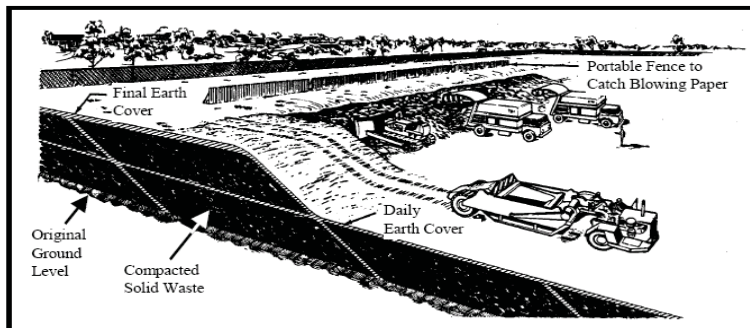
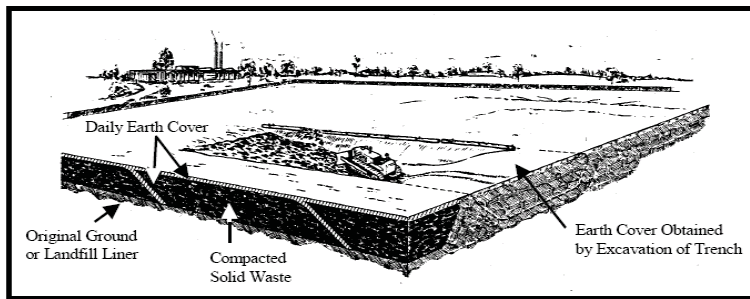


Disposal

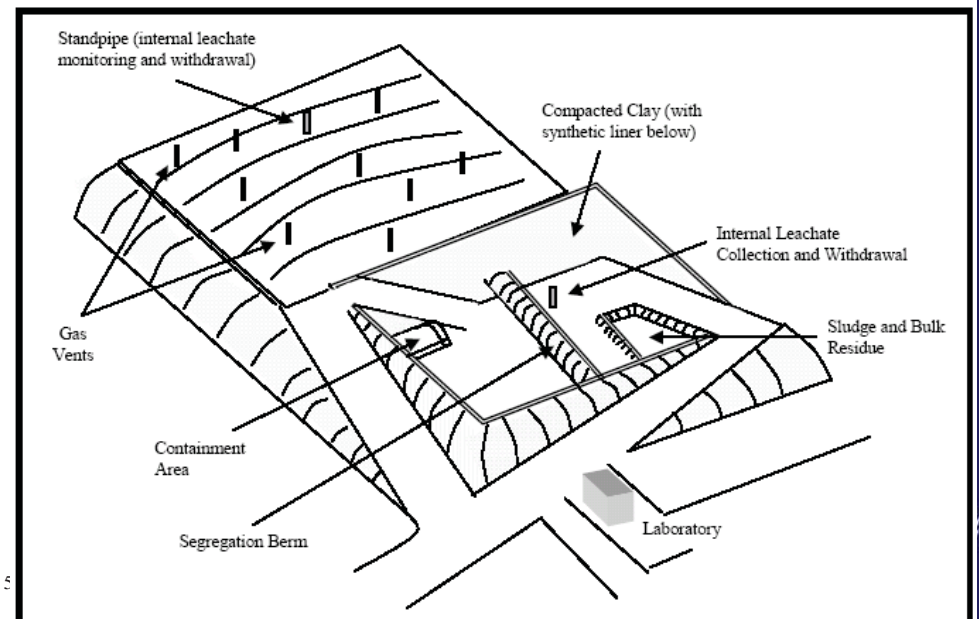
1. Open dump
2. Open burning
3. Landfill
4. Sanitary landfill
5. MBT
6. Controlled landfill for hazardous waste



Sanitary Landfill



Controlled Landfill



MBT

In response to the new EU Directives, asking for diversion of biodegradable waste from landfills, and also as an alternative to incineration, some European countries have started introducing this technology. This is also known as “Mechanical biological Pre-Treatment,” or “Biological and Mechanical Treatment (BMT)” was originally developed as a way of treating residual municipal waste after source segregation. This process is basically a combination of waste preparation and separation, recovery of two or more waste streams for further utilization or landfill and stabilization of the biodegradable fraction.

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Who are the Stakeholders?

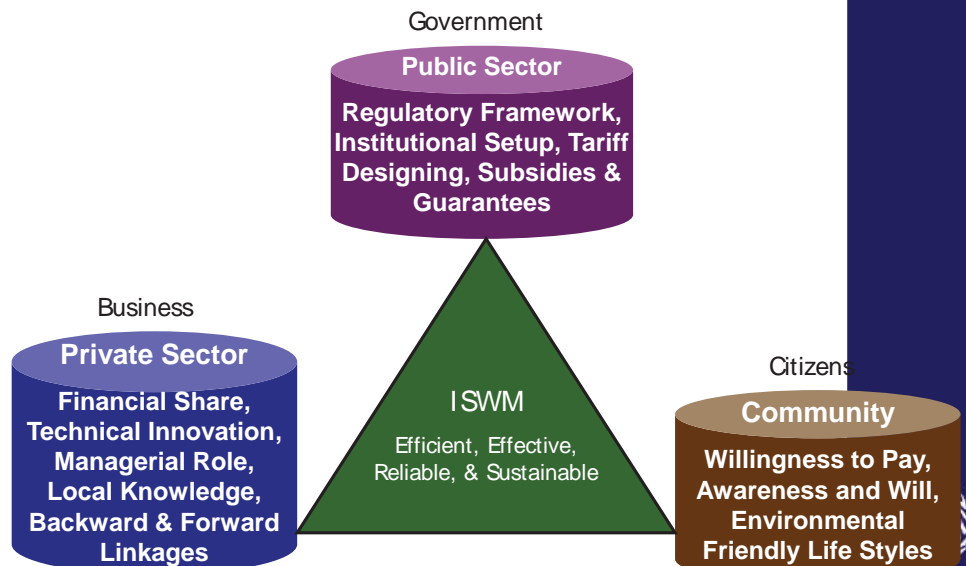
1. Waste Generators
2. Regulators
3. Service providers
4. Recyclers
5. Community

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Distribution of Roles for Improved SWM



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Waste Generators (Domestic, Commercial, Industrial, Medical, C&D, etc.)

1. Proper disposal of waste
2. Segregation?
3. Charges?

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Regulators

1. Waste management chain (segregation, disposal, collection & transportation, treatment and disposal and recycling)
2. Tariffs
3. Conflict resolution

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Service Providers

1. Type and quality of service
2. Earnings and expenditures
3. Business based approach

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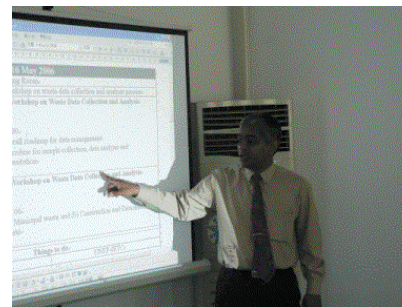


Community

1. Waste generators & community
2. Regulators and community
3. Service providers & community
4. Recyclers and community

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Thank You...



City Level Challenges

Social / Behavioural:

- Low levels of public awareness on waste management
- Low willingness to pay for waste services
- Lack of compliance with existing waste rules and regulations, cooperation with local authorities
- Inefficient waste segregation and treatment of domestic, industrial, hazardous waste
- Health and safety risks for workers

Environmental:

- Soil, water, air pollution and contamination

Economic:

- Insufficient resources for waste management technologies and land procurement
- Inadequate budget for operation, maintenance and upgrading of infrastructure

Institutional:

- Data gaps on waste generation and disposal
- Need for modification of existing laws and enhance enforcement of standards/regulations
- Challenges with collection and transportation of waste
- Issues related to land space availability

Experience of waste management in
Kitakyushu City
and potential technical cooperation with
MCDC

Yuji Aoyagi
Executive Director
International Environmental Strategies Department
Environment Bureau, City of Kitakyushu

City located near to other Asian nations, rich in nature,
and developed as a manufacturing area



Population: 975,000 (2012)
Area: 487.88 km²
GDP: 3,257 billion yen (2012)

Major companies
in Kitakyushu area



TOTO Ltd.



Nippon Steel & Sumitomo
Metal Corporation



Yaskawa Electric
Corporation



Mitsubishi Chemical
Corporation

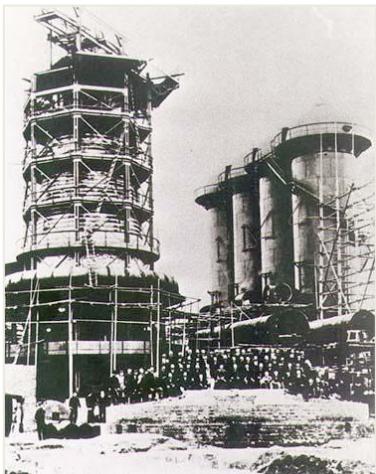


Toyota Motor Corporation -
Nissan Motor Co., Ltd.

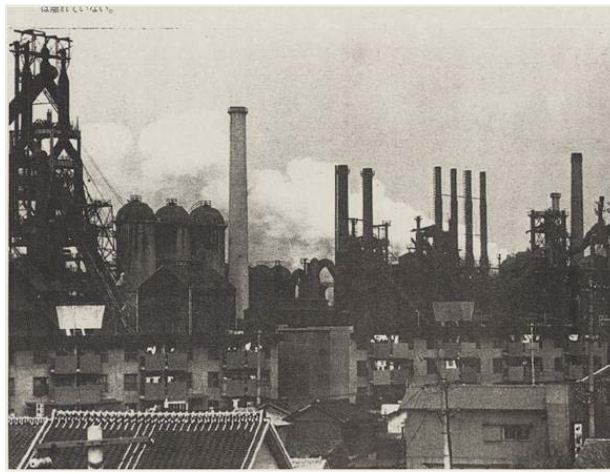


Mitsubishi Materials
Corporation

Kitakyushu's modernization through industrialization

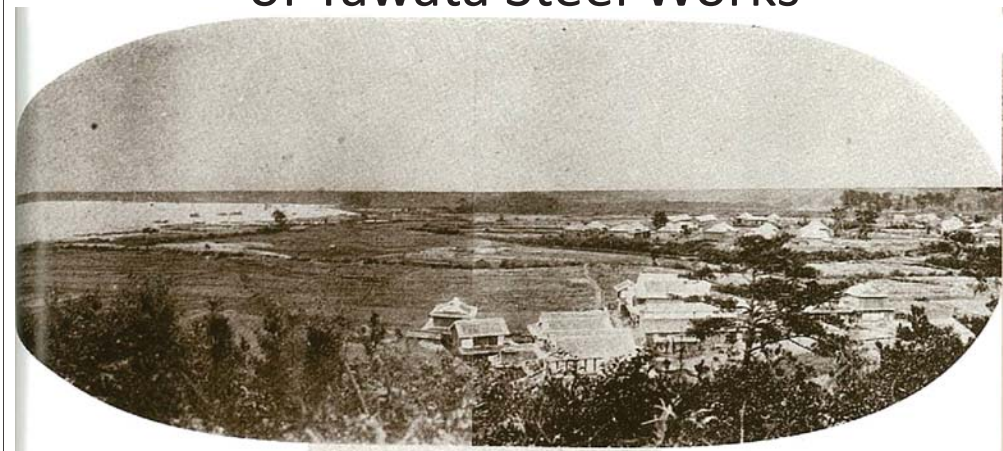


Yahata Steel Works
(Japan's first state-owned steel
works) began operation in 1901.



Kitakyushu Industrial Zone in 1950s

Yahata Village before the opening of Yawata Steel Works

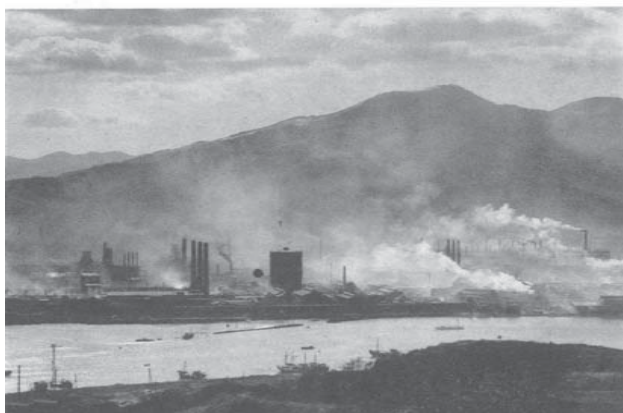


近附地敷所鐵製月二十年十三治明

Town of Yahata filled with smoke

"Machines working with growling sound, blast furnaces smelting and brightening up a night sky, and everything are vivid and vital. Yahata is called the capital of steel."

けむりにつつまれた八幡の町



《1961, Osaka Publishing》

(Provided by Prof. Takeuchi,
University of Tokyo)



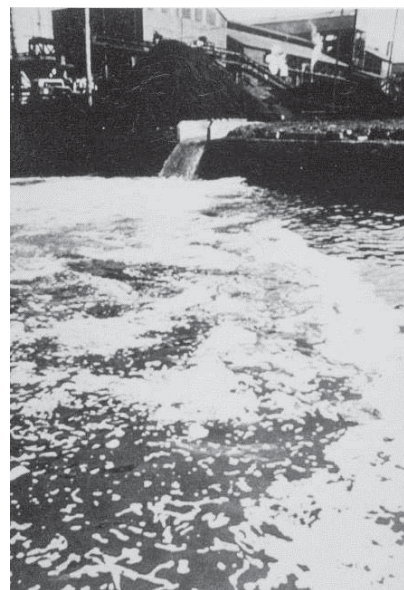
**Severe air pollution
in Shiroyama District, Yahata**

Heavy smoke from a lot of chimneys



**Heavy dust fall
on the roof**

Untreated water discharged into Dokai Bay / Corroded boat propeller in the toxic sea



Overcoming Severe Pollution: Kitakyushu's Experience



Current Waste Management in Kitakyushu City

• Solid Waste

- Municipal Waste : treated as **General Waste**, managed by the City
- Waste from Industrial Plants: treated as **Industrial Waste**, managed by private sector

• Liquid Waste

- When treated on-site and discharged to river / sea:
 - >> subject to **Water Pollution Prevention Act** (a regulation on the quality of discharged water)
- When treated apart from the generation point:
 - >> Regulated / treated as **Industrial Waste**

• Gaseous Waste

- >> Emission standards are set for pollutants (NO_x, SO_x, dust and soot...etc) under **Air Pollution Control Law**

Why do we need waste management?

• Issues from accumulation of wastes



Offensive odor



Air pollution



Contamination of water: river and sea

Pollution of soil and underground water



Spread of communicable diseases through rodents / insects

History of Waste Management in Kitakyushu - 1 ~ 1955

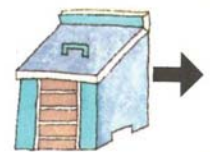
Wastes generated from households was very small in amount, and was burnt at each household. The ash was dumped at near-by landfill sites.

Transformation of Collection / Transportation methods

Wooden boxes for apples and coals were used as dust boxes.



Some dust boxes were made of cement.



Carts and carriages were used for collection / transportation.



History of Waste Management in Kitakyushu - 2

1963 Birth of Kitakyushu City (Merger of 5 municipalities)

Gradually introduced / expanded the collection system where wastes were collected by plastic container twice a week.

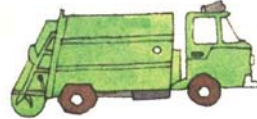
Waste incinerators were also gradually installed.



Dump cars were introduced.



Use of compactor trucks started to appear.



History of Waste Management in Kitakyushu - 4

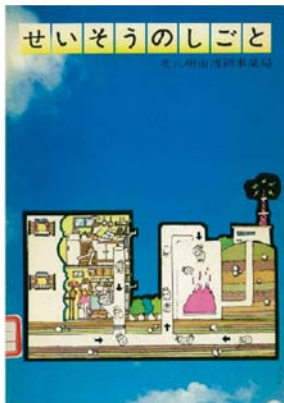
1972 Modern incineration facility became operational.

(Hiagari Waste Treatment Facility – 150t/day x 3 incinerators)

1974 Developed education material for 3rd-grade elementary school students titled “Work of Cleaning”

Dissemination of rules for putting out garbage

Elimination of occupational discrimination



History of Waste Management in Kitakyushu - 3

1969 Mechanization of collection trucks (compactor trucks) reached 100%

1971 Use of waste stations and plastic bags for primary collection was introduced and applied to the entire city.



Wastes are brought to designated collection points in plastic bags.



Wastes are collected twice a week.

An Essay by a Student

Green Truck

“Dad, stop working as a garbage collector”

When I said so to my dad, he replied with his chuckle,

“Then who’s gonna do the work for us?”

“The green truck is my office!”

he added, loudly, as he walked away for his job.

“If no one’s gonna do the work, what’s gonna happen?”

I thought to myself afterwards.

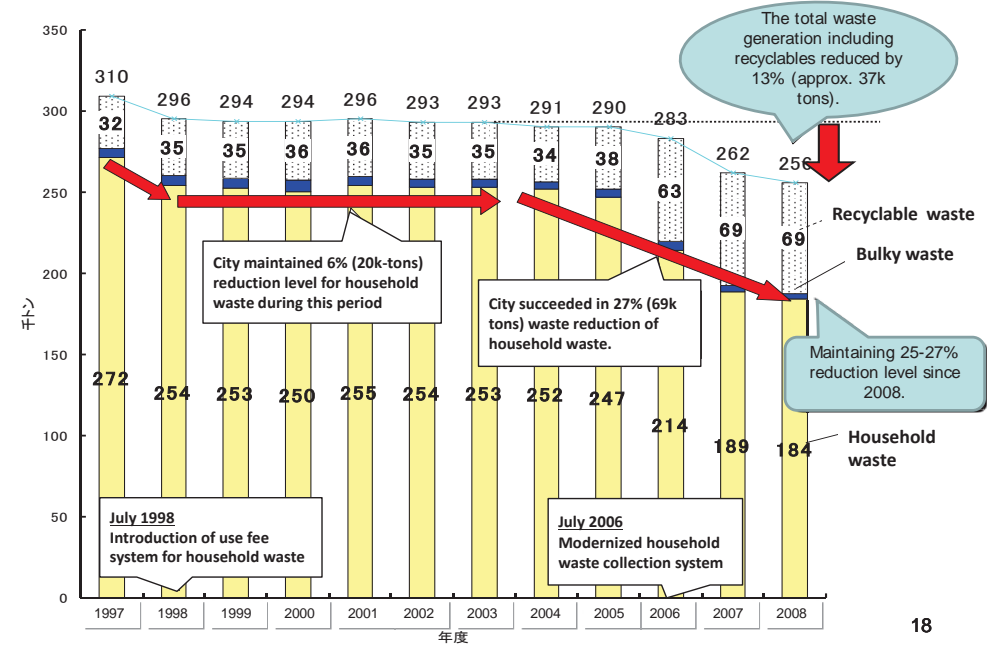
History of Waste Management in Kitakyushu - 5

1985 Published awareness raising educational material for small children titled "Let's Clean with Everybody"

Towards Material-Cycle Society

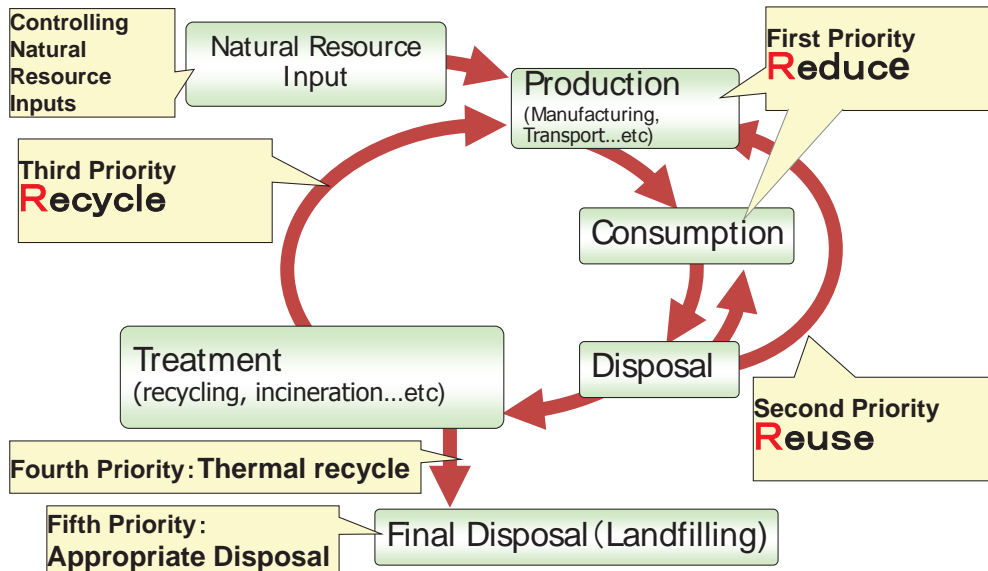
- 1993 Initiated source separation & collection of cans and glass bottles
- 1997 Initiated source separation & collection of PET bottles
- 1998 Introduction of user fee system for general waste (Use of designated plastic waste bags)
- 2000 Initiated source separation & collection of paper packs and white food tray.
- 2002 Initiated source separation f& collection of fluorescent lamps and colored food trays.

Transition of household wastes and recyclable wastes



Establishing a Sound Material-Cycle Society

Sound Material-Cycle Society: Society which reduces natural resource consumption and minimizes environmental impact through appropriate application of 3R and disposal.



Background and Outline of Kitakyushu Eco-town

Bird-eye-view of Empirical Research Area



Background

- 1901 Yahata Steel Works started its operation
 - 100 years since then, the city thrived as a city of manufacturing
- 60's Experienced devastating environmental pollution.
 - Citizens, businesses, and local authorities came together to overcome this issue → now known as "Kitakyushu method".
- 80's ~ Era of promoting international environmental cooperation.

Accumulation of Tech./HR/ knowhow
Established industrial infrastructure

Comparative Advantage of Hibiki-Nada Area

Emergence of "Sound Material-Cycle Society"

Development of network among citizens, businesses and local authorities

- Vast land area
- Final disposal site
- Proximity to industrial complex
- Re-vitalization of logistics infra.

Regional Development Strategy capitalizing on Regional Resource

Bird-eye view of Comprehensive Environmental Industrial Complex and Hibiki Recycling Area



Development of Eco-Town Project

- Number of research institutions: 19
- Operationalized facilities: 25
- PCB treatment facility: 1

Project Impacts

- Investments: approx. 76 billion JPY (City: 0.61B JPY, National Gov't: 27.1B JPY, Prefectural Gov't: 0.2B JPY, Private sector: 42.6B JPY)
- Employment: approx. 1,140 (including part-times)
- Visitors: cumulatively 650,000 (1998-Dec. 2007)

Record as of January 2008

Kitakyushu Eco-town Project (since 1997)

<Integration of Environmental Protection Policy and Industrial Development Policy>
Assuming a leading role in presenting a model of Sound Material-Cycle Society

Industrial Waste in Kitakyushu City

- Population ratio : 0.76%, GDP ratio : 0.71%
- Generation of Industrial Waste: 1.7% (2.17% excluding animal feces)
- Industrial waste from manufacturing sector tends to be the major source
- Waste Generation in FY2013
 - > Industrial Waste: 6,530kt
(Slag: 2,570kt, sludge: 1,980kt, debris: 630kt)
 - > Hazardous Waste: 20,000t
 - > Medical Waste: 2,250t

Industrial Waste in Kitakyushu City

- Many industrial waste processing companies
- Many of them process liquid as well as solid wastes
- Many of them treats construction and demolition wastes
- Quite a few companies treats hazardous wastes
- Adequate treatment capacity for medical waste

Industrial Waste

Permit Category	Collection and transport	Collection and Transport (including storage)	Intermediate treatment	Final Disposal
Permit	273	63	155	6

Specially-controlled Industrial Waste Management

Permit Category	Collection and transport	Collection and Transport (including storage)	Intermediate treatment
Permit	27	5	23

Management Flow for Industrial Waste



<Treatment objectives>

Reduce volume/amount, detoxification, stabilization

<Treatment methods>

- Incineration
- Solidified concrete
- Neutralization
- Dehydration
- Crushing
- Sorting
- Other

<Disposal methods>

- Landfilling
- Open sea dumping (Not done currently)

<Effective utilization>

- Parts recovery
- Resource recovery (metals, etc.)
- Construction materials
- Heat supply
- Power supply
- Other

Consignment of Management for Industrial Waste

Types of industrial waste management companies

Target waste	Action	Collection & transport	Intermediate treatment & final disposal
Industrial waste		Waste collection and transport services for industrial waste	Disposal service for industrial waste
Specially-controlled industrial waste		Collection and transport services for specially-controlled industrial waste	Disposal service for specially-controlled industrial waste

Consignment of management for industrial waste (Main requirements)



Industrial Waste Management in Kitakyushu

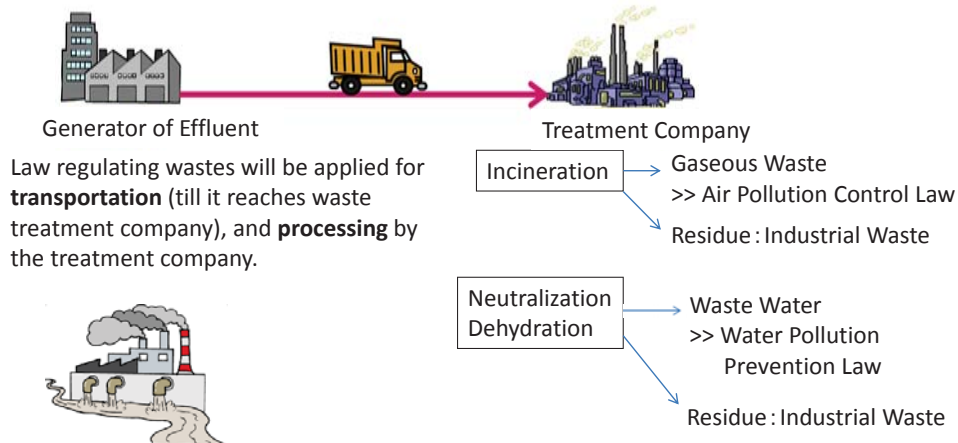
- Permit system for waste management companies
Elimination during examination (conditions for disqualification)
Relation to mafia/gangs, previous legal violations
- Permit system for waste treatment facilities
Examination for installation personnel (conditions for disqualification)
Examination of technical standards (treatment methods, treatment capacity, pollution control measures, etc.)
Dispute prevention guidelines: Prior explanations to local residents
Pollution control laws, such as the Air Pollution Control Law:
Notifications, compliance with standards

Liquid Waste 1

While **Waste Disposal Law** regulates all solid and liquid wastes, stipulations of **special laws** (e.g. *Water Pollution Prevention Act*) take precedence over Waste Disposal Laws for the wastes that are regulated by such special laws.

- *Water Pollution Prevention Act*
...regulates waste water discharged from factories and workplaces into public water areas such as rivers, lakes, marshes, ports, harbors, coastal areas, and irrigation canals.

Liquid Waste 2



Water Pollution Prevention Law will be applied if waste water is treated within the factory (generation point) and discharged to public water areas such as rivers.

Regulations on Atmospheric Pollution (Gaseous Waste)

- 32 Types of facilities which emit gaseous wastes are subject to **Air Pollution Control Law**
- The Law regulates NOx's emitted from the above targeted facilities.
- The Law also regulates most of the above targeted facilities in terms of their NOx's, dusts and soots emissions.
- The Law also regulates the above targeted facilities which can potentially emit cadmium, chlorine, hydrochloride, fluorine/hydro fluorine, and lead.
- Regulation on mercury is also expected to be in place in a few years time.

Cooperation with MCDC

Kitakyushu City's Potential

- Has a long experience of waste management by the city authority
- In possession of its own incineration facility, and of know-hows regarding its operation as well as issues associated with site selection.
- In possession of its own final disposal site.
- Has Japan's top-level industrial waste management technologies
- Currently in the development of "Kitakyushu Eco-town Project" with the greatest accumulation of recycling industry in Japan, and has extensive knowledge / know-hows of recycling.
- Has a long experience of awareness-raising / environmental education targeting citizens / students since publishing "Works of Cleaning" in 1974, and currently organizing field trips for elementary school students and inspection tours for citizens. Also currently promoting inter-elementary school exchanges.
- Currently engages in overseas exchanges with Myanmar and other Asian countries in diverse issue areas, and has developed collaborative projects in Indonesia, Philippines, and Vietnam.

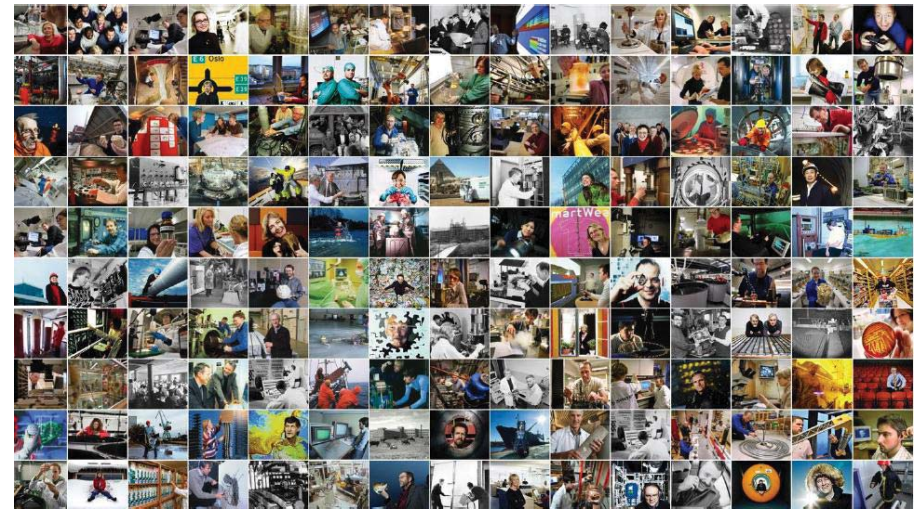
Master Plan for Hazardous Wastes in Myanmar

Mr. Palash Kumar Saha, Research scientist
Foundation for Scientific and Industrial Research, Norway

First Workshop for Developing the National/City Waste Management Strategies in Myanmar, Mandalay 16-17 June 2016

Ministry of Natural resources and Environment Conservation (MONREC) and International Environmental Technology Centre (IETC) of the United Nations Environmental Programme (UNEP)

The Norwegian Foundation for Industrial and Scientific Research, SINTEF, is one of Europe's largest research organisations.



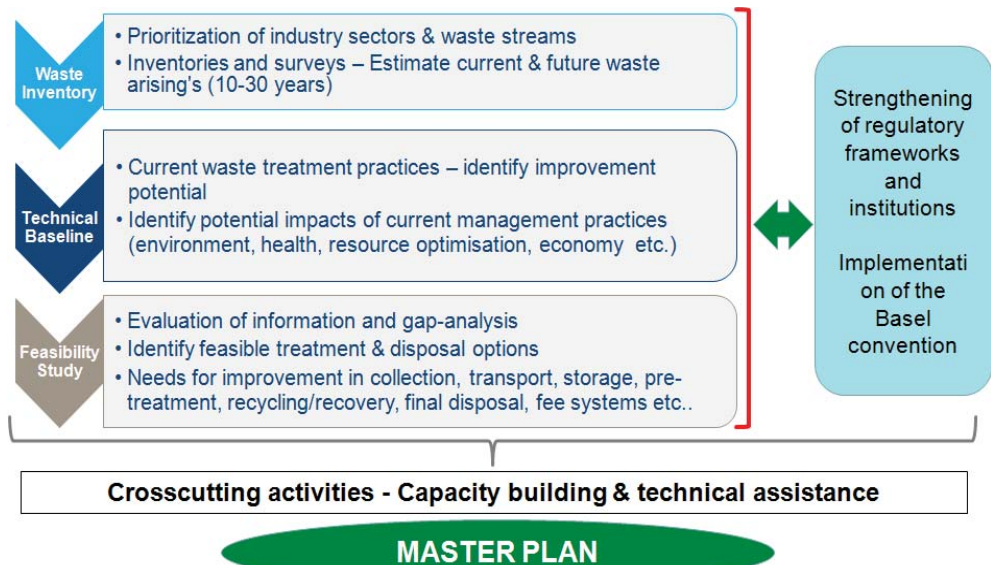
Master Plan for Hazardous Wastes in Myanmar

A three year Norwegian funded project started in February 2016 aiming to develop a Master Plan for Hazardous and Industrial Wastes in Myanmar.

The project will be conducted jointly by the Norwegian Environment Agency and SINTEF; MONREC and ECD NPT is the client.

The project will cover institutional, regulatory, technical and environmental aspects of hazardous waste management in Myanmar – assist in implementing the Basel Convention, build capacity and raise awareness of the need for an environmentally sound hazardous waste management system.

SINTEFs technical inputs

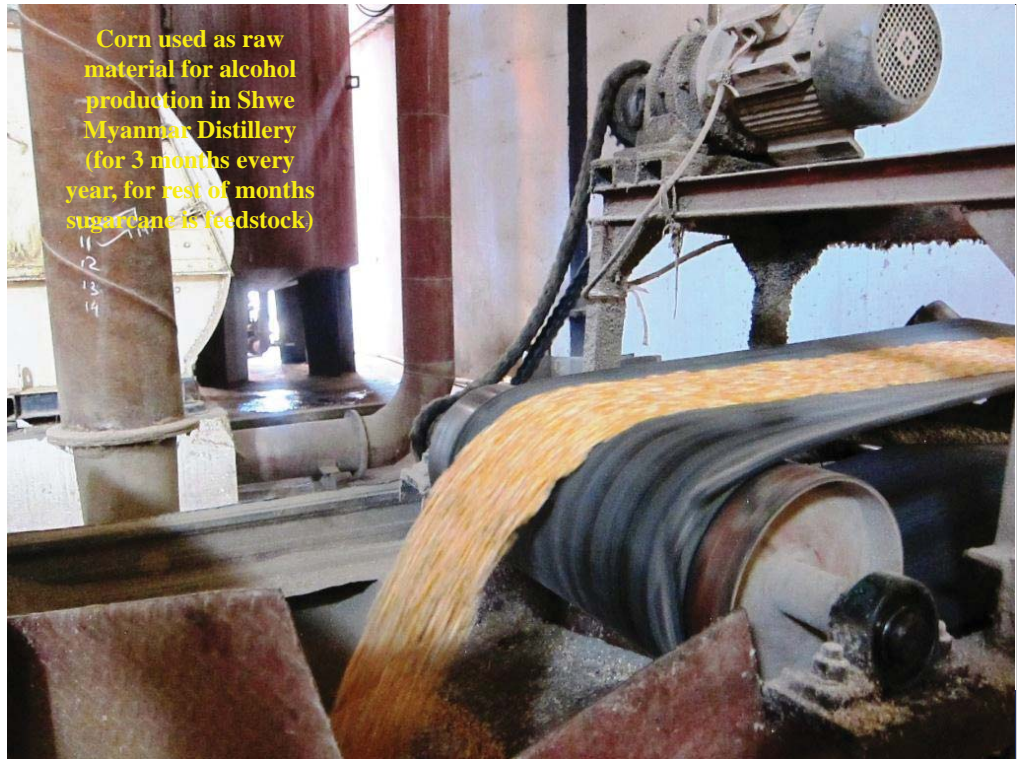


Shwe Pyi Thar IZ 1, 20 November 2015



Yangon







Waste water has high suspended solids; the water is aerobically and anaerobically treated; methane is captured and used as fuel



Residue from water treatment is filter-pressed and dried in a small rotary kiln before selling the same as poultry feed



Distilleries requires fuel

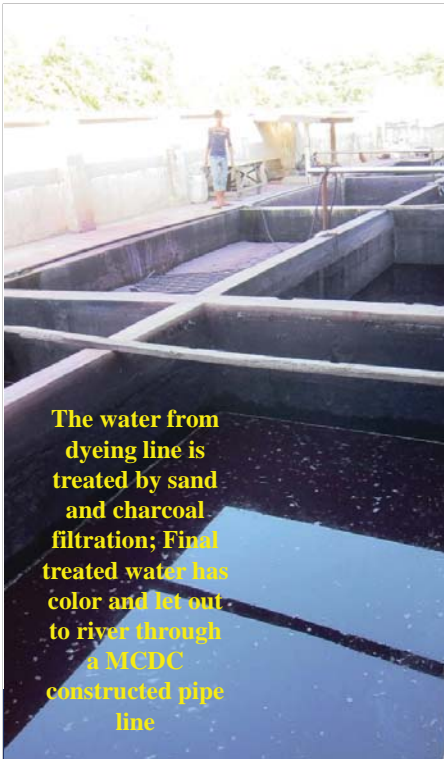


Threading line of
Aung Sein
Textile factory



The threads dyed in
steam chambers- 2 tpd
of coal used for
producing steam





The water from dyeing line is treated by sand and charcoal filtration; Final treated water has color and let out to river through a MCDC constructed pipe line



Textile dyeing requires fuel







Production of paper tissues ...













**Biggest final disposal site in Yangon (and in Myanmar) called Htein Bin-
950-1600 t/d of MSW dumped - no waste segregation**



**At the Htein Bin cemetery complex,
hazardous waste from industries
(managed by YCDC) is contained
in under ground brick-walled
chambers**



**One brick-thick pit;
leachates can be seen in
adjoining fields**





Wastes of all types and sources dumped in brick walled pits and covered by tooth paste tubes for odour suppression



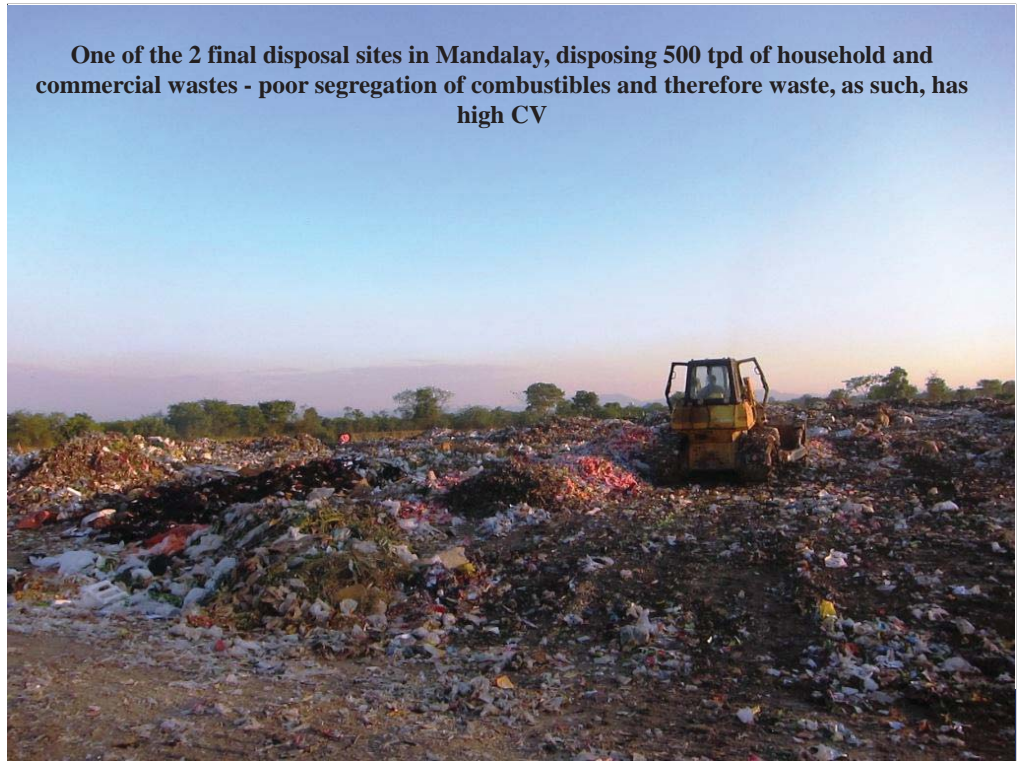
Mandalay

In corner of land fill site is an incinerator for burning clinical wastes (such as syringes)- Chinese technology, poor design, no flue gas treatment





One of the 2 final disposal sites in Mandalay, disposing 500 tpd of household and commercial wastes - poor segregation of combustibles and therefore waste, as such, has high CV











Scrap Metal Recycling Facility in Mandalay





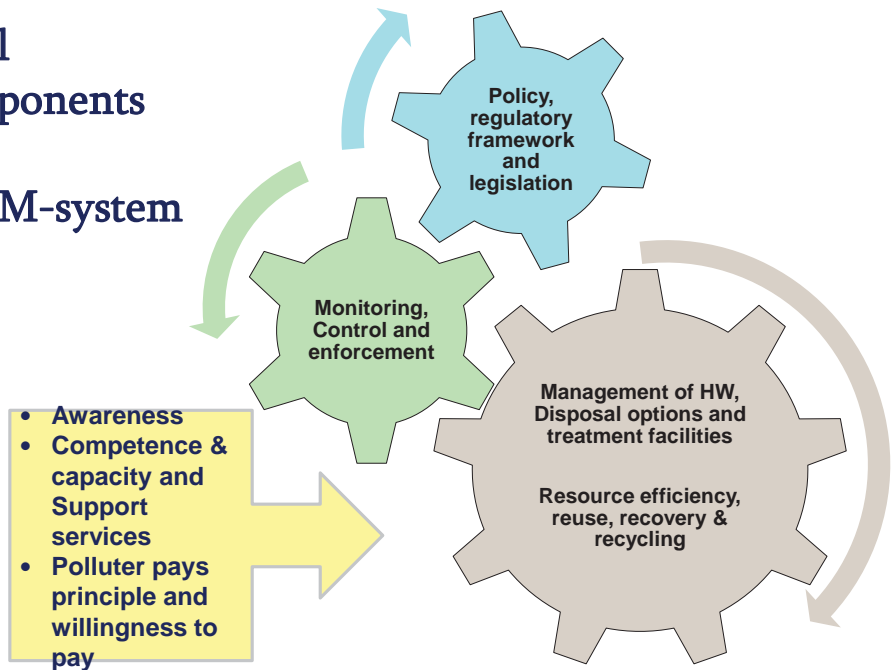




GOLDEN DOWA Ecosystem is setting up waste management facility in Thilawa SEZ.

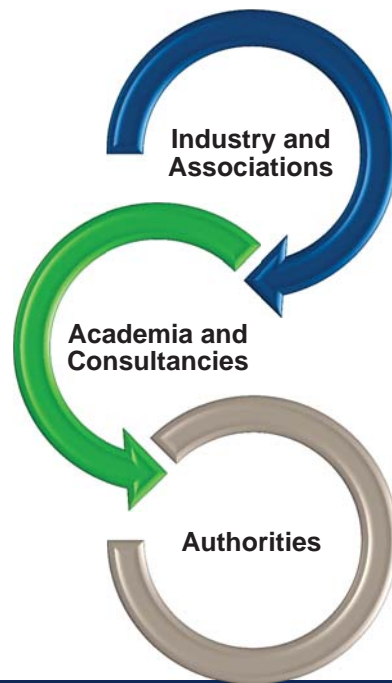


Vital components of a HWM-system



Cross cutting activities in the project

- Capacity building
- Awareness raising
- Training
- Technical assistance



WS on Hazardous Chemicals Management, Yangon 18 September 2014



WS on Basel Convention, Yangon 25 August 2015



Consultation meeting on Hazardous Substances, Yangon 27 November 2015



WS on Treatment of Industrial and Hazardous Wastes, Yangon 4 February 2016



Meetings with heads of departments of MCDC, Ministry of industry, ECD-Mandalay and industry representatives 23 November 2015

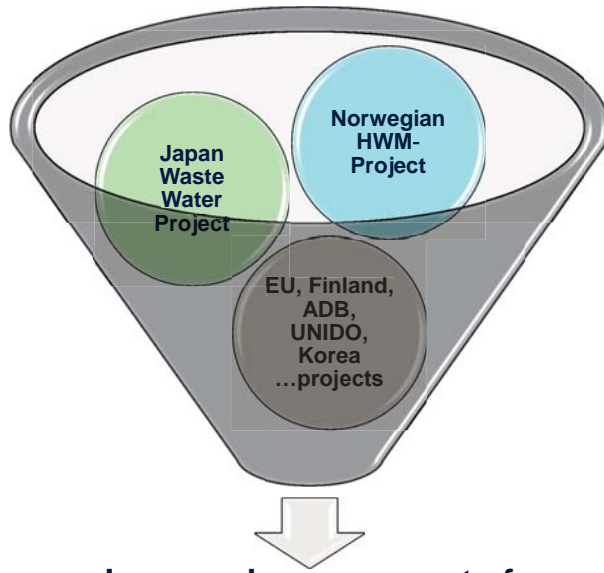


Media will be an important in raising awareness



Discussions with Yangon Technological University to provide a course on Hazardous Chemicals Management and supervise students doing their thesis

Cooperation & synergy



Improved management of Hazardous and Industrial Wastes in Myanmar

Myanmar - Norwegian Cooperation on the Management of Hazardous Waste in Myanmar

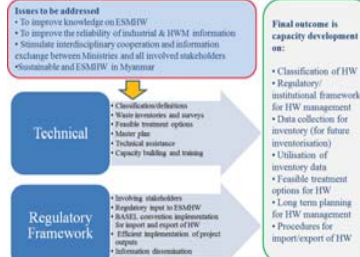


Overall Goal, Purpose and Outputs of the Project

Item	Overall goal, project purpose and Outputs
Overall Goal	<ul style="list-style-type: none"> Improved management of Hazardous Waste (HW) Assist in developing a regulatory framework for HWM in Myanmar, including implementation of the Basel Convention. Propose a Hazardous Waste Master plan for HW management in Myanmar.
Project Purpose	Contribute to the improvement of Environmental Management in Myanmar by strengthening institutional frameworks, by building capacities and providing technical assistance in the Environmentally Sound Management of Hazardous Waste (ESMHW).
Outputs	<ul style="list-style-type: none"> Output 1: Inception phase is finalised Output 2: Baseline for existing regulatory framework and institutional arrangement for HW in Myanmar is conducted. Output 3: Technical Baseline study and Inventory of HW in Myanmar is conducted. Output 4: Technical Feasibility study for different hazardous waste treatment solutions is conducted – Prepared a Master Plan for HWM

An intermediate outcome is strengthened capacity within MONREC/ECD, other relevant Ministries, City Development Committees, industry and relevant stakeholders on management of Hazardous Waste.

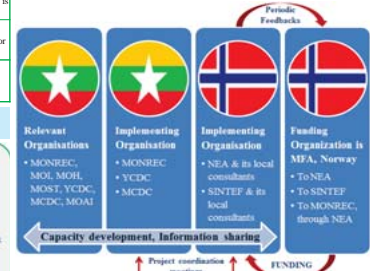
Overall Approaches



Project Schedule

Activities	Responsible	2016				2017				2018				
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Inception phase	NEA & SINTEF													
Baseline regulatory/institutional framework	NEA & MONREC													
Technical baseline	SINTEF													
Development of policy/ regulatory framework	NEA & MONREC													
Plan for Basel convention implementation	NEA & MONREC													
Feasibility of hazardous waste treatments	SINTEF													
Master Plan for Hazardous Waste management	SINTEF													
Capacity building	NEA & SINTEF													

Project Stakeholders



Project Target Areas



Project Expert Team

SINTEF TECHNICAL BASELINE AND MASTER PLAN	NEA REGULATORY FRAMEWORK AND BASEL CONVENTION
Dr. Kari H. Karstensen, Chief scientist	Ms Silje Johansson, Senior advisor
Mr. Palah K. Saha, Research scientist	Ms Kristin Eine, Senior advisor
Dr. Christian J. Engelsen, Senior research scientist	Mr. Aile Fretheim, Consultant
Ms Monica N. Mahmood, Research director	Mr. Jon Fossli/Larsen, Senior advisor
Dr. Serina Ng, Research scientist	

NEA: Norwegian Environment Agency; MFA: Ministry of Foreign Affairs; HW: Hazardous wastes; Contacts in MONREC: Mr. Min Maw and Dr. Tin A. Win.

Integrated Solid Waste Management Stakeholders' Concerns



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Identifying Stakeholders

1. Waste generators
2. Service providers
3. Regulators
4. Government departments
5. Recycling sector
6. Community or neighbourhood

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Stakeholders w.r.t. Source

MSW

- ❖ Domestic Waste (Residential)
- 2. Commercial – small businesses

ISW

- ❖ Industrial – process waste (hazardous & non hazardous)
- 4. Healthcare – hazardous waste

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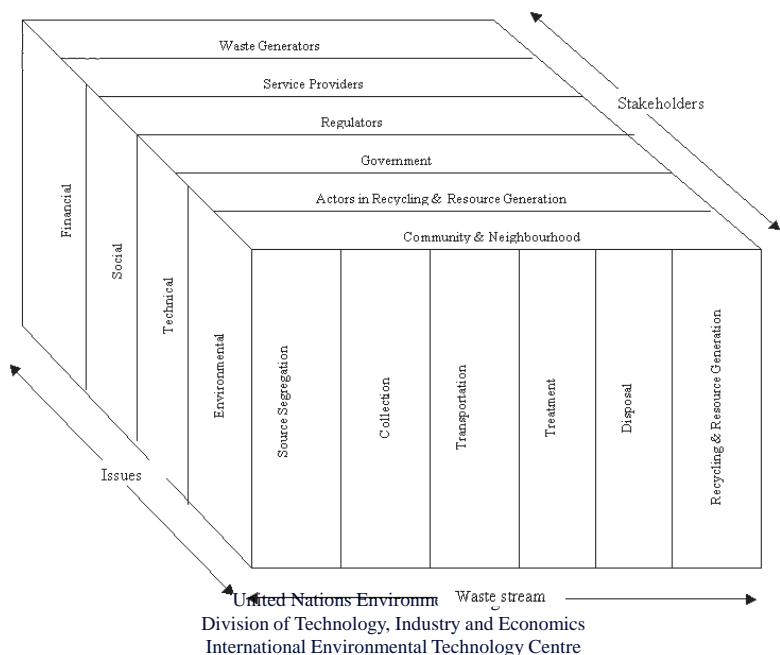
At Each Operational Stage

Stakeholders & Activities	Waste Generators	Service Providers	Regulators	Government	Actors in Recycling & Resource Generation	Community
Source Segregation						
Collection						
Transportation						
Treatment						
Disposal						
Recycling & Resource Generation						

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Issues and Concerns



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MSW (Segregation at Source)

	Waste Generators	Service Providers	Actors in Recycling
Financial	<ol style="list-style-type: none"> Who would bear the costs for buying bins and bags for source segregation Who would get the benefit of earnings from the sale of source-separated recyclables Current fee system and increase in the fee with respect to affordability 	<ol style="list-style-type: none"> Who would bear the cost of providing extra equipment and service Who should get the benefit from the sale of the source-separated recyclables 	<ol style="list-style-type: none"> Will scavengers get benefit from more and clean quantity of recyclables (income and better job safety)
Social	<ol style="list-style-type: none"> Cleaning the recyclables and keeping the garbage for longer duration Awareness raising for segregation of waste and proper primary disposal 	<ol style="list-style-type: none"> Who will be responsible for safety & security of additional facilities Sanitation workers working environment including health risks 	<ol style="list-style-type: none"> Will any training be required Sanitation workers working environment including health risks
Technical	<ol style="list-style-type: none"> Information about segregation of waste (different types of waste) Availability of different types of waste collection bags The size, shape and location of bins Methods for reuse and recycling waste at source Current problems in the waste collection and one or two possible suggestions for the improvements 	<ol style="list-style-type: none"> Technical adaptability of bins to transfer the garbage in the collection vehicles Training for sanitation workers Knowledge about different type of wastes, especially hazardous waste Segregation and recycling of waste after collection by sanitation workers 	<ol style="list-style-type: none"> How to distinguish between PET and other plastics Cleaning/treatment of the recyclables by waste pickers – availability of space, water, etc. Waste pickers' collection point (bins, community waste disposal points, etc.) for waste pickers
Environmental	<ol style="list-style-type: none"> Odour, leakage and attracting birds, animals and insects 	United Nations Environment Programme Division of Technology, Industry and Economics International Environmental Technology Centre	

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MSW (Collection)

	Waste Generators	Service Providers	Actors in Recycling & Resource Generation
Financial	<ol style="list-style-type: none"> Will there be any new collection charges 	<ol style="list-style-type: none"> Will there be revised collection charges for the service providers 	<ol style="list-style-type: none"> Whether scavengers will gain or lose in the new collection system?
Social	<ol style="list-style-type: none"> Can I allow scavengers to come to my house 		
Technical	<ol style="list-style-type: none"> Frequency and timing of collection 	<ol style="list-style-type: none"> What should be the collection frequency and timing based on the capacity of the department 	
Environmental	<ol style="list-style-type: none"> Odour and flies if the waste has to stay longer at my disposal point 	<ol style="list-style-type: none"> Will there be new health and environmental risks if the waste stays longer before it is collected 	

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MSW (Transportation)

	Service Providers	Community
Financial	<ol style="list-style-type: none"> Cost of transportation equipment 	<ol style="list-style-type: none"> Will the community have to bear any additional charges
Social		
Technical	<ol style="list-style-type: none"> Operational aspects Maintenance capacity 	
Environmental		<ol style="list-style-type: none"> Noise and congestion

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MSW (Treatment)

	Service Providers	Actors in Recycling & Resource Generation	Community
Financial	<ol style="list-style-type: none"> 1. Costs for each treatment option 2. Benefits (e.g. waste to energy) 3. Who should pay the costs 	<ol style="list-style-type: none"> 1. Costs and benefits of recycling at treatment plants 	<ol style="list-style-type: none"> 1. Will we get a share in the benefit
Social	<ol style="list-style-type: none"> 1. Can treatment facilities provide additional jobs 	<ol style="list-style-type: none"> 1. Working conditions at treatment facilities 	
Technical	<ol style="list-style-type: none"> 1. Operation & maintenance skills 2. Compliance with the regulations 	<ol style="list-style-type: none"> 1. What are the market opportunities 	
Environmental	<ol style="list-style-type: none"> 1. Water pollution from treatment facilities 	<ol style="list-style-type: none"> 1. Is this regarded as natural environmental damaging 	<ol style="list-style-type: none"> 1. Treatment facilities should not be located in my backyard

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MSW (Disposal)

	Service Providers	Actors in Recycling & Resource Generation	Community
Financial	<ol style="list-style-type: none"> 1. Costs for different options 		
Social	<ol style="list-style-type: none"> 1. Will there be any public involvement against the facility 2. What is the guarantee of recovering waste over long periods 		<ol style="list-style-type: none"> 1. Is the treatment self-viable over long-term
Technical	<ol style="list-style-type: none"> 1. Operation & maintenance skills 2. Compliance with the regulations 	<ol style="list-style-type: none"> 1. Scavenging at landfill 2. Technology and capacity for producing energy from landfill gas 	<ol style="list-style-type: none"> 1. Is there any risk of accident
Environmental	<ol style="list-style-type: none"> 1. Will there be future stringency in environmental law 		<ol style="list-style-type: none"> 1. Environmental impacts on ground water & air pollution, noise, odour, etc.

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Recycling & Resource Generation

	Actors in Recycling & Resource Generation
Financial	<ol style="list-style-type: none"> 1. What will be change in the earnings for individuals and businesses involved in collection and selling of recycling 2. Is there a ready market for resources generated from waste (e.g. compost, bio-gas) 3. Where is information available on new technologies utilizing waste as an input
Social	<ol style="list-style-type: none"> 1. Work safety of individuals involved into the recycling and composting 2. Acceptability of goods (including compost and gas) produced from waste
Technical	<ol style="list-style-type: none"> 1. Technology and capacity to convert waste into a resource
Environmental	<ol style="list-style-type: none"> 1. Compliance with the environmental standards

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ISW (Segregation at Source)

	Waste Generators
Financial	<ol style="list-style-type: none"> 1. Who will pay for the additional cost of segregation 2. The cost for treatment and reuse is very high 3. Is it expensive to treat special waste (hazardous waste, e-waste, etc.)
Social	<ol style="list-style-type: none"> 1. Are there any special provisions to be made for operators
Technical	<ol style="list-style-type: none"> 1. Compliance with the regulations 2. Technology, capacity and practices to store and treat or reuse/recycle the waste within the industry or hospital 3. Information about the type of waste for segregation at source 4. Opinions about the difficulties to manage industrial/hospital waste and one or two suggestions for the improvements
Environmental	<ol style="list-style-type: none"> 1. Any internal regulations, in addition to national and local regulations, regarding handling/managing special wastes at industry/hospital

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ISW (Collection)

	Waste Generators	Service Providers
Financial		<ol style="list-style-type: none"> 1. Waste generators are currently unwilling to engage service providers for waste collection 2. Are the collection charges, paid by the generators (industries/hospitals) enough to generate profits
Social	1. Service providers do not deploy trained personnel	1. Waste generators are not cooperative to facilitate the work of service providers
Technical	1. Frequency and timing of collection	<ol style="list-style-type: none"> 1. Technology and capacity to collect the source-separated waste from industries 2. Do service providers possess the licence to collect/manage special wastes
Environmental	1. Environmental protection measures by the service providers during collection	1. Meeting the environmental standards while collecting/managing special waste (hazardous, e-waste, etc.)

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ISW (Transportation)

	Service Providers	Waste Generators	Community
Financial	1. Cost of transportation equipment		
Social			
Technical	<ol style="list-style-type: none"> 1. Operational aspects 2. Maintenance capacity 	Service providers lack technical capacity and that may result into accidents and mismanagement	
Environmental			1. Noise, congestion and accidents

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ISW (Treatment)

	Waste Generators	Service Providers	Community
Financial	1. Charges	<ol style="list-style-type: none"> 1. Costs for each treatment option 2. Benefits (e.g. waste to energy) 	
Social			
Technical		<ol style="list-style-type: none"> 1. Operation & maintenance skills 2. Compliance with the regulations 	
Environmental			1. Environmental impacts

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ISW (Treatment)

	Service Providers	Community
Financial	1. Costs for each option	
Social		
Technical	<ol style="list-style-type: none"> 1. Operation & maintenance capacity 2. Compliance with the regulations 	
Environmental		1. Environmental impacts on ground water & air pollution, noise, odour, etc.

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