



Proceedings of the National Conference on
“Sustainable Solid Waste Management”
October 27-28, 2014
Taj Tashi, Thimphu



**Organized by the Ministry of Works and Human Settlement and
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1. Background

The two-day national conference on “Sustainable Solid Waste Management” was organized by the Ministry of Works and Human Settlement (MoWHS) with funding assistance from UNDP. The national conference was held on 27th and 28th of October, 2014 at Hotel Taj Tashi, Thimphu. The participants included the municipal engineers and environment officers from the twenty Dzongkhags and representative from relevant government agencies, Civil Society Organizations, private sectors, UNDP and the media.

Her Excellency, Lyonpo Dorji Choden, Minister of MoWHS formally started the opening ceremony of the conference and the conference was chaired by the Hon’ble Secretary, MoWHS.

2. Objective

There is an urgent need for combined and determined efforts from both the government and the private to find an amicable solution towards the ever increasing garbage problems in the towns. Regular events such as national conference or workshops could serve as a useful forum for not only in keeping the people informed with the new technologies available but also in brainstorming so that appropriate management technologies are explored for Bhutan to reduce environmental impact from the municipal garbage.

The aim of the conference is to “institutionalize the implementation of Sustainable Solid Waste Management System” through the principal of 3 Rs (Reduce, Reuse and Recycle) in Bhutan. Therefore the following are the objectives of organizing the national conference on sustainable solid waste management in Bhutan:

- To bring together all the individuals and groups to discuss on the issues and challenges facing authorities in terms of solid waste management and related environmental impacts
- Serve as a forum for the presentation, discussion, and way forward on solid waste management in the Thromdes and Dzongkhags.
- Identify knowledge gaps and familiarize the participants on the current technologies available for solid waste management through interactive presentation and discussions on selected case studies
- One of the main problems with the municipalities is the lack of human resource capacity because of which the municipal solid waste management (MSWM) is quite poor. This conference will serve to educate and expose those engineers working in the municipalities so that they become more aware and confident in initiating new management strategies.
- Discuss on the existing government policies and also explore ways in strengthening the institutions on solid waste management.
- Identify appropriate technologies which are practical and sustainable in the context of Bhutan.

3. Overview of the Conference

The two day national conference was a general conference on broad topics of Solid Sustainable Waste Management in Bhutan. The first day included topics on national policies and discussions of strengthening institution for solid waste management through environmental legislations. It also included an overview presentation of existing solid waste management practices in Bhutan and site visit to Serbithang Compost Plant and Greenerway. The second day covered topics on good initiatives and appropriate technologies on SWM taken both within and outside the country.

4. Resolution and Recommendations

The following are the summary of important presentations with recommendations and resolutions from the conference for relevant agencies to undertake follow up actions.

4.1 Sustainable Solid Waste Management in Bhutan

- i. The conference pointed out that due to lack of facilities and services provided by the service providers, the public burn their wastes. The conference discussed that burning of wastes is not a good practice mainly because the government is promoting 3 Rs, hence burning of waste defeats the purpose of segregation at source, sale of recyclables and most importantly, burning of plastic produces dioxins which cause cancer and respiratory diseases. Open burning of wastes has also been observed not only in the Thromdes but also in the Dzongkhags. Therefore, it was directed that strict enforcement of Waste Prevention and Management Act and its Regulation must be done whereby it is stipulated that open burning of wastes is prohibited. **Action: All Dzongkhags, Municipalities and Thromdes**
- ii. The conference deliberated that in order to achieve sustainable SWM, the soft as well as hard components of SWM need to be addressed. The hard component includes infrastructure development, provision of tools and equipments, etc. The soft component includes changing the mindset of people through public awareness. It was agreed that awareness on sustainable SWM is required to be conducted in all Dzongkhags. **Action: All Dzongkhags, Municipalities and Thromdes**
- iii. Reducing the quantity and noxiousness of waste at the source, introducing separate collection and sorting procedures to encourage recycling and reuse, organizing waste transportation, and investing in recycling, energy and organic recovery technologies are the fundamentals of sustainable waste management.

The UNDP emphasized on the need to do source segregation followed by separate collection and sorting procedures to encourage recycling and reuse, organizing segregated waste transportation, treatment and disposal. This would solve most of our solid waste management problems.

In addition, the floor discussed extensively that there is a need to have different collection schedule for segregated wastes. Some of the public practiced segregation of wastes but

were discouraged when the service providers dumped the segregated wastes together in one compactor truck thus defeating the promotion and purpose of segregation at source. It was decided that all the Thromdes and Municipalities should give priority to segregation of waste at source by the citizens, provision of separate storage facilities (bins/communal bins), provision of separate collection vehicles for dry and wet wastes, and provision of segregated waste processing facilities. **Actions: All Dzongkhags, Municipalities and Thromdes**

- iv. The lack of SWM in Gewogs and villages was also raised as an important issue. Currently, the SWM was limited to only within the Dzongkhag Municipalities. It was agreed that SWM in Gewogs and villages should be taken on board by the Dzongkhag Administration. **Actions: All Dzongkhags Administration.**
- v. The floor deliberated that there is a need to make it mandatory for all Dzongkhags and Thromdes to have an organic waste composting pit in each building. The participants learnt that is not necessary to have a big composting plant for such initiatives. Individuals/households may use innovative ideas of using old drums with holes drilled on it, hume pipes, boxes, old planks etc. **Actions: All Dzongkhags, Municipalities and Thromdes**
- vi. The MoWSH acknowledged Bhutan Trust Fund (BTF), UNDP, YDF, RSPN, WWF, Greener Way, Clean Bhutan for their support in solid waste management.

Following, the conference advised that Dzongkhags and Thromdes should adopt the Public Private Partnership (PPP) Model based on their own local conditions, needs, and situation. There are opportunities for organization like UNDP, BTF, Thimphu Rotary Club, WWF, WHO, RSPN etc. to fund such programs. The Dzongkhags and Thromdes were urged take the responsibilities of developing innovative projects and efficiently managing and developing their solid waste system which is sustainable with a well structured PPP model to result in significant improvement in efficiency and quality of solid waste management. However, there is a need to have standard legal instruments in place. **Actions: All Dzongkhags, Municipalities and Thromdes**

- vii. Presently, the municipalities cover most of the costs related to management of municipal waste. There is little to no financial contribution from users. As a result, waste management is a major liability for the Thromdes, Municipalities, and Dzongkhags. The presenters informed that the current solid waste management system is not sustainable as they were not able cover the operation and management of existing SWM services and infrastructures provided. The conference discussed that a solid waste management service fee should be introduced in order to have a sustainable system. The conference highlighted that solid waste management service fee should be introduced in Thromdes and Dzongkhags in consultation with the waste producers (public), communities and its local authorities. **Actions: All Dzongkhags, Municipalities and Thromdes**
- viii. In order to address the lack of information and baseline data on solid waste, it was discussed that there is a need have a solid waste information system in place in all Dzongkhags and Thromdes. The solid waste management information system should include but not be limited to the following:

- Documents on baseline data on solid waste in Dzongkhags and Thromdes – amount of waste generated, collected and disposed; amount of waste composted, sold to scrap etc.
- Amount of revenue generated and expenditure incurred from solid waste management service collection fee, O&M cost of SWM services and infrastructure.
- Need of Landfill management plan/system in Dzongkhags in place.
- Need of inventories on number of houses and properties for calculation of charges and fees on SWM

Actions: All Dzongkhags, Municipalities and Thromdes

The conference discussed that there are issues related to some recyclable materials especially the bottles (like spy wine bottles) as they are disposed of into the landfill since they do not have a resale value. Therefore, it was decided that there is a need to initiate dialogue between the relevant stakeholders on ‘take back mechanism’ with the manufacturing companies for those products which have no re-sale value. **Actions: NEC & Ministry of Economic Affairs**

The participants raised the concerns of hazardous waste like medical and e-waste entering into the municipal waste stream which is then disposed of to the landfills thus making it unsafe for the service providers, the formal and informal waste collectors at site. The following was decided:

1. *Medical Waste:* The representative from the Ministry of Health (MoH) clarified that medical wastes entering the municipal waste stream should be collected by the Municipalities/Thromdes/Dzongkhags and handed over to the MoH for proper disposal. The conference directed that the Thromdes and Municipalities are to highlight the issue of medical waste to the MoH and coordinate on the management strategy for medical waste management. It was decided that the MoH is to develop strategic plan for Medical Waste for municipalities and Thromdes.

Actions: Ministry of Health

2. *E-Waste:* The Department of Information and Technology, Ministry of Information and Communication (MoIC) informed that they are in the process of developing a Request for Proposal for outsourcing of e-waste management. The MoIC was directed to develop guidelines for e-waste management for Thromdes and Dzongkhags for effective implementation of e-Waste Management in Bhutan.

Actions: Ministry of Information and Communication

Some of the participants of the conference felt that cleaning campaigns was not a successful and sustainable solution to waste management. However, it was discussed that that cleaning campaigns should not be done away with as it has always been a good awareness initiative. It has also been successful in inculcating values on importance of cleaning and waste management. Therefore, it was decided that cleaning campaigns should be promoted as one of the medium of promoting awareness on SWM but it must not be the main strategy for waste management.

The floor raised that the each Dzongkhags had Environment officers but they were not involved in solid waste management. The conference decided that the Dzongkhag Environment Officers also need to actively take part in facilitating management of solid

waste management in Dzongkhags in collaboration with the Municipal Engineers.

Actions: All 20 Dzongkhag Environment Officers

- xiii. The conference discussed that there is a need for environmental inspectors in Dzongkhags and Thromdes to monitor the implementation of SWM which includes segregation at source, collection, and transportation of waste, treatment of wastes, littering, open burning etc. The Honorable Chair stated that everyone was expected to be an environment inspector; nonetheless he acknowledged that there was a strong need of environment inspectors in Thromdes and Dzongkhags for waste management.
- xiv. It was discussed that banning as a strategy for waste management is not a solution as the long term goals of integrated solid waste management cannot be achieved. Hence, banning should not be promoted.
- xv. It was discussed that the NEC should be involved in the framing of policies and R&Rs on Solid Waste Management while MoWHS is to develop guidelines for implementation of SWM. **Actions: NEC & MoWHS**
- xvi. It was also emphasized that there is a need for strict enforcement on the Solid Waste Management policies, plans, rules & regulations etc. **Action: NEC & MoWHS (to take the lead role), all Dzongkhags, Municipalities and Thromdes**

4.2 Solid Waste Management in Mongar Dzongkhag

- i. Since Gyelposhing town has the potential to expand with the opening of Gyelposhing - Nganglam Highway, the conference recognized that there is a need to promote the involvement of private firms to take up the SWM services (segregation/collection/transportation/treatment/disposal). **Action: Mongar Dzongkhag Administration**

4.3 Solid Waste Management in Gasar Dzongkhag

- i. The conference discussed that Gasar Dzongkhag is in the planning phase of development where the issues of SWM are not as voluminous and grave as in other Dzongkhags. However, the recent practice of open dumping and burning of wastes is not acceptable. Therefore, the new town at Koli Kha has opportunities to learn from other Dzongkhags and implement proper sustainable solid waste management. Gasar Dzongkhag should immediately identify landfill site and construct a landfill in collaboration with MoWHS. **Action: Gasar Dzongkhag Administration in collaboration with MoWHS**
- ii. In consultation with MoWHS, Gasar Dzongkhag should develop a sustainable waste management plan with emphasis on segregation at source, collection, and transportation of segregated recyclable waste. **Action: Gasar Dzongkhag Administration in consultation with MoWHS**
- iii. It was decided that Gasar being a tourist destination, wastes should be managed properly especially around the Tsachu area and along the trekking routes of Gasar and Laya. **Action: Gasar Dzongkhag Administration**

4.4 Solid Waste Management in Thimphu Thromde

- i. An extensive discussion was held on the proposal to introduce facility to convert plastic to fuel by Thimphu Thrompoen. It was felt that such projects must be considered only after studying its technical and economic viability. The proposal must be submitted to MoWHS following extensive consultation with stakeholders.
- ii. Majority of the participants raised the issue of lack of facilities for dumping waste in Thimphu Thromde. Based on the feed backs of the conference, the conference decided that Thimphu Thromde should re-install the steel containers in Thimphu for the benefit of the public. However, proper management system should be put in place whereby the service providers collect the waste regularly and improve their service delivery.
- iii. The Thimphu Thromde also made a presentation on Landfill Management: Design and operational challenges and Initiatives undertaken. The presentation informed that the future plan for Memelhakha is to build a semi-aerobic landfill. The activities include extension of existing landfill and renovation of existing infrastructures like construction of: new approach road; soil embankment; retaining wall; bottom leachate collection facility (main line and branch line); leachate collection pit and gabion for leachate collection).

In this regard, the conference discussed on likely practical problems that Thimphu Thromde would face based on other Dzongkhags experiences. It was submitted by the participants that due to the movement of the waste collecting vehicles inside the site, the piping layouts in the landfill were damaged which caused problems in the collection of leachate. It was suggested that the thickness of the pipes as well as its soil cover should be thoroughly discussed and studied prior to its implementation at Memelhakha.

The Chair commended the observations/issues raised and advised that only good quality pipes like Druk Polythene be used at the site. Furthermore, it was instructed that Thimphu Thromde should take note of these issues and discuss before implementing any of the plans in the Memelhakha. Therefore, it was decided that Thimphu Thromde should hold consultative meetings with stakeholders and experts prior to implementing of Memelhakha Landfill management plan. Accordingly, appropriate methodology and technology should be adopted.

- iv. With funding assistance from UNDP, Thimphu Thromde had initiated the Public Private Partnership Pilot Project in vegetable market, Chubachu, Changjiji Colony and Ministers enclave where the two bin system (segregation/storage/collection/disposal) for degradable and non degradable waste was initiated. The conference was informed that due to lack of monitoring, segregation of waste was very minimal. In addition, during the implementation of the project, the services for collection of wastes had been outsourced to the private firm however, the firm had sustain through sale of recyclable waste and therefore failed after a month. The conference directed that there is a need for Thimphu Thromde to study why the pilot area on outsourcing of solid waste services in the pilot

project area was not successful. There is a need to have proper research on such schemes with proper inventories (baseline information) prior to implementation of such projects.

- v. The UNDP highlighted that there is a need for Thimphu Thromde's PPP Pilot initiatives to be up-scaled - otherwise there is no end to pilot projects and this is a good time to demonstrate how PPPs can improve the collection, processing, and disposal of solid waste throughout the country. PPPs bring private sector investment for infrastructure and public services, innovative ideas as well as new technologies and managerial skills. A good PPP model on waste management will reduce burden on the municipality (in its scope of work). However, private sector engagement in waste management comes with risks, therefore it requires due diligence and standard legal instruments for PPP in place.
- vi. The conference participants raised that currently, one of the major challenges the public face is disposing their wastes on time. Most of the public are not able to wait for the Thimphu Thromde's scheduled collection vehicle as they have to go to their offices or attend to other urgent matters. Therefore, the conference decided that the Thimphu Thromde is to review and revise the collection schedules for waste in Thimphu.
- vii. The Thimphu Thromde informed that a draft proposal for solid waste collection fee has been prepared based on the cost of services & infrastructure provided in different areas like commercial, residential, institutions etc. However, the draft proposal will be implemented only upon approval by the Ministry of Finance. The conference discussed that the proposal should be also discussed with stakeholders including central agencies, local authorities, waste producers (public), and communities.

Action: Thimphu Thromde

4.5 Solid Waste Management in Samdrup Jongkhar

- i. Based on the pictures presented on the Samdrup Jongkhar's landfill presented, the conference noticed that the landfill contained mostly PET bottles. In this regard, the conference highlighted that there is a need to encourage segregation at source and installation of PET bailing plant whereby the operation of the plant could be either managed by the Thromde itself or could outsourced to the private sector. **Action: Samdrup Jongkhar Administration**
- ii. The composting plant is non operational mainly due to the hindrances caused by climatic conditions and miscreants lifting materials of commercial value from the compost plant. The floor discussed that compost plant is required to manage the bio-degradable wastes in Samdrup Jongkhar Thromde. The conference decided that the compost plant project needs to be revived. The MoWHS is to assist the Samdrup Jongkhar Thromde if required. **Action: Samdrup Jongkhar Thromde**
- iii. The conference also decided that Samdrup Jongkhar Thromde should be the recyclable waste collection hub of the eastern Bhutan whereby all recyclable materials (plastic, bottle, tin, paper etc.) should be collected and transported from other Dzongkhags like Pema Gasthel, Trashigang, Trashi Yangtshu etc. After establishment, private sector

should be encouraged to take this business opportunity. The main aim of this project is to encourage segregation and reduction of waste at source in the Eastern Dzongkhags of Bhutan. **Action: Samdrup Jongkhar Thromde (lead role), Trashigang Dzongkhag Administration, Pema Gatshel Dzongkhag Administration, Trashy Yangtsho Dzongkhag Administration**

4.6 Experiences and lessons learnt from Pilot Project of Integrated Solid Waste Management in Bajothang, Wangdue Phodrang

- i. The Wangdue Phodrang Dzongkhag Administration has implemented the Pilot Project on ISWM in Bajothang. Through the project, the administration was able to provide SWM infrastructures, services, and facilities; capacity building and awareness programs. The Municipality also initiated segregation at source with different collection and transportation timing for segregated wastes and collection of SWM fee. In addition, the management of SWM services like street sweeping, PET bailing plant and shed was privatized to individuals and private firms. The conference appreciated the Wangdue Phodrang Municipality for their commendable implementation of ISWM in Bajothang. The Municipal Engineer had presented that for the 11th Five Year Plan, a capital of Nu. 4.50 million has been approved for the rehabilitation of Nahe Landfill and purchase of machineries. In this regard, the conference advised that the Wangdue Dzongkhag Administration should discuss and work together with PHPA I and PHAPA II as PHPA has about Nu. 2 million allocated for solid waste management. In addition, some funds have also been earmarked by PHPA to fund SWM facilities in Wangdue. **Action: Wangdue Phodrang Dzongkhag Administration**

4.7 Sharing Waste Management experiences in Gelephu Thromde

- i. Participants questioned on the effectiveness of the door to door waste collection. It was shared that the door to door waste collection was also being practiced in Phuntsholing, however this did not bring along much improvement with residents dumping waste indiscriminately in the Thromde.

The Honorable Chair responded that the level of compliance will depend on the promotion of public awareness/education and improvement of effective SWM service delivery. The Chair suggested the services provided could be improved to properly address the needs of the community. He also advised the floor to not change the SWM system and initiatives abruptly when it does not function/work in the first years of implementation. There is a need to improvise and use innovative ideas and technologies to revive the system. **Actions: All Dzongkhags, Municipalities and Thromdes**

- ii. The floor questioned on the function of the Geo-Membrane sheet in landfills. In response, it was informed that the primary function of geo-membrane was to prevent the seepage of leachate into the ground which would otherwise pollute and contaminate the ground water and streams. Furthermore, it was explained that in Samtse Dzongkhag, a layer of clay was used in conjunction with geo-membrane to increase its effectiveness. It was deliberated Gelephu Thromde is the only area which had a controlled sanitary landfill

with HDPE lining. It was directed that the Dzongkhags and Thromdes should also try to convert their landfills/open dumps into controlled sanitary landfill and henceforth, new designs for disposal facilities should be sanitary landfills with HDPE or appropriate/required materials as a base liner to limit the infiltration of leachate to the subsoil/streams and rivers. **Actions: All Dzongkhags, Municipalities and Thromdes**

4.8 Organic Waste Treatment Technologies in Thailand

- i. Presentation of waste management in mega city of Bangkok, Thailand was made to the participants. Although participants learned on various aspects of SWM, not all of the technologies were suitable to be adopted in Bhutan. Nonetheless, some of the simple technologies like community based composting and household composting could be promoted in Bhutan whereby use of small concrete bins or boxes made of unusable wooden planks or metal drums with holes drilled through it etc. could be promoted. Similar technologies could be used at a smaller scale that would suit household composting in household's home or backyard. **Actions: All Dzongkhags, Municipalities and Thromdes**

4.9 Opportunities and challenges in waste recycling

With regard to adoption of appropriate waste management technologies, it was deliberated that the solution was quite simple as waste could be recycled with various waste technologies which are simple and cost effective. However, it was advised that raising awareness and starting slow was very important.

- i. The Honorable Chair commended Mr. Karma Yonten and Greener Way for their work on waste management. The Chair also stated that MoWHS shall request Greener Way to make a presentation in South East Asia Regional Meeting. **Action: MoWHS & Greener Way**

4.10 Solid Waste Management in Hydropower Project Sites: Segregation of waste in PHPAI & PHPAII

It was discussed that PHPA is one of the few large projects where segregation of waste has been implemented. Thus, other Dzongkhags with large projects could take such waste management with emphasis on source segregation initiatives in future. Hon'ble Secretary appreciated the PHPAs initiatives on outreach programs and in addition, it was emphasized that such initiatives like cleaning campaigns are a good medium for creating awareness on SWM.

- i. PHPA suggested that if the Royal Government of Bhutan could send notifications stating that non-nationals are not allowed to collect waste from the project sites, this would promote waste Bhutanese firms/individuals to collect wastes.

4.11 Initiatives on Waste Management (3Rs) in Schools

- i. Hon'ble Chair applauded and greatly appreciated Madam Chuki's passion for the management of her school children and solid waste management. MoWHS agreed to arrange all the logistic and travel expenses if the Principal and senior teacher from JLPS wishes to make such presentation to various schools in different Dzongkhags. MoWHS shall support JLPS to propagate their ideas to different schools in the country. **Action: MoWHS & JLPS**

4.12 Zero Waste Program: Samdrup Jongkhar Initiative

- i. The conference discussed that there is a need to promote the use of homemade Tshogs and avoid packaged Tshogs. The Ministry is to disseminate information on the positive benefits of offering homemade Tshogs to the public and monastic bodies via letter, print and broadcast media. At the same time, Hon'ble Secretary of Zhung Dratshang must be requested to instruct all Monastic Institutes not to accept packaged offerings/Tshogs from the public to reduce plastic wastes in sacred places. **Action: MoWHS**

4.13 Clean Bhutan Program

The participants raised concerns for the cleanliness of trek routes. Trek routes should be kept clean in order to keep tourism alive in Bhutan since it is the second highest income generator of the nation. Tourism Council of Bhutan should liaise with the Municipalities and Dzongkhags. **Action: All Dzongkhags, Municipalities and Thromdes**

In addition to solid waste management, the conference expressed the concern of increasing stray dog population in the country. There have been many incidences where scavenging by dogs caused scattering of wastes. It was discussed that there is a need to recognize that stray dog is an issue and the population must be controlled. Hon'ble Chair acknowledged the initiatives taken by the Ministry of Agriculture (MoA) and Forest and Ministry of Health (MoH) in controlling stray dogs through sterilization. In this regard, Hon'ble Chair highlighted that other central agencies and the public must also work together with the MoA and MoH to help dog sterilization programs to reduce the stray dog population.

5 Conference proceedings

5.1 Welcome Address

The Hon'ble Zhabtog Lyonpo welcomed all the participants to the special subject on Solid Waste which is "A thing of our own doing, a choice of our own, which haunts us."

Her Excellency informed that with socio-economic development, urbanization, globalization and technological advancement, Bhutan has transformed dramatically. The increased standard of living afforded by increased disposal income has led to much higher consumption of goods, thus leading to more generation of wastes which is alien to our natural environment. The current pattern of consumption starting from the clothes we wear, construction of houses to our daily

meals are detrimental to our environment unlike in past where everything was environment friendly. She said that the developed countries have gone through this stage because of ease, comfort and faster solutions to our living. Yet, the trend is now reversing towards going green, sustainable, natural and organic.

The problem of solid wastes cuts across all society. Lack of civic sense and inadequate awareness are considered the reasons for increased generation of wastes, although huge amount of money is already invested in public education and awareness. A one day cleaning campaign to be forgotten next day and litter being all over the paces again the very next day does not help much. It is the mindset that really needs to be changed and it can only be achieved through collaborative efforts of whole community and through such conferences.

However, Hon'ble Lyonpo mentioned that, Bhutan is in the best position to take the path that has lesser environmental baggage as our lives still remain close to environment and nature. Our great Kings, in particular the 4th King has laid a strong foundation that places environment at the forefront of all our development, as one of the pillars of our development philosophy "Gross National Happiness." Yet, we cannot relax ourselves but come up with strategies through such conference where simple solutions are explored to manage this complex issue of waste management.

Poor waste management is a debt for future generations to pay. Therefore, she urged that we all should come together, work towards collective goal and let the wastes from our own doings and choices not haunt us.

The Hon'ble Lyonpo thanked United Nations Development Program (UNDP) for their continued support to the Ministry in various forms. The Hon'ble Lyonpo also thanked all the officials from Non-Governmental Organizations (NGOs), Private and Government Organizations for their presence for the conference and wished the conference a successful deliberation.

5.2 Policy on Solid Waste Management in Bhutan – Ms. Kunzang Choden, Senior Legal Officer, National Environment Commission

The Senior Legal Officer of the National Environment Commission (NEC) informed that the general environmental principal of Bhutan is from the Article 5 and 8 of the Constitution of the Kingdom of Bhutan which states that "every Bhutanese is a trustee of the Kingdom's natural resources and the Government to ensure healthy environment and it is the fundamental duty of every Bhutanese to preserve, protect and respect the environment, culture and heritage". Following, the Waste Prevention and Management Act (WPMA), 2009 was enacted to protect and sustain human health through protection of environment by:

- Reducing waste generation at source
- Promoting segregation, 3 Rs
- Waste disposal in an environmentally friendly manner and
- Effective functioning and coordination among implementing agencies.

The Act emphasizes on the carrot and stick approach for enforcement. It varies from incentives/financial mechanisms to criminal offences which include felony, misdemeanor, etc. The Waste Prevention and Management Regulation, 2012 establishes procedures to implement WPMA, 2009, whereby roles and areas of implementation of the Implementing Agencies have been identified and costs in proportion to the waste volume generated has been assigned whereby the fees, charges and fines for non-compliance are levied based on the degree of hazardousness. MoWHS is the monitoring agency for the management of municipal Waste and the implementing agencies being Thromdes and Dzongkhags.

Integrated Solid Waste Management (ISWM) refers to the strategic approach to sustainable management of solid wastes covering all sources and all aspects, such as generation, segregation, transportation, sorting, treatment, recovery, and disposal in an integrated manner, with an emphasis on maximizing resource use and efficiency. To operationalise ISWM, it is important that all aspects of waste management; storage, segregation, collection and transportation, processing and disposal are considered and designed.

Implementation and action plan – collection transfer and treatment

Action	Target	Time
Individual planning at municipal/Dzongkhag/national level	ISWM planning process completed	2017
Waste collection and storage system	90% of HH collection	2017
Transfer station and transport systems	Route system design and aligned	2017
Segregation level achieved	25% first year – 15% annual increase thereafter	2017
Waste treatment and processing systems	Same	2018

Implementation and action plan – final disposal

Action	Time
Final disposal of residuals and inserts	
- Identify all open dumpsites	2017
- Determine criteria for regional landfills (locations)	2016
- Improve current open dumpsites to controlled disposal sites (standards)	2018
- Construct regional landfill sites	2018

5.3 Sustainable Waste Management: Introduction to Integrated Solid waste management and 3 Rs Concept - Hon'ble Secretary, MoWHS

MoWHS plays a major role in solid waste management and the main objectives being as follows:

- Promotion of awareness amongst the people on importance and initiatives on the economy of waste
- Ensure long term sustainability of waste management
- Effective implementation of Acts and regulations of Waste prevention and Management
- Ensure a cleaner environment

In order to achieve sustainable waste management, 3R concept should be practiced. Some of the 3Rs initiatives in the country are as follows;

- The Waste Prevention and Management Act, 2009 and Waste Prevention and Management Regulation, 2012 which promotes the principles of 3Rs
- In order to promote 3Rs, Thimphu and few other districts towns are implementing Public Private Partnership for ISWM where segregation of waste is carried out.
- High organic content of MSW indicated opportunity for recycling of organic waste and therefore, few compost plants are installed. Such compost plants will be replicated in other Dzongkhags after analyzing the success of the compost plant in Thimphu and Wangdue Phodrang.
- Most of the schools have initiated 3Rs as a part of extracurricular activities.
- Informal sector plays an important role in recycling initiatives and waste management. However, we need to develop an enabling environment for these informal entrepreneurs
- The only facility for plastic recycling is PET bottles and is managed with simple value addition i.e. shredding into smaller chips.
- For papers and card boxes, small scale paper recycling units are set up (Jungshi Indigenous Paper Factory, Jemina)

Implementing Hanoi 3R Declaration and Outcome of Surabaya 3R Forum

Half of humanity lives in cities today. The composition of wastes becomes more complicated as the countries develop. Low income countries generate more organic wastes as compared to high income countries. The Regional 3R forum in Asia and Pacific was organized with the goal to achieve low carbon and sound material cycle societies in Asia through facilitating bilateral and multilateral cooperation for increasing resource and energy efficiency through the 3Rs, and for promoting environmentally sound management of wastes in the region; to set in motion a regional mechanism to address 3R issues, needs and priorities in Asian countries, including emerging issues of concern in waste management (Tokyo 3R Statement, 2009). The 3R forum was held in Surabaya, Indonesia in 2014 and some of the best practices of Surabaya in terms of 3R implementation were showcased. Some of main activities that are carried out in Surabaya are;

- Socialization to the community

- Recruitment and training of staff
- Distribution of cleaning tools

5.4 Solid Waste Management in Mongar Dzongkhag – Kiba Wangchuk, Municipal Engineer, Mongar Dzongkhag Administration

The Municipal Engineer of Mongar Dzongkhag presented that the services for solid waste management is being covered in the core town area, Trailing, Changshingpeg, Jarakhshor, Gyelposhing and Lingmithang. Polythene/welded mesh bins are provided for houses in towns and residential areas. The volume of waste generation/day is approximately 1332 kilograms (1.332 tonnes). The wastes are collected and transported to the landfill by compactor/refuse collector and sometimes by DCM.

In Gyelposhing and Lingmithang, the waste collection and segregation has been outsourced to a private entrepreneur We-Care and for Yadi, it is outsourced to another private individual. It was informed that as an incentive, the wastes firms are paid Nu. 10,000 and Nu. 3,600 per month respectively by the municipality.

The landfill for Mongar is located at Changshingpeg and it was initially identified in 2000 as there were no settlements nearby. However, the landfill is now concealed due to complaints from the Thripang community. It was discussed that this was the only concealed landfill which was more of an open dump area in Bhutan. Thereafter, the wastes from Mongar town are now being disposed at Tshokor landfill, which is the landfill site for Gyelposhing and Lingmithang.

The main challenges and issues that the Mongar municipality face are lack of awareness, no landfill for Mongar and lack of proper equipment and machineries

Discussions

The conference deliberated that in order to achieve sustainable SWM, the soft as well as hard components of SWM need to be addressed. The hard component includes infrastructure development, provision of tools and equipments, etc. and the soft component includes changing the mindset of people through public awareness. It was agreed that awareness on sustainable SWM is required to be conducted in all Dzongkhags.

The lack of SWM in Gewogs and villages was also raised as an important issue. Currently, the SWM was limited only within the Dzongkhag Municipalities. It was agreed that SWM in Gewogs and villages should be taken on board by the Dzongkhag Administration.

Since Gyelposhing town has the potential to expand with the opening of Gyelposhing - Nganglam Highway, the conference recognized that there is a need to promote the involvement of private firms to take up the SWM services (segregation/collection/transportation/treatment/disposal).

5.5 Solid Waste Management in Gasa Dzongkhag – Penjor Dukpa, Municipal Engineer, Gasa Dzongkhag Administration

The present Gasa town is a temporary makeshift town, which will however, be relocated to Kolikha after the finalization of the Structural Plan. Gasa town generates 50 kilograms of organic waste and 70 kilograms of general wastes per day. In addition to no proper township in Gasa, Gasa Dzongkhag highlighted that the Dzongkhag Administration has no existing facilities such as collection vehicles and disposal facilities (Landfill). Residents of Gasa usually collect their household waste and dump it in an open pit and burn their wastes. It was presented that cardboards and bottles are collected for recycling.

The Municipal Engineer highlighted that the main challenges and issues faced are as follows:

- There is no committed budget/sources for SWM in 11 FYP
- No proper municipal organization to take a lead role in SWM
- People usually practice open dumping which is a major concern and it leads to scavenging and diseases.
- Lack of suitable location for a sanitary landfill as the area is strictly restricted under Jigme Dorji Wangchuk National Park
- Because of its geographical location and scattered population, it is very difficult to travel to places like Laya and Lunana to implement SWM.
- There are various trekking routes in Gasa which are inviting/attracting lots of tourists. This is leading to a major concern as wastes are being littered along Gasa-Laya mule track.

Discussions

The conference discussed that Gasa Dzongkhag is in the planning phase of development where the issues of SWM are not as dramatic as other Dzongkhags. Therefore, the new town at Kolikha has opportunities to learn from other Dzongkhags and implement proper sustainable solid waste management. Gasa Dzongkhag should immediately identify landfill site and construct a landfill in collaboration with MoWHS. In consultation with MoWHS, Gasa Dzongkhag should develop a sustainable waste management plan with emphasis on segregation at source, collection, and transportation of segregated recyclable waste.

It was decided that Gasa being a tourist destination, wastes should be managed properly especially around the Tsachu area and along the trekking routes of Gasa and Laya.

5.6 Solid Waste Management in Thimphu Thromde – Mr. Tshering Penjor, Officiating Chief Environment Officer, Thimphu Thromde

The Thimphu Thromde presented that the Environment Section's responsibilities are to collect, transport and dispose waste generated in Thimphu Thromde. They are also responsible for the operation and maintenance of disposal sites like the Memelhakha landfill and the compost plant in Serbithang. The Thimphu Thromde has 17 vehicles plying daily for solid waste collection and collects about 25 MT/day. The collection system in Thimphu Thromde is door to door collection and collection of communal bins.

With funding assistance from UNDP, Thimphu Thromde had initiated the Public Private Partnership Pilot Project in Chubachu, Changjiji Colony and Ministers enclave where the two bin system (segregation/storage/collection/disposal) for degradable and non degradable waste was initiated. The conference was informed that due to lack of monitoring, segregation of waste was very minimal. In addition, during the implementation of the project, the services for collection of wastes had been outsourced to the private firm however, the firm had to sustain through sale of recyclable waste and therefore failed after a month.

The Thimphu Thromde presented on the lesson learnt from the pilot project where it was highlighted that it was important to conduct repeated awareness on waste reduction and segregation at source and door-door awareness was found to be more effective when compared to the public consultation forum. In addition, there was a need to design affordable and flexible system since the initial investments for a solid waste management system is high.

The Thimphu Thromde presented on the existing and future projects like the implementation of land fill management plans with funding assistance from the Japanese Government; the installation of 3 Recyclable waste collection centre with funding assistance from GNHC and BTF; construction of transfer station below the Thimphu-Babesa Expressway where the management was outsourced to Greenerway; outsourcing of solid waste collection in Thimphu Thromde; make it mandatory for each building to have waste bins; strengthen the compost plant; plastic to fuel energy plant; and introduction of waste tariff system.

Finally, the Thimphu Thromde presented on the challenges faced by the division on SWM which are as follows:

- Low community awareness and participation
- Huge financial burden and budget constrain
- Inefficiency in the collection system as all wastes is being dumped into one collection vehicle.
- Difficulty in monitoring and detecting defaulters.
- Dustbins placed in various locations are vandalized or manhandled by public.
- The compost production from the Serbithang compost plant is increasing every year since its operation in 2010 however, its efficiency is being reduced because the biodegradable wastes are mixed with other wastes. This is mainly due to poor participation and awareness among the communities. In addition, the compost business is not viable for the private sector as they have to compete with the chemical fertilizers which are highly subsidized by the Government.

Discussions

Majority of the participants raised the issues of lack of facilities for dumping waste in Thimphu Thromde. Based on the feed backs of the conference, the conference decided that Thimphu Thromde is to re-install the steel containers in Thimphu for the benefit of the public. However, proper management system should be in place whereby the service providers collect the waste regularly.

The viability of plastic to fuel project initiated by Thimphu Thromde should be reviewed and discussed amongst the stakeholders and should be endorsed by the MoWHS before the implementation.

Thimphu Thromde should hold consultation meetings with stakeholders and experts prior to implementing of Memelhakha Landfill management plan. Accordingly, appropriate methodology and technology should be adopted.

There is a need for Thimphu Thromde to study why the pilot area on outsourcing of solid waste services in the pilot project area was not successful. There is a need to have proper research on such schemes with proper inventories (baseline information) prior to implantation of such projects.

Dzongkhags and Thromdes should adopt the PPP Model based on their own local conditions, needs, and situation. There are opportunities for international organization like UNDP, BTF, Thimphu Rotary Club, and WWF etc. to fund such programs. The Dzongkhags and Thromdes are urged take the responsibilities of developing innovative projects and efficiently managing and developing their solid waste system which is sustainable with a well structured PPP model to result in significant improvement in efficiency and quality of solid waste management. However, there is a need to have standard legal instruments in place.

The conference participants raised that currently, one of the major challenges the public face is disposing their wastes on time. Most of the public are not able to wait for the Thimphu Thromde's scheduled collection vehicle as they have to go to their offices or attend to other urgent matters. Therefore, the conference decided that the Thimphu Thromde is to review and revise the collection schedules for waste in Thimphu.

In Bhutan, the municipalities cover most of the costs related to management of municipal waste. There is little to no financial contribution from users. As a result, waste management is a cost centre in the Thromdes, Municipalities, and Dzongkhags. The presenters informed that the current solid waste management system is not sustainable as they were not able cover the operation and management of existing SWM services and infrastructures provided. The conference discussed that a solid waste management service fee should be introduced in order to have a sustainable system. The Thimphu Thromde informed that a draft proposal for solid waste collection fee has been prepared based on the cost of services & infrastructure provided in different areas like commercial, residential, institutions etc. However, the draft proposal will be implemented only upon approval by the Ministry of Finance. The conference highlighted that solid waste management service fee should be introduced in Thromdes and Dzongkhags in consultation with the waste producers (public), communities and its local authorities.

The conference pointed out that due to lack of facilities and services provided by the service providers, the public burn their wastes. The conference discussed that burning of wastes is not a good practices mainly because the government is promoting 3 Rs hence burning of waste defeats the purpose of segregation at source, sale of recyclables and most importantly, burning of plastic produces dioxins which cause cancer and respiratory diseases. Open burning of wastes has also been observed not only in the Thromdes but also in the Dzongkhags. Therefore, it was directed

that strict enforcement of Waste Prevention and Management Act and its Regulation must be done whereby it has been stipulated that open burning of wastes is prohibited.

In order to address the lack of information and baseline data on solid waste, it was discussed that there is a need have a solid waste information system in place in all Dzongkhags and Thromdes. The solid waste management information system should include but not be limited to the following:

- Documents on baseline data on solid waste in Dzongkhags and Thromdes – amount of waste generated, collected and disposed; amount of waste composted, sold to scrap etc.
- Amount of revenue generated and expenditure incurred from solid waste management service collection fee, O&M cost of SWM services and infrastructure.
- Need of Landfill management plan/system in Dzongkhags in place.
- Need of inventories on number of houses and properties for calculation of charges and fees on SWM

5.7 Solid Waste Management in Samdrup Jongkhar – Ms. Sonam Pelden, Environment Officer, Samdrup Jongkhar Thromde

The Samdrup Jongkhar Thromde presented that Samdrup Jongkhar generated about 2.5 to 3 tonnes of wastes per day. The type of wastes generated are domestic, construction, commercial, medical, industrial and e- wastes. These wastes generated are collected door to door by one dumper truck and two tractors. They also collect the common waste bins located within the Thromde. The wastes are collected on a daily basis in the core town area and twice a week from Deothang.

The Samdrup Jongkhar Thromde does not have any treatment facilities and hence all the wastes collected are dumped into the landfill which is actually an open dump in Deothang which is 3 kms from the main town.

The Thromde has implemented several solid waste management projects like the following:

- *Zero Waste Pilot Project*: This project is implemented by the Samdrup Jongkhar Initiative Project.
- *Two bin segregation system*: This project has been piloted in the NRDCCL colony which serves 56 households. Through this project, the collection of organic and inorganic wastes is done once a week.
- *Composting Plant*: The construction and installation of a compost plant amounting to Nu. 142,000/- was funded by Danida and UNDP. The organic wastes were collected from the NRDCCL colony and vegetable market was composted using the aerated pile method. However, due to the climatic condition causing hindrance in composting, the implementation of the compost project was not successful. In addition, the plant being located close to the border, miscreants from the border lifted away all the materials of commercial value.

The main issues faced by the Thromde presented were as follows:

- High volume of transit population with low level of awareness.
- Difficulty in convincing the public on the responsibility of waste management.
- Poor participation of the people.
- Insufficient man power in enforcement and implementation of acts and regulations on solid waste management.
- Space constraint for upcoming new services.

Discussions

Based on the pictures of the landfill presented, the conference noticed that the landfill contained mostly PET bottles. In this regard, the conference highlighted that there is a need to encourage segregation at source and installation of PET bailing plant whereby the operation of the plant could be either managed by the Thromde itself or could outsourced to the private sector.

The conference decided that the Compost plant projects needs to be revived. The MoWHS is to assist the Thromde if required.

The conference also decided that Samdrup Jongkhar Thromde should be the recyclable waste collection hub of the eastern Bhutan whereby all recyclable materials (plastic, bottle, tin, paper etc.) should be collected and transported from other Dzongkhags like Pema Gasthel, Trashigang, and Trashi Yangtshé etc. After establishment, private sector should be encouraged to take this business opportunity. The main aim of this project is to encourage segregation at source in the Eastern Dzongkhags of Bhutan.

5.8 Experiences and lessons learnt from Pilot Project of Integrated Solid Waste Management in Bajothang – Mr. Lobzang, Municipal Engineer, Wangdue Dzongkhag Administration

The project for piloting Integrated Solid Waste Management (ISWM) in Bajothang which is being funded by the Bhutan Trust Fund is being implemented by the Urban Development and Municipal Services, Wangdue Phodrang Dzongkhag Administration. The aim of the project is to improve the SWM system through separation of wastes at source by supporting storage infrastructures and enhancing recycling of organic wastes through composting.

The following includes the components of the project:

- Construction and installation of Solid Waste Management Infrastructures like the compost shed in Omlum, construction of PET bailing shed in Bajo. The management was able to outsource the management of the PET bailing plant to a private individual.
- Purchase of dumper truck, steel container/communal bins, mini pickup truck, two bins for dry and wet wastes which were distributed to the households.
- Design for waste collection routes with different collection days for wet and dry wastes.
- Capacity building program
- Awareness program

The Municipality informed that Daily waste generation is 4800 kgs (Veg/fruits <1%, paper, plastic, leather, metals >99%).

The Municipality also collects waste collection charges to the household based on the 6th Dzongkhag Tshogdu approval. The Dzongkhag Tshogdu had approved Nu 30 to be collected from each building unit and Nu. 200 from each commercial unit. Therefore, the Municipality collects Nu. 737, 510 per annum.

Outsourcing of collection system is to be experimented after the ISWM system in Bajothang is functional. Currently, the Municipality was able to outsource the management of following:

- Street sweeping: Contract includes waste collection/cleaning urban roads/drainages/sewer lines etc. A monthly contract payment Nu. 110,000.00 which are made from current deposit account are made to the private sector.
- Leasing PET bottle plant and transfer station made to private individual for which the monthly leasing charge is Nu. 6,000.00.

The Municipality informed that the following are the challenges faced by the administration:

- Difficult to change people's mindset
- Difficult to implement the 3Rs principle mainly because of the socio-economic development, literacy rate, shortage of resources etc.

The Municipality presented that the way forward was that the concept of 3Rs should be shared responsibility among the Ministries like MoEA, MoWHS & NEC. There is a need to encourage waste recycling programs and PPP modules for SWM. There should also be regular awareness campaigns conducted and capacity building programs for service providers. In addition, the Dzongkhag Environment Officers should take the lead role on SWM in the Dzongkhags.

Discussions

The Municipal Engineer had presented that for the 11th Five Year Plan, a capital of Nu. 4.50 million has been approved for the rehabilitation of Nahe Landfill and purchase of machineries. In this regard, the conference advised that the Wangdue Dzongkhag Administration to discuss and work together with PHPA I and PHAPA II as PHPA has about Nu. 2 million allocated for solid waste management. In addition, some funds have also been earmarked by PHPA to fund SWM facilities in Wangdue.

The conference questioned why biodegradable wastes in Bajothang composed of 1% while others were 99%. It was discussed that the biodegradable wastes from households and the vegetable market were either sold to the farmers or individuals owning farm animals for animal feed.

The conference discussed that each Dzongkhags had Environment officers but they were not involved in solid waste management. It was decided that the Dzongkhag Environment Officers

also need to actively take part in the management of solid waste management in Dzongkhags in collaboration with the Municipal Engineers.

There is a need to make it mandatory for all Dzongkhags and Thromdes to have an organic waste composting pit in each building. The participants learnt that is not necessary to have a big composting plant for such initiatives. Individuals may use innovative ideas of using old drums, hume pipes, boxes, old planks etc.

The conference discussed that there are issues related to some recyclable materials especially the bottles (like spy wine bottles) as they are disposed of into the land fill since they do not have a resale value. Therefore, it was decided that there is a need to initiate dialogue between the relevant stakeholders on ‘take back mechanism’ with the manufacturing companies for those products which have no re-sale value.

The participants raised concerns on hazardous waste management like medical and e-waste entering into the municipal waste stream which is then disposed of to the landfills thus making it unsafe for the service providers, the formal and informal waste collectors at site. The following was decided:

1. *Medical Waste:* The representative from the Ministry of Health (MoH) clarified that medical wastes entering the municipal waste stream should be collected by the Municipalities/Thromdes/Dzongkhags and handed over to the MoH for proper disposal. The conference directed that the Thromdes and Municipalities are to highlight the issue of medical waste to the Ministry of Health (MoH) and coordinate on the management strategy for medical waste management. It was decided that the MoH is to develop strategic plan for Medical Waste for municipalities and Thromdes.
2. *E-Waste:* The Department of Information and Technology, Ministry of Information and Communication (MoIC) informed that they are in the process of developing a Request for Proposal for outsourcing of e-waste management. The MoIC was directed to develop guidelines for e-waste management for Thromdes and Dzongkhags for effective implementation of e-Waste Management in Bhutan.

5.9 Lessons from PPP-ISWM Project Thimphu Thromde – Mr. Karma Rapten/Pema Dorji, UNDP

The Representative from UNDP presented that there is a need for Thromdes, Municipalities, and Dzongkhags to work together with the private sector. This would allow for the improvement in service quality/delivery; possible source of revenue; reduce the administration’s financial and Operation & Management burden; and will have cost recovery for waste collection services. It will also create investment opportunities for private sector. In addition, it would save costs to the administration and would reduce bureaucracy/procedures.

The public and private sector together will need to assume much more responsibility for waste generation and disposal, specifically product design and waste separation. Formalizing these responsibilities through well structured PPPs can result in significant improvements in efficiency

and quality to solid waste management. However, for effective improvement in efficiency and quality to SWM through PPP, the following must be considered:

- Identify the problem (collection system design, complaints, revenue, service standards etc.)
- Formulate and prioritize objectives (in which areas where the private sector can play a stronger role).
- Assess conditions and capacities (Legal provision, client, and private sector capacities to regulate and provide services etc.)
- Determining the most viable option of PPP model (as there is no “one size fits all PPP model.” They have to be designed for specific purpose and for specific municipality).

Thimphu Thromde had initiated the pilot waste segregation initiative under the PPP project funded by the UNDP. A survey was conducted for this project to analyze public’s perception and feedback on the existing situation, planned activities, willingness to pay, preferred waste management system and etc. It was analyzed that the collection services were provided in the mornings and most people (68.41%) felt that the existing collection services were adequate. 78.11% public do not segregate their wastes at homes but 79% were willing to segregate wastes at source and 86.68% were willing to pay for the collection services as well. About 76% were willing to pay Nu. 50.00 per month. Also, 66% of the household preferred door-to-door collection systems over block collection system which is the existing system.

The UNDP representative informed that Thromdes and Municipalities can work with the private sector in the collection and transport services. This would allow for improved service delivery and increased client satisfaction. To make PPPs successful, the government must consider the following:

- Institutional arrangement of management which includes the payment of service fee by service users and payments to private party by clients; and the type of services that must be provided for by the private sector to the service users (public).
- Responsibilities of client (the Thromdes/Municipalities/Dzongkhags) and private sector.
- Identification of revenue source or base.
- The type of PPP model to be adopted: For example; Leasing and management buyout or investment and franchising.

The presentation concluded that there is a need for pilot initiatives to be up-scaled - otherwise there is no end to pilot projects and this is a good time to demonstrate how PPPs can improve the collection, processing, and disposal of solid waste throughout the country. PPPs bring private sector investment for infrastructure and public services, innovative ideas as well as new technologies and managerial skills. A good PPP model on waste management will reduce burden on the municipality (in its scope of work). However, private sector engagement in waste management comes with risks, therefore it requires due diligence. It was also highlighted that there is a need for introduction of waste collection fees (allowed in waste regulations 2012) to allow for the provisions of sustainability for waste collection services.

Discussions

The UNDP representative emphasized on the need to do source segregation followed by separate collection of segregated wastes for transport, treatment and disposal. This would solve most of our solid waste management problems. It was presented that the most essential elements of waste segregation and the most critical components of the implementation of the 3 Rs concept are the commitment of the public; need for separate waste storage facilities; separate collection of wet and dry wastes; and requirement of segregated waste processing facilities.

It was decided that all the Thromdes and Municipal should give priority to segregation of waste at source by the citizens, provision of separate storage facilities (bins/communal bins), provision of separate collection vehicles for dry and wet wastes, and provision of segregated waste processing facilities.

Dzongkhags and Thromdes should adopt the PPP Model based on their own local conditions, needs and situation. There are opportunities for international organization like UNDP, BTF, Thimphu Rotary Club, WWF etc. to fund such programs. The Dzongkhags and Thromdes are urged take the responsibilities of developing innovative projects and efficiently managing and developing their solid waste management system which is sustainable with a well structured PPP model to result in significant improvement in efficiency and quality of solid waste management. However, there is a need to have standard legal instruments in place.

5.10 Landfill Management: Design and operational challenges and Initiatives undertaken – Mr. Phub Tshering, Environment Officer, Thimphu Thromde

The Thimphu Thromde presented on landfill management carried out at Memelhakha. The Memelhakha landfill site was built in 1994 as an open dumpsite and remained so until 2010. In 2010, with the financial support from ADB, the dumpsite was extended and proper infrastructures built.

The Environment Officer then informed on some of the current issues faced at the landfill such as leaking of leachate, broken fencing and waste overflow. Furthermore, it was stated that the waste had already reached the 4th bed of the landfill.

Following that, improvement works being carried out currently was also presented. A technology transfer project in collaboration with Japan Environment Sanitation Center (JESC) and funded by JICA has also started. Some of the immediate issues being addressed by the Thimphu Thromde were the prevention of landslides and overflow of waste.

With regard to the future plans of Thimphu Thromde for Memelhakha, some of the salient points were the extension of the area and the renovation of existing infrastructures. In addition, Thimphu Thromde was planning on building a semi-aerobic landfill which will be more advanced and sanitary with proper infrastructure and a more efficient system for collection of leachate. It was informed that as per the future plan, the treatment of waste would be carried out at site and Thimphu Thromde would do away with the current practice of transporting the leachate to the treatment plant in Babesa which was time both tedious and uneconomical.

Discussions

The representative from Paro Municipality shared that a few years back in Samtse town, due to the movement of the waste collecting vehicles inside the site, the piping layouts in the landfill were disturbed which caused problems in the collection of leachate. It was opined that the thickness of the pipes as well as its soil cover should be thoroughly discussed and studied prior to its implementation at Memelhakha.

The representative from Samdrup Jongkhar Dzongkhag questioned if concrete channels could be used more effectively in place of pipes.

The representative from Chukha Dzongkhag pointed out that there was no standard height of the bedding in the landfills. It was also questioned whether an existing drainage system would be able to cater to the increased volume of waste as the number of landfill beds kept on increasing.

The Thimphu Thromde clarified that the height of the bedding was generally between 3 and 5 meters. He also mentioned that in order to cater to the increase in the volume of waste, it is a practice in other countries to lay lateral collection pipes at each bedding. However, due to budget constraints, the pipes are only laid at the bottom at Memelhakha.

The Honorable Chair commended the observations/issues raised and advised that only good quality pipes like Druk Polythene be used at the site. Furthermore, it was instructed that Thimphu Thromde should take note of these issues and discuss before implementing any of the plans in the Memelhakha.

5.11 Sharing Waste Management experiences in Gelephu Thromde – Mr. Sangay Dorji, Gelephu Thromde

Gelephu Thromde has a population of 13, 615 in an area of 11.52 sq. km and consists of six Demkhongs. The amount of waste generated is approximately 4 metric tons per day. The Thromde Administration has two compactor trucks, one back-hoe machine, and one open truck. Door to door collection is being done daily (core town areas except on Sundays) and thrice a week in the Local Areas (I & II).

Gelephu Thromde has a controlled sanitary landfill which is located in Bhur (11 km from the core town towards Sarpang) and had been commissioned in 2008. The landfill has used HDPE (High Density Polyethylene) material as a base liner to limit the infiltration of leachate to the subsoil. The site also has two leachate ponds. The total landfill area is 12 acres with a design capacity of 3 metric tons per day. It was informed that a PET bottle crushing plant has been installed at site and the management has been outsourced to a private party.

Communal bins (green for bio-degradable wastes and blue for non-biodegradable wastes) with a capacity of 1100 liters have been placed in strategic locations like; Bus Parking, Taxi Parking, Vegetable Market, Avenue Park, Truck Parking and Public Ground. The wastes which cannot be

recycled are disposed of to the landfill which are then covered with soil and sand, and compacted as and when required (usually once a month).

The Thromde had also taken some initiatives like advocacy and sensitization programs to educate the public and create awareness along with the private sector. However, the Thromde faces issues and challenges whereby the ignorance and negligence of the community, lack of environmental ethics has resulted to littering and indiscriminate dumping of wastes. In addition to illegal dumping of solid waste, illegal dumping of construction waste was also a major issue faced by the Thromde. The lack of compactor machine at site was also highlighted.

Discussions

The Phuntsholing Thromde questioned on the effectiveness of the door to door waste collection. He shared that the door to door waste collection was also being practiced in Phuntsholing, however, this did not bring along much improvement with residents dumping waste indiscriminately in the Thromde. The Thromde was now planning on installing CCTV at strategic location to deter the residents.

The Honorable Chair responded that the level of compliance will depend on the promotion of public awareness/education and improvement of effective SWM service delivery. The Chair suggested the services provided could be improved to properly address the need of the community. He also advised the floor to not change the system abruptly because of a few things that are not working at the moment.

The conference deliberated that SWM systems and initiatives should not be stopped when it does not function/work in the first years of implementation. There is a need to improvise and use innovative ideas and technologies to revive the system.

The Municipal Engineer from Chukha Dzongkhag Administration questioned on the function of the Geo-Membrane sheet in landfills. In response, the Paro Municipal Engineer answered that the primary function of geo-membrane was to prevent the seepage of leachate into the ground which would otherwise pollute and contaminate the ground water and streams. He also added that in order to make it more effective, a layer of clay was used in conjunction with geo-membrane in Samtse Dzongkhag.

The conference discussed that there is a need for environmental inspectors in Dzongkhags and Thromdes to monitor the implementation of SWM which includes segregation at source, collection, and transportation of waste, treatment of wastes, littering, open burning etc. The Honorable Chair stated that everyone was expected to be an environment inspector; nonetheless he acknowledged that there was a strong need of environment inspectors in Thromdes and Dzongkhags for waste management.

5.12 Organic Waste Treatment Technologies in Thailand – Dr. Alice Sharp, Sirindhorn International Institute of Technology, Thammasat University

Dr. Alice presented on the organic waste treatment technologies used in Thailand and the difficulties and obstacles. The treatments technologies employed include composting, anaerobic

digestion, bio-digester, mechanical biological treatment and landfill gas recovery. She informed that different types of wastes were treated differently to produce different types of products in order to make the best use of the wastes. For instance, organic waste used to produce composts and biogas.

In Thailand, community based composting is being done whereby concrete bins were used for composting organic wastes. After the wastes are composted, the compost is then screened whereby the large particles are either shredded to finer particles or disposed to the landfill. The compost is then tested and used as fertilizers. Accordingly, Bhutan could use treatment technologies that best suits the amount of waste generated within the country like the community based composting whereby they use small concrete bins or boxes made of unusable wooden planks or metal drums with holes drilled through it etc. Similar technologies could be used at a smaller scale that would suit household composting in household's home or backyard.

Discussions

The Hon'ble Chair commended Dr. Alice on the presentation and informed the floor that it was good information for all. However, he cautioned that not all of the technologies were suitable for adoption in Bhutan. Nonetheless, some of the simple technologies like community based composting and household composting could be promoted in Bhutan.

5.13 Opportunities and challenges in waste recycling – Mr. Karma Yonten, Greener Way

Mr. Karma presented Greener Way as the first and only licensed waste management company in Bhutan. He then listed and elaborated on the challenges the company faces presently for instance waste awareness, occupation and health safety, financial constraints, bureaucratic red tape etc. He informed that Greener Way had visited 72 schools creating awareness on waste management. Regarding hospital waste, being hazardous by nature, he said it needed special attention as these wastes are dumped in the same landfill site where people work. He also highlighted the need to provide adequate and appropriate facilities for waste management.

Mr. Karma mentioned that one serious issue in waste management in Bhutan was the lack of adequate and reliable data on solid waste, its volume etc. He also put forward a request to the government to reduce the bureaucratic red tape in order to encourage entrepreneurship in waste management. It was also informed that there are a lot of informal waste collectors working in the waste sectors who were exposed to risks and hazards of wastes. Collection of recyclable wastes from households and the landfill were the only form of income for the informal sector. Thus, there is a need to recognize the informal waste sector.

Following the issues on waste management, he briefly outlined the future plans of Greener Way. He informed that the company had a budget of Nu. 49 Million to build a material recovery facility at Ngabirongchu with proper facilities for waste management. It was informed that Greener Way is the raw material supplier for waste papers to YDF's egg tray project. Furthermore, he shared that two children's books will be launched to educate children on waste management on 7th November, 2014.

Discussions

Representative from the Samdrup Jongkhar Initiative and the Bhutan Rotary Club asked the presenter if he had any recommendation on technologies that the SJI could adopt considering all the funding constraints and ground difficulties with the waste segregation in Bhutan. It was opined that the solution was quite simple: raising awareness and starting slow. He said that wastes can be recycled with various technologies which are simple and cost effective.

The Honorable Chair commended Mr. Karma Yonten and Greener Way for their work on waste management. The Chair also stated that MoWHS will fund Greener Way to make a presentation in South East Asia Regional Meeting.

5.14 Solid Waste Management in Hydropower Project Sites: Segregation of waste in PHPAI & PHPAII – Mr. Sangay Dorji, Dy. Chief Environment Officer, PHPA II

PHPA started the presented with the three main drivers for waste management in PHPA I and II which are a) Bilateral Agreement between India and Bhutan focusing on the construction of the mega project with minimum environmental damage, b) Compliance to the terms and conditions of the Environmental Clearance and c) Prevention of Unmanaged waste which will become a liability to Bhutan and the Bhutanese.

PHPA presented that the different types of waste generated at PHPA are wastes from construction, domestic and offices. PHPA I and II generates about 28 tons of waste per months. PHPA I & II has waste segregation units in all contract packages. In PHPA I, four personnel are designated to work at the collection centre and in PHPA II required manpower is provided by the contractors to ensure that wastes are segregated. With regard to management of wastes, the following are being implemented:

- *Construction wastes management:* Muck is being disposed in designated sites; packaging materials are being reused and used oil is being sold by the contractors; and segregated recyclable wastes (like Metals and Glasses/ Plastics & Rubber/ Wood, Textile, Cardboard and Paper/ PET and PVC) are stored in segregation units which are then transported to vendors in Thimphu when scrap vendors from Wangdue do not collect them. Cement bags are being returned to cement factories or recycled by vendors.
- *Domestic and office wastes management:* Segregated biodegradable wastes are collected and buried in pits close to the camp sites and food wastes are given to farmers for animal feed. The non biodegradable wastes which do not have resale value are being dumped into the Nahe Landfill in Wangdue Phodrang.

The PHPA has also been conducting outreach programs on waste management which includes waste collection from villages and disposal to Punakha Landfill; distribution of bins to schools, institutions and villages, clean up campaigns, development of recreational area in Bajo Green Zones etc.

Discussion

It was discussed that PHPA is one of the few large project where segregation of waste has been implemented. Thus, other Dzongkhags with large projects could take such waste management with emphasis on source segregation initiatives in future. Hon'ble Secretary appreciated the PHPAs initiatives on outreach programs and in addition, it was emphasized that such initiatives like cleaning campaigns are a good medium for creating awareness on SWM.

The MoWHS acknowledged Bhutan Trust Fund (BTF), UNDP, YDF, RSPN, WWF, Greener Way, Clean Bhutan for their support in solid waste management. In this regard, the BTF informed that BTF funds projects from the brown sector and hence recommended the floor to submit good proposals on solid waste management. The Conference encouraged the Dzongkhags and Thromde to prepare good proposals on sustainable solid waste management and request for funds from agencies like Bhutan Trust Fund, UNDP, WHO, RSPN, NGOs, etc.

The Dy. Chief Environment Officer pointed out that clarifications on the eligibility of scrap dealers to collect waste from project sites need to be spelt out by the regulatory authorities in the interest of safeguarding the sanctity of the licensed waste dealers in Bhutan and to ensure that the waste dealers lift all recyclable waste instead of just those with high resale value. He further pointed out that this was discussed with the Scrap Dealers Association during their conference but there was no response from the association.

5.15 Initiatives on Waste Management (3Rs) in Schools – Madam Chuki, Jigme Losel Primary School

Jigme Losel Primary School (JLPS) began with Campus beautification in year 2007 when waste was not a major issue. And later in 2008-2011, waste management was given more emphasis. The School emphasized on packed lunch, green day and WASH program and these programs discouraged junk food, use of plastic and money. The school students and teachers visited Memelhakha landfill which made them aware of waste management issues and its importance. The School believes in “learn, value and practice” and following in year 2012, the school started the implementation of 6Rs – Refuse, Recycle, Reduce, Replace, Reuse and Re-educate. The activities implemented were as follows:

- Using old buckets, tires as flower pots
- Making teaching materials out of wastes
- Showcasing innovative products made from waste in fairs held in the Thimphu Clock Tower
- Making water taps from used cooking oil containers/jerry cans
- Cleaning campaigns
- Adoption of Wang Chhu
- Conducting Waste Management awareness in school which is then transferred to children's parents as the school believes that “Change beings at home.”
- Development of a “Creativity Room” within the school campus.
- Implementing the “My Tree Project”

- Implementing “Race against Waste, 2013” where the JLPS won a cash price of Nu. 93,731/- where 15608 kg of waste was collected (19kg per child).
- Implementing the “Class Waste Bank Account 2014”

The Class Waste Bank Account is a project that was initiated in 2014. In this project, individual child sells their recyclable wastes which have been collected from littered areas or from their homes. These wastes are added to the total amount of waste collected from the class. The total amount of wastes deposited are recorded and displayed on the board. The individual and the class with the highest amount of recyclable waste collected are then recognized. The recyclable waste collected are then sold to the Waste Firms. Through this project, the school has also been able to generate some income and with this money, the school had purchased equipments like smart TV, 22 water filters, grass cutting machine, 1 water tank, and pipes. In addition, the school celebrates by providing *shamdays* to the students and teachers twice a year.

Through all the waste projects initiated by JLPS, the children was able to establish a sense of ownership for the environment making them responsible towards their school, community and the nation as a whole thus inculcating civic sense. The Piggy bank account also taught the students about money management. However, the school faced challenges while implementing these projects like space for waste bank and time management. There is the issue of transportation of wastes for the school as well as children. Children who walk to school had to carry huge sacks of waste to school. In addition, collecting waste by children would cause to be unhealthy as children may not wash their hands properly after handling wastes. Above all, the most challenging issue faced by the school was changing the individual state of mind and attitude towards garbage.

Discussions

Hon’ble Chair applauded and greatly appreciated Madam Chuki’s passion for the management of her school children and solid waste management. MoWHS agreed to arrange all the logistic and travel expenses if the Principal and senior teacher from JLPS wishes to make such presentation to various schools in different Dzongkhags. MoWHS will officially offer the proposal to the School Management.

5.16 Zero Waste Program – Mr. Tshewang Dorji, Samdrup Jongkhar Initiative

The Executive Director of Samdrup Jongkhar Initiative (SJI) informed that wastes has no boundaries and that waste travels faster than roads and electricity as there are wastes everywhere. This was to highlight that every individual produces wastes and hence must be managed. SJI has two pilot projects in Dewathang and Wooling village. Their values are to design and manage materials and processes to reduce the volume and toxicity of waste materials; conserve and recover all resources from wastes and refrain from burning and dumping of materials. SJI emphasized that these are not new concepts as the Bhutanese had already been practicing it in the past but there is a need to revive the habits of reuse and recovery.

In order to help change current waste management, SJI’s pilot project emphasized on the following:

- Creating awareness on segregation at source whereby different containers for disposal of different wastes have been placed so that segregation is followed.
- Thinking strategically whereby waste containers are placed in areas where everyone can see thus taking care of littering.
- Instituting non-packaged Tshog and waste free school lunch options.
- Initiating reusable bag.
- Bring awareness and capacity development to the local partners/community who implements the project.
- Conduct creative capacity development and education trainings to youth and adult.

SJI focused their awareness through economic diversification where waste reduction and thoughtful consumerism was made to look trendy. He informed that it was important to have the income generation attached to zero waste program. SJI provided training for preparing waste materials for reuse like the plastic wrapper weavings marketed with a tutorial for cutting wrappers into strings, woven plastic bottle bag (with tutorial), and mattress filled with shredded plastic wrappers.

In Dewathang and Wooling, villagers carry their own bags for shopping and use their own cups and plates avoiding plastic bags, plastic cups, and plates. These actions were taken to reduce the pressure on the landfill.

Discussion

The conference discussed that there is a need to promote the use of homemade Tshos and avoid packaged Tshos. The Ministry is to disseminate information on the positive benefits of offering homemade Tshos to the public and monastic bodies via letter, print and broad cast media.

Most of the participant in the Conference suggested that we promote homemade Tshos to Lhakhangs and avoid packaged Tshos in order to reduce waste. And the Conference decided to create awareness on the use of homemade Tsho through BBS and other media to the public.

5.17 Clean Bhutan Program – Mr. Nidup Tshering, Clean Bhutan

Clean Bhutan Program is dedicated to the 60th Birth Anniversary of the Fourth Druk Gyalpo. Clean Bhutan focuses on advocating behavioral change towards zero waste to be a responsible citizen and keep towns, villages, trek routes, trails, and rivers waste free. The major activities of Clean Bhutan are as follows:

- Organize clean up campaigns but not to continue
- Stakeholders meetings with relevant communities
- Educate school children e.g. Google volunteer team coming soon
- Establish waste management system e.g. Taktshang trail completed
- Study areas to make observations and submit to relevant agencies
- Using social media – facebook/twitter/website/ linkedin

It was informed that waste management is not implemented properly because everyone is playing a blame game. There is a need to understand the type of waste generated identify the issues and consult with people who are affected on management strategies. For example: Community from different background has different needs e.g. working family wants different solutions to manage their waste, devotees need to be told what is waste and how they generate, school children need to be guided by teachers and parents etc.

Clean Bhutan informed that according to the survey on peoples' opinion in the town area, 1200 correspondents opined that there was no place to throw the waste and the timing of compactor truck is not ideal for more than 70% of the Thimphu communities. With regard to waste management, it was informed that there is no single magic wand to solve different levels of problem. There is a need to think beyond banning or fining as these are short term measures. It was emphasized that there is a need to listen to communities and work with them. He also stressed that Bhutanese society should avoid being a consumerism society.

Discussions

The participants raised concerns for the cleanliness of trek routes. Trek routes should be kept clean in order to keep tourism alive in Bhutan since it is the second highest income generator of the nation. Tourism Council of Bhutan should liaise with the Municipalities and Dzongkhags.

Some of the participants of the conference felt that cleaning campaigns was not a successful and sustainable solution to waste management. However, it was discussed that that cleaning campaigns should not be done away with as it has always been a good awareness initiative. It has also been successful in inculcating values on importance of cleaning and waste management. Therefore, it was decided that cleaning campaigns should be continued as one of the medium of promoting awareness on SWM but it must not be the main strategy for waste management.

It was discussed that banning as a strategy for waste management is not a solution as the long term goals of integrated solid waste management cannot be achieved. Hence, banning should not be promoted. It was discussed that the NEC should be involved in the framing of policies and R&Rs on Solid Waste Management while MoWHS is to develop guidelines for implementation of SWM.

It was also emphasized that there is a need for strict enforcement on the Solid Waste Management policies, plans, rules & regulations etc.

In addition to solid waste management, the conference expressed the concern of increasing stray dog population in the country. There have been many incidences where scavenging by dogs caused scattering of wastes. It was discussed that there is a need to recognize that stray dog is an issue and the population must be controlled. Hon'ble Chair acknowledged the initiatives taken by the Ministry of Agriculture (MoA) and Forest and Ministry of Health (MoH) in controlling stray dogs through sterilization. In this regard, Hon'ble Chair highlighted that other central agencies and public must also work together with the MoA and MoH to help dog sterilization programs to reduce the stray dog population.

6 Closing Remarks

Hon'ble Chair thanked the presenters for their commendable and very informative presentations. The conference provided the participants a very interactive platform to discuss on SWM issues and enriching answers and innovative ideas to address the challenges of implementing Sustainable Solid Waste Management in our country. He also thanked and expressed his deep appreciation to UNDP for funding the conference and their continued effort in assisting in SWM. A conference becomes a success only with active participation from participants. Thus, he expressed his sincere thanks to all participants and presenters who travelled from different Dzongkhags to attend the conference.

The Hon'ble Secretary said that he thoroughly enjoyed being the Chair person for the two day conference. He said that it is hoped that the participants take the knowledge from this conference on Sustainable Solid Waste Management and implement them in their Dzongkhags and Thromdes.

Annexure 1: Conference Agenda

“National Conference on Sustainable Waste Management”

October 27-28, 2014

Taj Tashii

Thimphu, Bhutan

PROGRAMME – DAY 1: “OVERVIEW”			
Time			
0830 - 0900	Registration and arrival of Guests		
0900	Arrival of Chief Guest		
0900 - 0905	Marchang Ceremony		
0905 - 0920	Welcome Speech	Chief Engineer, WSD	
0920 - 0925	Opening Remarks	Chief Guest	
0925 - 0935	Vote of Thanks	Director, Department of Engineering Services	
0935 - 0945	Group Photo with Chief Guest		
0945 - 1000	COFFEE BREAK		
Chairperson: Hon'ble Secretary, MoWHS			
1000-1005	Outline and objectives of the Conference	Dy Chief Environment Officer, PPD, MoWHS	Rapporteurs
1005 – 1015 1015 - 1025	Policy on Solid Waste Management - National Integrated Solid Waste Management Strategy - Waste Prevention & Management Act (2009) and Waste Prevention & Management Regulations (2012)	Sr. Legal Officer, NEC	Tshering Choden, WSD & Dechen Yangden, WSD
1025 - 1040	Question and Answer Session		
1040 – 1100	Sustainable Waste Management - Introduction to Integrated Solid Waste Management - 3 Rs Concept	Hon'ble Secretary, MoWHS	
1100 - 1115	Question and Answer Session		
1115– 1125	Solid Waste Management - Current practices, issues and future challenges	Municipal Engineer, Monggar Dzongkhag	
1125 - 1140	Question and Answer Session		
1140 – 1150	Solid Waste Management - Current practices, issues and future challenges	Municipal Engineer, Gasar Dzongkhag	
1150 - 1205	Question and Answer Session		

“National Conference on Sustainable Waste Management”

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Taj Tashi

Thimphu, Bhutan

Cont. PROGRAMME – DAY 1: “OVERVIEW”			
1205 – 1220	Solid Waste Management - Current practices, issues and future challenges - ISWM Pilot Project: Experiences and lessons learnt - Recyclable Waste Collection Centre	Solid Waste Section, Thimphu Thromde	Jigme Phuntsho WSD
1220 - 1235	Question and Answer Session		
1235 – 1245	Solid Waste Management - Current practices, issues and future challenges	Samdrup Jongkhar Thromde	& Sonam Desel,PPD MoWHS
1245 - 1300	Question and Answer Session		
1300 - 1400	LUNCH BREAK		
Chairperson: Hon'ble Secretary, MoWHS			
1400 – 1410	Experiences and lessons learnt from Pilot Project of ISWM in Bajothang	Municipal Engineer, Wangduephodrang	
1410 - 1425	Question and Answer Session		
1425 – 1435	Sharing experiences on PPP – ISWM project – A perspective from a development partner	UNDP	
1435 - 1450	Question and Answer Session		
14.50 - 1510	COFFEE BREAK		
1510 - 1700	Site Visit to Memeylhakha Landfill	Thimphu Thromde	
	Site Visit to Serbithang Compost Plant	Thimphu Thromde	
	Site Visit to Greener Way collection centre	Thimphu Thromde	

“National Conference on Sustainable Waste Management”

October 27-28, 2014

Taj Tashi

Thimphu, Bhutan

PROGRAMME – DAY 2: “EXISTING WASTE MANAGEMENT INITIATIVES”			Rapporteurs
Chairperson: Hon'ble Secretary, MoWHS			
0900 – 0915 0915 - 0930	Landfill management - Design and operational challenges, Initiatives Question and Answer Session	Solid Waste Section, Thimphu Thromde	Sonam Yangdhen, EARRD & Dechen Dema, ESD
0930 -0940 0940 -0955	Sharing waste management experiences in Gelephu Thromde - Landfill management Question and Answer Session	Gelephu Thromde	
0955 -1010 1010 -1025	Organic Waste Treatment Technologies in Thailand - Sharing experiences on Composting Question and Answer Session	Sirindhorn International Institute of Technology, Thammasat University, Thailand	
1025 - 1040	COFFEE BREAK		
1040 – 1050 1050 - 1110	Opportunities and challenges in waste recycling - A perspective from a private company Question and Answer Session	Greener Way	
1110 – 1120 1120 - 1135	Solid Waste Management in Hydropower Project Sites - Segregation of waste in PHPA I & PHPAII Question and Answer Session	Sangay Dorji, Senior Environment Officer, PHPA II	Chhoki Gyeltshen, RISD & Kuenzang Choden, FEMD
1135 – 1145 1145 - 1200	Initiatives on Waste Management - 3Rs Question and Answer Session	Principal, Jigme Losel Primary School	
1200 – 1215 1215 - 1230	Zero Waste Program, Samdrup Jongkhar Initiative Question and Answer Session	Executive Director, Samdrup Jongkhar Initiative	
1230 – 1245 1245 - 1300	Clean Bhutan Question and Answer Session	Clean Bhutan	
1300 - 1400	LUNCH BREAK		
Chairperson: Dasho Secretary, MoWHS			
1400 - 1645	Closing Session - Recapitulation of the conference - Way forward: Resolutions - Finalization of Resolution/Resolutions		All rapporteurs
1645 - 1700	Closing Remarks		

Note: The presentations have been included in the pen drive which was distributed to all the participants

Annexure 2: List of Rapporteurs


1. Ms. Sonam Desel, Dy. Chief Environment Officer, PPD, MoWHS (**Chief Rapporteur**)
2. Ms. Dechen Yangden, Chief WSD, MoWHS
3. Ms. Tshering Choden, Dy.EE, WSD, MoWHS
4. Mr. Jigme Phuntsho, WSD, MoWHS
5. Mr. Sonam Yangdhen, Dy. EE, EARRD, MoWHS
6. Ms. Dechen Dema, Engineer, ESD, MoWHS
7. Mr. Choki Gyeltshen, AE, RISD, MoWHS
8. Ms. Kuenzang Choden, Engineer, FEMD, MoWHS

Annexure 3: List of Participants

1	Dasho (Dr.) Sonam Tenzin	Hon'ble Secretary, MoWHS
2	Dasho Kinley Dorji	Thrompoen, Thimphu Thromde
3	Minjur Dorji	Executive Secretary, Thimphu Thromde
4	Phub Rinzin	Department of Engineering Services, MoWHS
5	Dechen Yangden	Chief, Water and Sanitation Division, DES, MoWHS
6	Sonam Desel	Dy. Chief Environment Officer, PPD, MoWHS
7	Rinzin Jamtsho	Executive Engineer, Water and Sanitation Division, DES, MoWHS
8	Tshering Choden	Executive Engineer, Water and Sanitation Division, DES, MoWHS
9	Gem Tshering	Engineer, WSD, DES, MoWHS
10	Dechen Dema	Engineer, DES, MoWHS
11	Dago Zangmo	Department of Engineering Services, MoWHS
12	Sonam Yangdhen	Dy. Executive Engineer, DES, MoWHS
13	Tenzin Jamtsho	Dy. Executive Engineer, WSD, DES MoWHS
14	Phuntsho Wangdi	Water and Sanitation Division, DES, MoWHS
15	Sherab Wangdi	CEO, NWAB
16	Damchen Zangmo	ICT Officer, MoIC
17	Dorji Rabten	Engineer, Ministry of Health
18	Sonam Lhaden Khandu	Sr. Environment Officer, NEC
19	Tenzin Khorlo	Chief Environment Officer, Environment Services Division, NEC
20	Wangdi Phuntsho	Assistant Environment Officer, National Environment Commission
21	Lalit Gurung	SPBD, Ministry of Education
22	Karma Rabten	PM, UNDP
23	Kinga Wangdi	P.O RSPN
24	Pema Dorji	UNDP
25	Dorji	Bhutan Trust Fund
26	Nedup Tshering	Executive Director, CLEAN BHUTAN
27	Dr. Alice Sharp	Sirindhorn International Institute of Technology, Thammasat University, Thailand
28	Dr. Sandhya Babel	Sirindhorn International Institute of Technology, Thammasat University, Thailand
29	Tshewang Dendup	Executive Director, Samdrup Jongkhar Initiative, Dewathang
30	Ugyen Dorji	Druk Waste Collection
31	Rajni	Royal University of Bhutan
32	Choki Dukpa	Principal, Jigme Losel Primary School, Thimphu
33	Taylor Stevenson	Rotary Club, SJI
34	Kencho Wangdi	CR, SNV

35	Nirmala Pokhrel	Reporter, Kuensel
36	Pema Lhaden	Reporter, BBS
37	Karma Yonten	Greener Way
38	Subash Sharma	Greener Way
39	Tek Bdr. Gurung	Municipal Engineer, Tsirang
40	Damcho Zangmo	Municipal Engineer, Pema Gatshel
41	Tshering Dendup	Dzongkhag Architect, Bumthang
42	Lobzang	Executive Engineer, Wangdue Dzongkhag Administration
43	Sonam Tobgay	Municipal Engineer, Dagana
44	Sangay Dorji	Principal Engineer, Gelephu Thromde
45	Pema Chokey	Municipal Engineer, Trashigang
46	Jigme Tshewang	Municipal Engineer
47	Penjor Dukpa	Offtg. Dzongkhag Engineer, Gasa
48	Tenzin Wangdi	Engineer, Thimphu Dzongkhag Administration
49	Dawa Lhamo	Municipal Engineer, Trongsa
50	Yeshi Wangdi	Dy. Executive Engineer, Thimphu Thromde
51	Choki Gyeltshen	Assistant Engineer
52	Ugyen Phuntsho	Engineer
53	Gyem Dorji	Dy. Executive Engineer, Sarpang
54	Sangay Tenzin	Municipal Engineer, Lhuntshe
55	Sangay Tenzin	Municipal Engineer, Paro
56	Tshering Dendup	Municipal Engineer, Zhemgang
57	Sangay Lhamo	Assistant Engineer, Wangdue
58	Kiba Wangchuk	Engineer, Mongar
59	Aiman Limboo	Municipal Engineer, Punakha
60	Pelden Norgay	Dzongkhag Engineer, Samdrup Jongkhar
61	Sonam Jamtsho	Municipal Engineer, Chukha
62	Kinga Dorji	Engineer, Phuntsholing Thromde
63	Sangay Tenzin	Municipal Engineer, Paro
64	Choki Wangmo	Dzongkhag Environment Officer, Chukha
65	Chhimi Wangchuk	Dzongkhag Environment Officer, Pemagatshel
66	Sachin Limbu	Dzongkhag Environment Officer, Lhuntse
67	Rinchen Penjor	Dzongkhag Environment Officer, Punakha
68	Sangay Dorji	Dy. Chief Environment Officer, PHPA II
69	Yeshey Choden	Jr. Environment Officer, PHPA II
70	Ngawang	Offtg. Dzongkhag Environment Officer/CDAO, Trashiyangtshel
71	Sangay Khandu	Dzongkhag Environment Officer, Haa
72	Tenzin Choda	Dzongkhag Environment Officer, Sarpang
73	Sonam Peldon	Environment Officer, Samdrup Jongkhar Thromde

74	Tshering Dekar	Dzongkhag Environment Officer, Mongar
75	Tshering Yangzom	Dzongkhag Environment Officer, Trongsa
76	Tandin Dorji	Dzongkhag Environment Officer, Dagana
77	Sonam Gyelpo	Dzongkhag Environment Officer, Samdrup Jongkhar
78	Langa Dorji	Dzongkhag Environment Officer, Tsirang
79	Jigme Choki	Dzongkhag Environment Officer, Bumthang
80	Tempa Zangmo	Dzongkhag Environment Officer, Thimphu
81	Chimmi Wangchuk	Dzongkhag Environment Officer, Pema Gatshel
82	Dorji Khando	Dzongkhag Environment Officer, Trashigang
83	Dorji Wangchuk	Dzongkhag Environment Officer, Gasa
84	Tashi Dendup	Dzongkhag Environment Officer, Zhemgang
85	Tshering Penjor	Offing Chief Environment Officer, Thimphu Thromde
86	Phub Tshering	Environment Officer, Thimphu Thromde
87	Karchen Dorji	Environment Officer



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