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Policy issues: state of the environment

Chemicals management, including mercury

Addendum

Waste management

Summary

The present report is being submitted to the Council/Forum at its twenty-fifth session pursuant to paragraphs 3 and 4 of decision SS.X/1 of 22 February 2008, with a view to facilitating the consideration by the Council/Forum of the significant programme-related matters raised in the report of the Executive Director on waste management submitted to the Council/Forum at its tenth special session. The present report constitutes a full report on the implementation of decision 24/5 of 9 February 2007 on waste management, as requested by decision SS.X/1.

* UNEP/GC.25/1.

Waste management

I. Draft decision

1. The Governing Council may wish to consider adopting a decision along the following lines:

The Governing Council,

Recalling its decisions 24/5 of 9 February 2007 and SS.X/1 of 22 February 2008 on waste management,

Recalling also the United Nations Environment Programme medium-term strategy for 2010–2013, as welcomed by decision SS.X/3 (Medium-term Strategy for the period 2010–2013) of 22 February 2008,

Takes note of the report by the Executive Director summarizing the activities undertaken by the United Nations Environment Programme in the context of the implementation of decision SS.X/1.

II. Review of the work

A. Introduction

2. The rapid increase in the volume and types of solid waste and hazardous waste generated, mainly owing to economic growth, urbanization, industrialization and the lack of both physical and institutional infrastructures, represents a growing problem for both national and local Governments and also for municipal authorities in their endeavours to ensure the effective and sustainable management of waste. Notwithstanding the considerable efforts by many Governments, international and national organizations and agencies in tackling waste-related problems, looking at both the minimization of waste at its pre-generation stage and at the treatment of waste at its post-generation stage, international reports indicate that major gaps to be filled remain in this area.

3. In line with the Plan of Implementation of the World Summit for Sustainable Development, the 10-Year Framework of Programmes on Sustainable Consumption and Production (the Marrakech Process), the International Panel for Sustainable Resource Management and requests made to the Governing Council/Global Ministerial Environment Forum at its special session in Jeju, Republic of Korea, the United Nations Environment Programme (UNEP), in conjunction with partners, intends to step up and enhance its activities in the field of waste management. It will focus on specific delivery at the national and local levels, on the scientific understanding of synergies between resource augmentation and waste management to decouple waste generation and environmental impacts from economic growth, on the promotion of tools such as waste prevention, the “3R” (reduce, reuse and recycle) initiative and cleaner production at the international level. In support of the Bali Strategic Plan for Technology Support and Capacity-building, UNEP activities will focus on capacity-building and provide support for technology identification, assessment and implementation at the national and local levels.

4. The present report, prepared through consultation with relevant organizations, aims to identify the needs and gaps in the field of waste management, including hazardous waste. A draft copy was circulated and feedback and other information were sought, including through personal interaction wherever possible. In developing the report, the secretariat of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, which is considered to be a significant global framework for hazardous and other wastes, provided inputs on its activities. An assessment has been made of the activities and programmes undertaken by various international organizations to identify areas that require further work and strengthening to assist countries in improving their waste management systems. The report will also help UNEP to forge synergies with Governments, international and national agencies and organizations.

5. This analysis does not include national bilateral developing agencies, nor is it concerned with the activities of non-governmental organizations. The information provided generally refers to the situations in developing countries and may not apply to developed countries. Since special management systems for nuclear wastes, space wastes and wastes linked to chemical weapons have been set up and are strictly controlled by Governments, these types of waste also fall outside the purview of this analysis.

B. Waste

6. There are a number of waste categories according to various definitions and criteria.¹ For the purpose of the present report, hazardous and other wastes are broadly classified as follows:

- (a) Municipal waste from households and commercial centres. This consists of both non-hazardous waste such as organic waste, textile and paper, and hazardous wastes such as batteries, paint containers and oil mixtures;
- (b) Industrial waste from processes or manufacturing and services. This consists of non-hazardous waste such as organic waste, textile and paper, in addition to hazardous waste and sludge from wastewater treatment plants;
- (c) Historical hazardous waste, of which production has ceased, such as polychlorinated biphenyls, polychlorinated terphenyls, polybrominated biphenyls and ozone-depleting-substance waste;
- (d) End-of-life equipment, discarded products and appliances, such as electronics and electrical appliances (and their peripherals and spares) and motor vehicles, which constitute the emerging waste streams of e-waste and end-of-life vehicles (normally considered separately). Some of these discarded products and appliances may end up in municipal waste;
- (e) Health-care and laboratory waste from laboratories, hospitals and clinics, medical and nursing facilities and offices;
- (f) Construction and demolition waste from construction activities or renovation of buildings; and post-disaster wastes;
- (g) Agricultural waste, crop residues, manure and chemical wastes such as pesticides, including persistent organic pollutants, polychlorinated biphenyls and ozone-depleting substances;
- (h) Marine-related wastes, such as marine litter, products dumped at sea, land-based wastes discarded in the marine environment, waste from dismantled ships and ship recycling.

7. In many developing countries, owing to lack of awareness, capacity and poor segregation of domestic and municipal wastes, hazardous wastes are often mixed with domestic and municipal wastes and disposed together in an uncontrolled manner. These unsound practices, among others, contaminate underground water and pose health risks to disposal site operators. Realizing the importance of this problem, the Basel Convention recognized the need to consider the concept of integrated waste management when tackling the issue of environmentally sound management of hazardous and other waste, in particular for small island developing States and least developed countries.

C. Impacts of waste

8. The increased amount of wastes and the concomitant rise in the hazards that it poses are severely affecting global and local environments, natural resources, public health and local economies and living conditions, and in this way hampering the attainment of relevant Millennium Development Goals. Various diseases, including cancers, result from exposure to hazardous emissions, mainly from open burning and substandard incineration of wastes. Communities living near dumps are suffering from the associated littering, odour, insects and vermin. Human scavengers incur even greater health risks.

9. Wastes accumulated over decades and leachate from unmanaged landfills and wastes dumps have contaminated groundwater and soil worldwide. Waste dumping into rivers, lakes and seas has caused damage that threatens the agriculture, water supplies and livelihoods that depend on these aquatic systems. Wastes choke sewage and irrigation systems, leading in turn to damage to infrastructure and the local economy.

10. Substandard landfills and waste dumps emit methane, among other gases, which is a major greenhouse gas of concern for climate change. Promoting modern waste management in countries can contribute significantly to greenhouse gas reductions at the global level. Similarly, construction and building waste also represents a lost opportunity for reducing greenhouse gas emissions, as the reuse or recycling of some components, such as steel, aluminium and concrete, is more energy-efficient than

¹ In most of the categories, there are waste types that affect distinct media (air, water and soil). At the present stage, the strategy focuses on solid waste and hazardous waste. Specific waste streams – such as nuclear waste, mining waste, munitions waste, space waste and litter – lie outside the scope of the present paper.

using virgin materials. Being highly inflammable, methane has also been the cause of repeated accidents involving fires, explosions and collapses at landfills and dumps. For example, more than 200 people died and hundreds were injured when Payatas dumpsite in the Philippines collapsed in 2000.²

11. For many components of the waste streams (such as plastics, metals and glass), and for some waste streams themselves (such as e-waste), environmental impacts are not only caused by the waste treatment and disposal processes themselves, but also derive indirectly from the loss of potential resources from the economy loop. This means that these resources have to be produced again from virgin materials (often non-renewable), thus not only depleting the valuable stock of natural resources but also perpetuating the vicious cycle of environmental degradation and resource depletion. The resulting ever-increasing demand for resources makes waste management a global issue.

D. Waste by volume

12. It is estimated that the total amount of municipal solid waste generated worldwide reached 1.84 billion tons in 2004, a 7 per cent increase on the 2003 total (*Global Waste Management Market Report 2004*).³ It is further estimated that, between 2004 and 2008, worldwide generation of municipal waste will rise by 31.1 per cent, representing an annual rate of increase of some 7 per cent.

13. Analysts at the Basel Convention estimated that some 318 and 338 million tons of hazardous and other waste were generated for 2000 and 2001 respectively,⁴ based on incomplete reports provided by Parties to the Convention. Health-care waste is classified as a subcategory of hazardous wastes in many countries. The World Health Organization (WHO) estimates that, in most low-income countries, total health-care waste per person per year ranges between 0.5 kg and 3 kg.⁵

14. The amount of industrial wastes generated worldwide is difficult to assess. Estimates are available for Australia, Brazil, Canada, China, European Union, Japan, Mexico, Thailand, Republic of Korea and United States of America. The volume of non-hazardous industrial waste in those countries ranges from 1.1 to 1.8 billion tons.⁶ No recent and reliable data are available for the Russian Federation, while estimates for China range from 315 million tons to 1 billion tons. The United States Environmental Protection Agency estimates that industrial facilities in that country generate and dispose of approximately 7.6 billion tons of non-hazardous industrial solid waste each year.⁷ This clearly shows a large gap when estimating the amount of world industrial waste.

15. The term “special waste” refers to waste streams that present particular problems and need specific policies and regulation for their management. These include hazardous wastes, e-wastes⁸ and end-of-life motor vehicles, to name but a few. The amount of hazardous waste in selected countries (Canada, China, India, European Union, Japan, Mexico, Republic of Korea, South Africa, Thailand and United States) is estimated at approximately 150 million tons. Waste from agriculture and rural areas include both biomass agricultural residues and hazardous wastes such as spent pesticides. The European Union estimates that its 27 member States annually produce a total of 700 million tons of agricultural waste.⁹

16. E-waste generation is steadily increasing owing to large-scale use of electronic and white goods.¹⁰ E-waste is one of the fastest growing segments of the waste stream: 315 million personal computers became obsolete in 2004 and 130 million mobile phones were disposed of in 2005. Similar waste flows for personal digital assistants, MP3 players and video game equipment account for 20–50 million tons of e-waste per year worldwide (equivalent to about 1 kg of e-waste per capita and year).

17. As a result of globalization, with the increasing availability of all types of products, there will be an accompanying significant increase in waste generation levels worldwide. There is a need for

2 <http://www.iges.or.jp/en/pub/pdf/asia2000/e-12.pdf>

3 http://www.researchandmarkets.com/reportinfo.asp?report_id=72031

4 <http://maps.grida.no/go/collection/collectionid/17F46277-1AFD-4090-A6BB-86C7D31FD7E7>

5 <http://www.who.int/mediacentre/factsheets/fs253/en/>

6 Organization for Economic Cooperation and Development (www.oecd.org/waste), the Statistical Office of the European Communities (<http://epp.eurostat.cec.eu.int>).

7 <http://www.epa.gov/osw/non-haz.htm>

8 Some e-wastes are hazardous under the Basel Convention (e.g., A1150, A1160, A1170, A1180, A1190 and A2010).

9 <http://ec.europa.eu/environment/waste/index.htm>

10 White goods are house and kitchen appliances such as refrigerators, washing machines, microwaves.

improvements to the availability of valid data on waste generation from all sources and to national reporting under the Basel Convention.

E. Waste by cost

18. The World Bank estimates that, in developing countries, it is common for municipalities to spend 20–50 per cent of their available recurrent budget on solid waste management, even if only 30–60 per cent of all the urban solid waste is actually collected and less than 50 per cent of the population is served. In most developing countries, open dumping with open burning is the norm.¹¹

19. In low-income countries, collection alone drains up to 90 per cent of municipal solid-waste management budgets. In mid-income countries, collection costs between 50 and 80 per cent of total budgets. In high-income countries, by contrast, collection accounts for less than 10 per cent of the budget, which allows large funds to be allocated to waste treatment facilities. Up-front community participation in these developed countries reduces the collection cost and facilitates waste recycling and recovery.

20. Based on case studies, it was found that, for regions spending \$1–10 per capita and year for waste management, the improvement of disposal systems (complete collection, upgrading to sanitary landfilling) was the most cost-effective method to attain the objectives of environmentally sound waste management. Technologies that are widely applied in developed countries are not suitable methods to attain waste management goals in countries where people cannot spend more than \$10 per person for the collection, treatment and disposal of their waste.¹²

F. Waste management: needs analysis

21. An analysis has been carried out in respect of needs at the policy and regulatory, technical, financial and social and institutional levels. In addition, as needs could vary at the global, regional, national or local levels, the analysis has been differentiated wherever required.

(a) Policy and regulatory

- (i) Greater conceptual clarity supported by practical application strategies is required to enable synergies between resource augmentation and waste management. Awareness-raising and capacity-building is required in such areas as waste prevention, the 3R initiative, cleaner production and sustainable material management.
- (ii) National policy frameworks need to be strengthened and expanded to shift the emphasis from an end-of-pipe approach to an integrated resource management approach. At the local level, integrated waste management strategies and action plans for municipalities, especially in developing countries, need to be developed and implemented. In the light of changing trade patterns in recyclables, national policies may need to be coordinated regionally to improve efficient use of resources;
- (iii) Effective implementation of waste-related multilateral agreements and guidelines is needed at the national level. Corresponding legislation, regulations and standards need to be developed and their enforcement strengthened at both the national and local levels;
- (iv) Non-regulatory instruments are required, whether at the local, national or regional levels, to address the specificities of particular waste streams and taking into account the rollercoaster effects of the economy;
- (v) Industry-driven mechanisms and tools, such as design for recyclability, product service systems and remanufacturing, must be promoted, in the light of the need to ensure security of supply in resources generated from waste;

(b) Technical and scientific understanding:

11 <http://www.worldbank.org/solidwaste/>

12 P. H. Brunner, "Setting priorities for waste management strategies in developing countries", *Waste Management & Research*, vol. 25, No. 3, (2007), pp. 234–240.

- (i) Greater scientific understanding of the synergies between resource augmentation and waste is required;
 - (ii) Enhanced access to environmentally sound waste-management technologies and enhanced capacity in technology assessment and selection are required. Simultaneously, research and development work is required to adapt these technologies to local conditions (for example, in respect of locally available skills, resources, climate conditions and culture);
 - (iii) Technical guidelines, case studies and demonstration and pilot projects for integrated waste management are needed, especially in developing countries. For hazardous wastes management, many technical guidelines have been developed, for example under the Basel Convention, however, implementation at the national and regional levels has been lacking;¹³
 - (iv) Local-level capacity to implement and operate waste-management technologies needs to be built or strengthened, including by making the best use of United Nations-supported national and regional specialized institutions in training, capacity-building and technology transfer;
- (c) Financial:
- (i) The resources available for developing, implementing and operating waste-management systems in developing countries need to be enhanced;
 - (ii) There is a need to develop and implement appropriate economic instruments to raise funds for waste management and make it economically attractive;
 - (iii) Public-private partnerships need to be explored further to enhance the availability of and access to financial resources and to meet the growing demand for the construction and operation of waste-management systems;
- (d) Social:
- (i) There is a need to change attitudes and to raise awareness at all levels and, in particular, among all waste generators, so as to promote waste minimization, source segregation and the proper disposal of waste;
 - (ii) In developing countries, waste management programmes and policies need to find ways to incorporate and improve employment and working conditions of vulnerable sections of society, notably, scavengers and ragpickers;
 - (iii) The involvement of private sector and local communities in developing, building and running waste-management systems needs to be strengthened and made more effective;
- (e) Institutional:
- (i) Institutional strengthening and capacity-building are required at the national level to enable work on policy, technical, financial and social aspects;
 - (ii) At the local level, institutional capacity needs to be built or strengthened to raise awareness and develop human resources for waste management.

G. Key actors and major initiatives

22. The primary stakeholders in international waste management, whether at the global, regional, national or local level, are UNEP and some of the UNEP-administered multilateral agreements, namely, the Basel Convention, the Stockholm Convention on Persistent Organic Pollutants, the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer, together with some of the established UNEP action programmes, such as the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities and the Regional Seas Programme.

23. Other United Nations agencies working on various aspects of waste management include the United Nations Development Programme (UNDP), WHO, the International Maritime Organization

13 See <http://www.basel.int/meetings/sbc/workdoc/techdocs.html>

(IMO), the United Nations Human Settlements Programme (UN-Habitat), the United Nations Centre for Regional Development (UNCRD), the United Nations Industrial Development Organization (UNIDO) and, to a lesser extent, the economic and social commissions in the various regions. Among other international organizations, the Organization for Economic Cooperation and Development (OECD) is a key stakeholder.

24. In addition, various international financing institutions are engaged in work related to waste management, namely, the World Bank Group (the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), the International Finance Corporation (IFC) and the Prototype Carbon Fund (PCF)) and regional development banks such as the Asian Development Bank, the European Bank for Reconstruction and Development (EBRD), the Inter-American Development Bank (IADB) and the African Development Bank (AfDB). The World Bank, in particular, has prepared several guidelines and training programmes and has carried out a number of studies.

25. The key stakeholders active in various aspects of waste management needs are summarized in table 1, based on information from their websites. The work being implemented or planned has been analysed along two lines: first, the pre-generation stage of the waste chain (before resources actually appear as waste), covering waste minimization, cleaner production and the 3R initiative, and, second, the post-generation stage of waste (after the waste has been generated), covering waste treatment and disposal. In addition, a distinction has been made between actions at various geographical levels – global, regional or national and local.

Table 1.

Agencies having existing and planned activities in waste management

Level Aspects of needs	Pre-generation stage of waste			Post-generation stage of waste		
	Global	Regional/national	Local	Global	Regional/national	Local
Policy and regulatory	UNEP, SBC	OECD, UNEP, UNIDO, UNCRD, ADB	--	UNEP, SBC, IMO	OECD, SBC, UNDP, UNEP, UNIDO, WB, ADB, EBRD, IADB, AfDB, UN-Habitat, UNCRD	UNEP, UNDP, UN-Habitat, WB
Technical and scientific understanding	WB, SBC, UNEP, UNU	OECD, UNIDO, UNEP	UNIDO, UNEP	SBC, IMO, UNEP, WB	OECD, WB, ADB, EBRD, IADB, SBC, UNDP, UNIDO, UNEP, UN-Habitat	UNDP, UNEP, UN-Habitat, WB
Financial	--	IADB, ADB	--	--	WB, OECD, EBRD	WB-PCF
Social	UNEP	UNEP, UNCRD, ADB, NGOs	NGOs	UNEP, SBC, WB	UNEP, UNDP, UNESCO, ADB, IADB, AfDB	UNEP, NGOs, SBC
Institutional	WB, UNEP, UNIDO	UNEP, UNIDO, UNCRD, ADB	--	UNEP, WB	OECD, SBC, GEF, WB, ADB, EBRD, IADB, AfDB, UN-Habitat, UNIDO, UNEP, UNDP	UNEP, UNDP, UN-Habitat

H. Waste management needs and extent to which they are being met

26. Table 2 summarizes the extent to which the waste management needs identified above are being met to by organizations that have existing and planned activities in the field of waste management. Information was sought from the various organizations and the responses received have been summarized in document UNEP/GC.25/25/INF/29. These success stories, compiled from the information given by the organizations, are reproduced in the same document. Information available from published sources and websites has also been used. For the sake of simplicity and ease of understanding, a broad qualitative assessment – low, medium or high – has been made.

Table 2.
Needs analysis at the pre-generation stage of waste

Waste management needs	Global assessment	Regional/national assessment	Local assessment
<p>Policy and regulatory: (i) Greater conceptual clarity supported by practical application strategies is required to enable synergies between resource augmentation through waste management. Awareness-raising and capacity-building are required in areas such as waste prevention, the 3R initiative and cleaner production.</p> <p>National policy frameworks need to be strengthened and expanded to shift the emphasis from an end-of-pipe approach to an integrated resource management approach. An integrated resource management strategy and action plan, especially in developing countries, needs to be developed and implemented.</p> <p>Effective implementation of multilateral waste-related agreements and guidelines is needed at the national level. Corresponding legislation, regulations and standards need to be developed and their enforcement strengthened at the national and local levels.</p>	<p>The International Panel for Sustainable Resource Management has recently been launched by UNEP. The Marrakech Process is the major global initiative to promote sustainable consumption and production, under which waste prevention and cleaner production is also addressed. The Government of Japan put forward the 3R initiative at a Group of Eight summit and is now working to disseminate it at the regional level. The Basel Convention has carried out substantive work in the field of hazardous waste and also has achievements in other fields. Level: low</p> <p>Virtually no effort at the global level. Level: very low</p> <p>SBC and other secretariats of corresponding multilateral environmental agreements doing good work in this direction, although effectiveness of implementation at the national level needs to be improved. Level: high</p>	<p>OECD has done considerable work but mostly limited to OECD countries. UNEP-UNIDO through the National Cleaner Production Centre programme has met the need in some developing countries. Recently UNCRD has started work on the 3R initiative in some countries. Level: medium</p> <p>Sporadic efforts at the local level, e.g., Cleaner Production Act in China. Level: low</p> <p>Few regional bodies, e.g., Basel Convention regional centres, are active in this area, however resources are limited. Level: medium</p>	<p>No national-level effort worthy of mention. Level: very low</p> <p>Virtually no effort at the local level except for a few pilot projects by UNEP. Level: very low</p> <p>Local-level implementation on preventive aspects may be low, depending on regions. Level: low–medium</p>
<p>Technical and scientific understanding: Greater scientific understanding of the synergies between resource augmentation and waste management to decouple waste generation and economic impact from economic growth, in particular for emerging special waste streams such as e-wastes.</p>	<p>UNEP carries out a global assessment on global metal flows and does work on decoupling under the International Panel for Sustainable Resource Management, UNU leads work on the “Solving the E-waste Problem” initiative. Level: medium</p>	<p>OECD has a programme on material flows and resource productivity. Level: medium</p>	<p>No work done at the local level. Research and development adoption remains extremely low Level: low</p>

Waste management needs	Global assessment	Regional/national assessment	Local assessment
<p>(i) Enhanced access to cleaner and resource-efficient technologies and building capacity for technology assessment and selection is required. At the same time, research and development work is required to adapt these technologies to local conditions (e.g., in respect of locally available skills, resources, climatic conditions and culture).</p> <p>(ii) Development of the normative framework for the environmentally sound management of hazardous and other waste by the Basel Convention.</p> <p>(iii) Technical guidelines, case studies, demonstration and pilot projects for preventive aspects of integrated waste management, especially in developing countries, are needed.</p> <p>(iv) Build or enhance capacity at the local level to implement and operate cleaner and resource efficient technologies.</p>	<p>Little or no effort at the global level. Environmentally sound technologies and processes for persistent organic pollutant waste selected by the Basel Convention. Level: low</p> <p>SBC had many initiatives, in particular on priority waste streams. Little effort at the global level on preventive aspects of an integrated waste management in developing countries. World Bank has produced some guidelines. Level: low</p> <p>No effort at the global level. Level: very low</p>	<p>OECD has worked to enhance access but mostly applicable to OECD countries. UNIDO has technology databases for preventive technologies but the information is not cutting-edge and not regularly updated. Recent efforts include the setting up by UNEP of a 3R knowledge hub at the Asian Institute of Technology. Cooperation between SBC and regional projects (ASP) on technology assessment. National reporting system under the Basel Convention on national facilities. Level: low</p> <p>SBC and UNEP-UNIDO through National Cleaner Production Centre programme have developed a number of guidelines, manuals, case studies, etc., on preventive aspects. Level: high</p> <p>UNEP-UNIDO through National Cleaner Production Centre programme has built and strengthened capacity at the national level on preventive waste management technologies. Level: medium</p>	<p>No work done at the local level. Research and development adoption remains extremely low. Level: very low</p> <p>SBC and UNEP have begun a few pilot demonstration projects. UNEP-UNIDO through National Cleaner Production Centre programme has done quite good work at the local level. Level: high</p> <p>No concerted work carried out at the local level. Level: very low</p>
<p>Financial:</p> <p>(i) The availability of resources for developing, implementing and operating waste prevention systems in developing countries needs to be enhanced. There is a need to develop and implement appropriate economic instruments to raise funds for waste prevention and make it economically attractive.</p> <p>(ii) Public-private partnerships need to be further explored to raise availability and access to financial resources and to meet growing demand for construction and operation of waste prevention systems.</p>	<p>No effort at the global level to enhance availability of financial resources for waste prevention. Under BC, voluntary funds only. Level: very low</p> <p>Mobile Phone Partnership Initiative and Partnership for Action on Computing Equipment under the Basel Convention. No concerted effort at the global level to establish such partnerships, except Mobile Phone Partnership Initiative. Level: very low</p>	<p>Regional development banks, particularly ADB, have set up country-specific loan and technical assistance projects credit lines in their respective regions. Here again the number of beneficiaries is rather low. Level: low</p> <p>No concerted effort at the regional level to establish such partnerships. Level: very low</p>	<p>No concerted effort at the local level except sporadic cases, e.g., in Bangladesh, Brazil and India. Level: very low</p> <p>No concerted effort at the local level to establish such partnerships. Level: very low</p>

Waste management needs	Global assessment	Regional/national assessment	Local assessment
<p>Social:</p> <p>(i) There is a need to change attitudes and raise awareness at all levels and among all waste generators to promote waste minimization, source segregation, reuse and recycling of waste.</p> <p>(ii) In developing countries, the waste-recycling sector needs to find ways to incorporate and improve employment and working conditions for vulnerable sectors of society, e.g., the informal sector, scavengers and ragpickers.</p> <p>(iii) The involvement of the private sector and local communities in developing, building and running waste minimization efforts needs to be strengthened and made more effective.</p>	<p>Some effort at the global level by UNIDO and UNEP. Level: very low</p> <p>No concerted effort at the global level Level: very low</p> <p>The private sector is only working on a few occasions with UNEP and other organizations on waste minimization issues at the global level, such as the Life Cycle Initiative. Level: Low</p>	<p>UNEP-UNIDO through National Cleaner Production Centre programme has done considerable work at the national level. Level: high</p> <p>No concerted effort at the regional level Level: very low</p> <p>No effort at the regional or national levels. Level: very low</p>	<p>No concerted effort at the local level. Level: very low</p> <p>Sporadic efforts at the local level Level: low</p> <p>Sporadic efforts by organizations such as UNEP and UNCRD. Level: low</p>
<p>Institutional:</p> <p>(i) Institutional strengthening and capacity-building required at the national and local levels to enable work on policy, technical, financial and social aspects, in particular, to move towards sustainable material management.</p> <p>(ii) At the local level, institutional capacity needs to be built or strengthened to raise awareness and develop human resources for waste minimization.</p>	<p>Organizations such as WB, UNEP and UNIDO have undertaken considerable work in building and enhancing capacity in countries. The pedagogical impacts are, however, mostly based on experience in developed countries. Level: high</p> <p>No global effort for building local institutional capacity except Basel Convention regional centres Level: low</p>	<p>The UNEP-UNIDO National Cleaner Production Centre programme has been extremely effective in building preventive waste management capacity at the national level. Further effort is needed to build the institutional basis for sustainable material management. Level: medium</p> <p>Considerable efforts at the regional and national level by academic institutions to build and develop human resources. Level: high</p>	<p>Sustainable material management begins at the local level where the capacity of the institutions is weak. Level: Low</p> <p>No local-level initiative to develop human resources. Level: low</p>

Table 3
Needs analysis at the post-generation stage of waste

Waste management needs	Global assessment	Regional/national assessment	Local assessment
<p>Policy and regulatory: (i) Greater conceptual clarity supported by practical application strategies is required to enable synergies between resource augmentation and waste management. Awareness-raising and capacity-building required in areas such as waste prevention, the 3R initiative, cleaner production, etc.</p> <p>National policy frameworks need to be strengthened and expanded to shift the emphasis from an end-of-pipe approach to an integrated resource management approach. At the local level, an integrated waste management strategy and action plan for municipalities, especially in developing countries, needs to be developed and implemented.</p> <p>Effective implementation of multilateral waste-related agreements and guidelines is needed at the national level. Corresponding legislation, regulations and standards need to be developed and their enforcement strengthened at the national and local levels.</p>	<p>The Marrakech Process is the major global initiative to promote sustainable consumption and production, under which waste management is also addressed. The 3Rs initiative from Japan also addresses post-generation stage of waste but is so far mostly limited to 6–8 countries. Level: low</p> <p>Global efforts (mainly WB, SBC, IMO) predominantly continue to lay emphasis on end-of-pipe approach.</p> <p>Little global effort on integrated waste management. Level: very low</p> <p>Secretariats of corresponding multilateral environmental agreements active in this direction, although increased support would need to be provided Level: high</p>	<p>Regional 10-year framework of programmes on sustainable consumption and production, the African version of which was approved by the African Ministerial Conference on the Environment, identify waste management as one of the key priorities. Level: very low</p> <p>Regional and national efforts (mainly WB, regional development banks) also continue to emphasize the end-of-pipe approach. UNEP and UNDESA have begun tackling this issue through regional round tables on sustainable consumption and production. Level: low</p> <p>Regional and national set-ups exist, particularly for multilateral environmental agreements such as Basel Convention, work picking up for Stockholm Convention and Rotterdam convention, also under Marrakech Process. Level: high</p>	<p>In developing countries only a few sporadic initiatives, such as organic waste composting in Bangladesh. Most other initiatives are market-driven. Level: low</p> <p>Increasing number of cities developing waste management strategies. There is a strong need to enhance the integrated solid waste management dimension. Level: very low</p> <p>Local-level implementation gradually strengthening, specifically for hazardous waste, ozone-depleting substances, persistent organic pollutants, etc. Level: high</p>
<p>Technical and scientific understanding: Enhanced access to cutting-edge waste management technologies and building capacity for technology assessment and selection is required. At the same time, research and development is required to adapt these technologies to local conditions (e.g., in respect of locally available skills, resources, climatic conditions and culture).</p>	<p>At the global level considerable work done (BC, IMO, UNEP) for wastes convened under specific multilateral environmental agreements. For other wastes (such as municipal and industrial) few guidelines made available (UNEP, WB). Little or no work done for local adoption. Level: low</p>	<p>At the regional and national levels considerable work done (WB, regional development banks, OECD) to provide technology guidelines. Capacity for technology assessment and selection continues to be low in developing countries. Level: low</p>	<p>Some work done (UNDP, UN-Habitat, UNEP) at a few locations to enhance technology access at the local level. Little or no work done for local adoption. Level: low</p>

Waste management needs	Global assessment	Regional/national assessment	Local assessment
<p>Technical guidelines, case studies and demonstration and pilot projects for integrated waste management, especially in developing countries, are needed.</p> <p>(i) Build or enhance capacity at the local level to implement and operate waste management technologies.</p>	<p>Little effort at the global level on integrated waste management except guidelines by UNEP. Level: very low</p> <p>No work done at the global level. Level: very low</p>	<p>No work done at the regional or national levels. Level: very low</p> <p>Pilot projects under the Basel Convention on persistent organic pollutants, used oils, e-waste, used lead-acid batteries, etc. Overall little work done at the regional or national levels. Level: low</p>	<p>Except for a few pilot projects by UNEP and the Basel Convention, no work done. Level: very low</p> <p>Except for local capacity-building as part of locally implemented projects by development banks, little work done. Level: low</p>
<p>Financial:</p> <p>(i) The availability of resources for developing, implementing and operating waste management systems in developing countries needs to be enhanced. There is a need to develop and implement appropriate economic instruments to raise funds for waste management and make it economically attractive.</p> <p>(ii) Public-private partnership needs to be explored further to raise availability and access to financial resources and to meet growing demand for construction and operation of waste management systems.</p>	<p>At the global level WB has set up country-specific credit lines to provide financial resources. The number of beneficiary countries is, however, rather low in view of the demand for resources. Development of economic instruments is rather absent. Financial resources from institutions such as GEF and mechanisms such as CDM do not support integrated waste management projects but isolated aspects such as persistent organic pollutants and landfill gas. Level: low</p> <p>No concerted effort at the global level to establish such partnerships except under Basel Convention. Level: very low</p>	<p>Regional development banks have made significant financial resources available for implementation of end-of-pipe waste management system. Not much work done, however, towards development of economic instruments. Level: high</p> <p>No concerted effort at the regional or national levels to establish such partnerships. Level: very low</p>	<p>No concerted effort to increase availability of financial resources at the local level. Level: very low</p> <p>Limited efforts at the local level, e.g., Bangladesh, Brazil, India and Kenya. Level: low</p>

Waste management needs	Global assessment	Regional/national assessment	Local assessment
<p>Social:</p> <p>(i) There is a need to change attitudes and raise awareness at all levels and among all waste generators to promote waste minimization, source segregation and proper disposal of waste.</p> <p>(ii) In developing countries, waste management needs to find ways to incorporate and improve employment and working conditions of vulnerable sections of society, e.g., scavengers and ragpickers.</p> <p>(iii) Involvement of the private sector and local communities in developing, building and running waste management system needs to be strengthened and made more effective.</p>	<p>SBC has contributed towards raising awareness on proper waste disposal although mainly on hazardous waste and some other specific waste types. UNEP has worked in the area for ozone-depleting substances and persistent organic pollutants. Little work done for municipal and industrial waste in developing countries. Level: low</p> <p>Some concerted effort at the global level. Level: very low</p> <p>No efforts at the global level to involve private sector and local communities. Level: very low</p>	<p>Actions by Basel Convention regional centres. Otherwise little concerted effort at the regional and national levels. Level: low</p> <p>Sporadic efforts by organizations such as UNEP, UNCRD and non-governmental organizations. Level: low</p> <p>No effort at the regional or national levels. Level: very low</p>	<p>No concerted effort at the local level. Level: very low</p> <p>A number of non-governmental organizations active at the local level. Level: medium</p> <p>Sporadic efforts by organizations such as UNEP and UNCRD. Level: low</p>
<p>Institutional:</p> <p>(i) Institutional strengthening and capacity-building required at the national level to enable work on policy, technical, financial and social aspects.</p> <p>(ii) At the local level, institutional capacity needs to be built or strengthened to raise awareness and develop human resources for waste management.</p>	<p>Global efforts (mainly WB) are based on experience in developed countries and experience from developing countries has not been used to enhance the normative function. Level: low</p> <p>No global effort in institutional enhancing at the local level. Level: very low</p>	<p>Regional and national efforts (mainly regional development banks) are country-specific and experience sharing in similar countries is missing. Level: low</p> <p>Considerable effort at the regional and national levels by academic institutions to build and develop human resources. Level: high</p>	<p>Not applicable</p> <p>No local-level initiatives to develop human resources. Level: very low</p>

I. Tangible recommendations

27. From tables 2 and 3, it is clear that several areas remain to be tackled in the field of waste management. A review of the two tables shows that, although considerable efforts have been made in the environmentally sound management of waste over past years, gaps remain to be filled if countries' needs are to be met. The main recommendations in this regard are set out below along the two lines used before: first, the pre-generation stage of the waste chain, and, second, the post-generation stage of waste.

28. Recommendations at the pre-generation stage of waste:

(a) Policy and regulatory:

(i) Greater conceptual clarity, supported by practical application strategies to promote resource augmentation through waste recovery, reuse and recycling, is

- required, particularly at the local level. Awareness-raising and capacity-building are required in areas such as waste prevention, the 3R initiative and cleaner production;
- (ii) National policy frameworks need to be strengthened and expanded to shift the emphasis from an end-of-pipe approach to an integrated resource management approach, including implementation of standards on waste management;
 - (iii) Implementation of preventive aspects of waste-related multilateral agreements needs to be strengthened at the local level;
- (b) Technical and scientific understanding:
- (i) Greater scientific understanding of the synergies between resource augmentation and waste management to decouple waste generation and economic impact from economic growth, in particular for emerging special waste streams like e-wastes, needs to be brought to the local level;
 - (ii) Access to environmentally sound waste-management technologies needs to be enhanced and development and use of best practices should be encouraged concurrently;
 - (iii) Greater South-South cooperation is needed;
 - (iv) Strengthened capacity is required for technology assessment and selection;
 - (v) At the same time, research and development work is required to adapt these technologies to suit local conditions;
 - (vi) Technical guidelines, case studies, demonstration and pilot projects for waste minimization, especially in developing countries, need to be prepared and disseminated at the global level, using, in the case of hazardous wastes, technical guidelines developed under the Basel Convention, as appropriate;
 - (vii) Capacity needs to be built or enhanced at the local level to implement and operate cleaner and resource-efficient technologies;
- (c) Financial:
- (i) Availability of resources for developing, implementing and operating waste prevention systems, particularly at the local level in developing countries, needs to be enhanced. The Millennium Development Goals on water and sanitation and poverty reduction for many regions, especially Africa, cannot be met without adequate waste management; accordingly, donors should intensify support to waste management projects;
 - (ii) Public-private partnerships need to be established to increase the availability of and to improve access to financial resources to meet the growing demand for the construction and operation of waste management systems;
- (d) Social:
- (i) Awareness-raising is required to change the attitude of waste generators, particularly at the municipal and industrial levels, to raise their awareness of the need for proper segregation and disposal of waste;
 - (ii) In developing countries, employment-generation schemes are required and working conditions in particular for waste recycling sectors of vulnerable sections of society, e.g., scavengers and ragpickers, need to be improved;
 - (iii) The private sector and local communities in developing countries should be involved in waste minimization efforts;
- (e) Institutional:
- (i) Institutional enhancing and capacity-building is required at the local level to enable work on policy, technical, financial and social aspects, in particular to move towards sustainable material management;

- (ii) Institutional capacity needs to be built or enhanced at the local level to raise awareness and develop human resources for waste minimization.
29. Recommendations at the post-generation stage of waste:
- (a) Policy and regulatory:
 - (i) Greater conceptual clarity, supported by practical application strategies to promote resource augmentation through waste recovery, reuse and recycling is required, particularly at the local level;
 - (ii) National policy frameworks need to be strengthened and expanded to shift the emphasis from an end-of-pipe approach to an integrated resource management approach, including implementation of standards on waste management;
 - (iii) At the local level, an integrated waste management strategy and action plan for municipalities, especially in developing countries, needs to be developed and implemented;
 - (b) Technical and scientific understanding:
 - (i) Access to environmentally sound waste-management technologies needs to be enhanced and development and use of best practices should be encouraged concurrently;
 - (ii) Greater South-South cooperation is needed;
 - (iii) Enhanced capacity is required for technology assessment and selection;
 - (iv) At the same time, research and development work is required to adapt these technologies to local conditions;
 - (v) Technical guidelines, case studies, demonstration and pilot projects for integrated waste management, especially in developing countries, need to be prepared and disseminated. For hazardous wastes management, technical guidelines developed under the Basel Convention need to be implemented, as appropriate;
 - (vi) Capacity needs to be built or enhanced at the local level to implement and operate waste-management technologies;
 - (c) Financial:
 - (i) Availability of resources for developing, implementing and operating waste-management systems, particularly at the local level in developing countries, needs to be enhanced. The Millennium Development Goals on water and sanitation and poverty reduction for Africa cannot be attained without adequate waste management; accordingly, donors should increase support to waste management projects;
 - (ii) Appropriate economic instruments to raise funds for waste management and to make it economically attractive need to be developed and implemented;
 - (iii) Public-private partnerships need to be established to increase the availability of and to improve access to financial resources to meet the growing demand for the construction and operation of waste management systems;
 - (d) Social:
 - (i) Awareness-raising is required to change the attitude of waste generators, particularly at the municipal and industrial levels, to raise their awareness of the need for proper segregation and disposal of waste;
 - (ii) In developing countries, employment-generation schemes are required and working conditions of vulnerable sections of society, e.g., scavengers and ragpickers, need to be improved;
 - (iii) The involvement of the private sector and local communities in developing, building and running waste management system needs to be strengthened and made more effective;

- (e) Institutional:
 - (i) Institutional enhancing and capacity-building at the national level is required to enable work on policy, technical, financial and social aspects of the post-generation stage of waste management. The experience gained through projects in developing countries should be factored into the capacity-building activities, thus enhancing the normative function of this work;
 - (ii) Institutional capacity needs to be built or enhanced at the local level to raise awareness and develop human resources for waste management.

III. Outcome of the process of cooperation with other organizations

30. The outcomes of the process of cooperation with other organizations are set out below.

- (a) Policy and regulatory:
 - (i) UNEP, in cooperation with the secretariat of the Basel Convention, will promote resource augmentation through waste recovery, reuse and recycling, supported by awareness-raising activities and practical application strategies, particularly for municipal waste at the local level, and for some material flows also at the global level. UNEP, through existing mechanisms including the Marrakech Process, will take the lead in enhancing and expanding national policy frameworks to shift the emphasis from an end-of-pipe approach to an integrated resource management approach, as appropriate, based on scientific knowledge provided by the International Panel for Sustainable Resource Management;
 - (ii) UNEP will take the lead at the local level in developing and implementing integrated waste management strategies and action plans for municipalities, especially in developing countries. It will work towards having integrated waste management recognized as a key priority area under the current "One United Nations" approach;
 - (iii) The secretariats of the multilateral environmental agreements, particularly the Basel Convention, the Stockholm Convention and the Montreal Protocol, within their respective mandate and available resources, will enhance their implementation of preventive aspects of waste-related multilateral agreements, particularly at the local level.
- (b) Technical:
 - (i) OECD, the World Bank, UNIDO, the Asian Development Bank, IADB and the African Development Bank are invited to enhance access to cutting-edge, waste-management and resource-efficient technologies. This includes understanding the global market for those technologies and the enhancing of capacity in developing countries for technology transfer, including assessment and selection, towards which UNEP is willing to work in close cooperation with OECD and UNIDO. Research and development institutions such as UNU may enhance the necessary efforts on research and development required to understand the challenges for moving towards sustainable material management and to adapt existing approaches and technologies to suit local conditions;
 - (ii) The secretariat of the Basel Convention will continue its efforts and UNEP will initiate appropriate programmes, within their respective mandates and available resources, for preparation of technical guidelines, case studies, demonstration and pilot projects for integrated waste management, especially in developing countries;
 - (iii) UNEP, UNDP, UNIDO, development banks and the Basel Convention regional centres could consider initiating programmes to build or enhance capacity at the local level to implement and operate waste management and resource-efficient technologies;

- (c) Financial:
- (i) The World Bank and the development banks are invited to enhance availability of resources for developing, implementing and operating waste management systems (both preventive and post-generation stage of waste), particularly at the local level in developing countries needs to be enhanced;
 - (ii) The secretariat of the Basel Convention, with support from UNEP, is developing a framework for assessing costs and benefits through the implementation of the convention for use by developing countries. OECD, the World Bank and development banks are invited to support developing countries in framing appropriate economic instruments to provide incentives for waste minimization and to raise funds for waste management and make it economically attractive;
 - (iii) Establishing public-private partnerships and working with the financial sector are means for UNEP and other organizations to raise awareness on issues, changing business models towards more resource-efficiency and a potential source of financial resources, to meet growing demand for awareness-raising campaigns and capacity-building activities for waste minimization, resource-efficient technology transfer and construction and operation of waste management systems;
- (d) Social:
- (i) UNEP is willing to cooperate with UNCRD, UNIDO, UN-Habitat and UNDP to launch awareness-raising programmes to change the attitude of waste generators, particularly municipal and industrial waste generators on proper segregation and disposal of waste;
 - (ii) UNEP is willing to work with UNDP, UNCRD and UN-Habitat towards improving the working conditions and incomes of vulnerable, informal sectors of society, e.g., scavengers and ragpickers, in developing countries;
 - (iii) UNEP would like to establish partnerships with the private sector for promoting waste minimization. The World Bank and development banks could consider enhancing the involvement of private sector and local communities in developing, building and running of waste management systems;
 - (iv) UNIDO has developed a responsible entrepreneurs achievement programme to assist small- and medium-sized enterprises in their efforts to implement management approaches based on corporate social responsibility and operation methods. Corporate social responsibility issues that can be tackled through the responsible entrepreneurs achievement programme include water, energy, waste, and raw material management.
- (e) Institutional:
- (i) UNEP would like to enhance its cooperation and collaboration with UNDP, UNIDO, the multilateral environmental agreement secretariats and the Basel Convention regional centres to launch programmes on institutional enhancing and capacity-building at the national level, to enable work on policy, technical, financial and social aspects of the pre- and post-generation stage of waste management. The experience gained through projects in developing countries should be factored into the capacity-building activities, thus enhancing the normative function. Institutional capacity-building or enhancing at the local level could be initiated by UNDP, UNIDO, UNCRD, and the Basel Convention regional centres.
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