Metadata on SDGs Indicator 11.6.1

Indicator category: Tier II

Goal 11: *Make cities and human settlements inclusive, safe, resilient and sustainable*

Target 11.6: *By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management*

Indicator 11.6.1: *Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities*

LAST REVIEWED: MARCH 2018

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1. Concepts and definitions

1.1 Definition:

Proportion of municipal solid waste regularly collected and with adequate treatment and disposal out of total municipal solid waste generated

The goal of this indicator is to generate data on the proportion of municipal solid waste regularly collected and that is adequately treated and disposed out of all the total municipal waste generated by the city.

1.2 Rationale:

Urban households and businesses produce substantial amounts of solid waste that must be collected regularly, recycled or treated and disposed properly in order to maintain healthy and sanitary living conditions. Many cities are increasingly facing solid waste management challenges due to rapid urbanization, lack of technical and financial capacity or low policy priority. As urbanization and population growth will continue, it is expected that municipal solid waste generation will double by 2025. In addition, the higher the income level of a city, the greater the amount of the solid waste produced. Therefore, the economic growth to be experienced in the developing and emerging countries will pose greater challenges in solid waste management to local governments in the next decades.

The environmental impacts of uncollected waste in a city are significant. Uncollected solid waste can end up in drains leading to the blockage of drainage systems and cause unsanitary conditions that have a direct health impact on residents. Open burning of uncollected waste produces pollutants that are highly damaging locally and globally. Vectors such as mosquitoes usually breed in blocked drainages and blocked drainages contribute to flooding. In 2015, the Global Waste Management Outlook estimated that at least 2 billion people do not have access to regular waste collection . This is particularly worse in informal settlements and the UN-Habitat's report Solid Waste Management in World Cities published in 2010 estimated only 5% of waste in squatter areas is regularly collected .

Even when solid waste is collected, it is not uncommon that recycling and treatment facilities or landfill sites are not operated in an environmental sound manner, especially when lacking a pollution control system. Particularly in developing countries lacking technical and financial capacity, open dumping or uncontrolled landfill is the common way of disposal. Leachate generated in dumping sites pollutes surface and groundwater. Frequent fire and explosions caused by the high temperature inside the accumulated waste is a source of air pollution. Composting and recycling facilities and incineration plants lacking pollution control systems are one of the largest pollution sources. Open dumpsites are major sources of greenhouse gasses (GHG) emission in urban settings, and if the situation follows the business as usual together with the rapid urbanization, dumpsites will account for 8-10% of the global anthropogenic GHG emission by 2025.

Improper waste management accelerates poverty and social exclusion. In an open dumpsite, waste pickers or scavengers are regularly collecting recyclables without any protection measures. They are exposed to extreme health threats and it is estimated that 20% of these waste pickers are children missing school. The frequent explosion or landslides in open dumpsites often kill these waste pickers. It is also not unusual that gangs or cartels are involved in these informal recycling activities or open dumpsites operations.

Plastics and other waste material along ocean shore © nationalgeographic.com

The indicator 11.6.1 is the quotient of municipal solid waste regularly collected and with adequate treatment and disposal divided by total municipal solid waste generation of a city. This can effectively address the key aspects in the waste stream from generation to disposal. Municipal solid waste management is generally the mandate of sub-national or local governments and has four stages: waste generation; waste collection and transport; recycling and treatment; and disposal. In these four stages, environmentally sound ways of management and operation are essential to reduce the adverse impacts of wastes to cities. Also, the environmentally sound management of solid waste contributes to the formalization of informal sector and improves waste pickers lives in many cases. For example, the improvement of solid waste disposal operation through upgrading open dump-sites to sanitary landfills creates jobs in waste separation or landfill site operation. This can empower waste pickers who currently work under extreme conditions.

The indicator 11.6.1 will also promote Integrated Solid Waste Management (ISWM). An integrated solid waste management system is strongly connected to three dimensions: urban environmental health, the environment and resource management. Moreover, a regular solid waste management strategy is a clear indicator of the effectiveness of a municipal administration. Good waste governance that is inclusive, financially sustainable and based on sound institutions is one of the key challenges of the 21st century, and one of the key responsibilities of a city government.

Many developing and transitional countries and cities have an active informal sector and micro-enterprise recycling, reuse and repair; which often help them achieve higher recycling and recovery rates comparable to those in the west. This results in savings on the waste management budget for the cities. There is a major opportunity for the city to build on these existing recycling systems, reduce some unsustainable practices and enhance them to protect and develop people's livelihoods, and to further reduce the city costs/expenditures for managing the residual wastes. The formal and informal sectors need to work together, for the benefit of both. Promoting this indicator also can help formalization of the informal sector in the process of increasing the portion of 'solid waste with adequate discharge'.

Garbage collection in a city © rusustain.files.wordpress.com

The indicator 11.6.1 has strong linkages to other SDG indicators such as 6.3 (proportion of wastewater safely treated), 12.4.2 (Hazardous waste generated per capita and proportion of hazardous waste treated and by type of treatment) and 12.5 (National recycling rate). It is important to harness synergies and manage potential conflicts or trade-offs both within and between the indicators. This will require collaboration across institutions that are traditionally structured in silos that focus on specific sectors. New ways of collaborative working in partnerships with either informal or formal mechanisms are needed to facilitate collaboration such that policy makers, managers and experts with different responsibilities are able to harness the synergies between goals and targets. This will be a major challenge in implementation of the 2030 Agenda.

1.3 Concepts:

It will be necessary to define the following components to compute the proportion of municipal solid waste regularly collected with adequate treatment and disposal out of all the total municipal solid waste generated by the city.

Municipal Solid Waste is waste generated by households, and waste of a similar nature generated by commercial and business establishments, industrial and agricultural premises, institutions such as schools and hospitals, public spaces such as parks and streets and construction sites. Generally, it is non-hazardous wastes composed of food waste, garden waste, paper and cardboard, wood, textiles, nappies (disposable diapers), rubber and leather, plastics, metal, glass, and refuse such as ash, dirt and dust. Sewage sludge and faecal sludge is also included in the category of municipal solid waste, but it excludes wastewater. This will be the monitoring scope of the indicator.

Regularly Collected Municipal Solid Waste refers to municipal solid waste that is routinely collected from specific addresses or designated collection points. Waste collection is conducted directly by municipal authorities or private contractors licensed/commissioned by municipal authorities with a regular schedule of the day of the week and time of collection. In some cases, private waste collection companies have contracts with clients individually and provide collection services.

Uncollected Municipal Solid Waste refers to waste generated in a city but uncollected due to the lack of collection services. In many cities, informal settlements areas do not have access to this basic service. The amount of uncollected waste can be estimated by waste generation per capita in the city multiplied by the population which does not have access to the solid waste collection service.

Total Municipal Solid Waste Generated by the City is sum of municipal solid waste, or the sum of regularly collected municipal solid waste and uncollected municipal solid waste.

Municipal Solid Waste with Adequate Final Treatment and Disposal refers to the total municipal solid waste destined for treatment or disposal facilities that at least reached an intermediate level of control. The level of adequacy for a particular facility can be assessed using the qualitative criteria including 1) degree of control over waste reception and general site management; 2) degree of control over waste treatment and disposal and 3) degree of monitoring and verification of environmental control. A score of at least 10 on each criterion is the threshold required to be considered as 'adequate final treatment and disposal.

2. Method of Computation

The numerator of this indicator is ***'municipal solid waste regularly collected with adequate final treatment and disposal' and the denominator is 'total municipal solid waste generated by the city'***.

$$x = \left[\frac{\text{Municipal solid waste regularly collected with adequate final treatment and disposal}}{\text{Total municipal solid waste generated by the city}} \right] \times 100$$

Multiplication of the municipal solid waste generation per capita and population of the city can estimate total municipal solid waste generated by the city. When the municipal solid waste generation per capita is not available, surveys to collect data on daily waste generation in households and other premises (e.g. restaurants, hotels, hospitals, schools, etc.) should be conducted. Since the waste generation can differ according to the seasons, the survey should be conducted at least two times a year to estimate the municipal solid waste generation per capita.

Municipal solid waste regularly collected with adequate final treatment and disposal is estimated through qualitative judgement of the degree of environmental control of facilities where the city's municipal waste is collected and transported. The judgement of environmental control can be conducted in line with the criteria below. Another important thing is to deduct residue amount from treatment facilities to avoid double count.

All the treatment and disposal facilities that receive municipal solid waste of the city are checked against the criteria above and scored. Facilities that are scored above 10 for all the criteria are accounted as facilities that can deliver 'adequate treatment and disposal'. Therefore, the amount of municipal solid waste received by the facilities that has capacity of delivering 'adequate treatment and disposal' is accounted as the amount of Municipal solid waste regularly collected with adequate final treatment and disposal.

***Table 1:** Criteria to be used in evaluating waste collection mechanisms and disposal.*

<table>
<tr><td rowspan="2">Degree of control over waste reception and handling at each site. This criterion should be applied to all treatment and disposal sites, whatever the specific process being used</td><td colspan="2">Factors affecting the assessment include:
• Vehicular access to the site (high level of control: hard surfaced access roads of adequate width and load-bearing capacity, kept clean and free of mud)
• Traffic management (high level of control: any queues for site access kept short in time and contained within the site; little impact of traffic on neighbours).
• Site security (high level of control: site fenced; no unauthorised site access; gates locked when site closed).
• Waste reception and record keeping (high level of control: reception office; staffed during all opening hours; all vehicles logged and loads checked; weighbridge installed and all weights logged). Note that the procedures for monitoring the records thus collected are assessed under (3).
• Waste unloading (high level of control: waste directed to a designated area; unloading supervised by site staff).
• Control over nuisance (high level of control: successful control of windblown litter, flies, vermin, birds and of 'mud' leaving the site on vehicle tyres)
• Control of fires (high level of control: no routine burning of wastes; no 'wild' fires; active fire prevention and emergency response systems in place in case of accidental fire)</td></tr>
<tr><td>a. No control
b. Low level of control
c. Medium level of control
d. Medium/High level of control
e. High level of control</td><td>0 is scored
5
10
15
20</td></tr>
<tr><td>Degree of control over both the waste treatment and disposal process in use at each site and over any potential emissions.

This criterion covers both the presence of the necessary technologies, and the operating procedures for their proper use.</td><td colspan="2">The nature of controls required will depend on both the process employed and on the potential emissions. As an example, the table below provides guidance on how the general principles can be applied to land disposal and thermal treatment (using the specific example of mass-burn incineration).
For biological treatment, the detail will vary with the type of process (e.g. windrow composting, in-vessel composting, anaerobic digestion). However, in all cases a 'high level' of control would imply a high degree of control over: the incoming waste (to avoid hazardous waste or contrary materials); processing temperature to ensure pathogen destruction; retention time in the process; mixing in the process (including turning of windrows); atmospheric emissions including odours and bio aerosols; and leachate collection and treatment.
Similar principles can be applied to other facilities, including mechanical-biological treatment (MBT) plants, advanced thermal treatment and new technologies for valorisation of organic waste in developing countries. In each case, the user may use the following scoring tables as a 'best judgment' guideline for scoring.
Where a fuel is being made from waste to be burnt elsewhere, then the assessment should include the process and emission controls at the user facilities.</td></tr>
</table>

Degree of monitoring and verification of environmental controls (Includes the existence and regular implementation of: robust environmental permitting/ licensing procedures; regular record keeping, monitoring and verification carried out by the facility itself; AND monitoring, inspection and verification by an independent regulatory body)	The environmental monitoring programme and process control record keeping required will be specific to the type of facility. • All sites must comply with the federal/national/local environmental legislation, have conducted an Environmental Impact Assessment (EIA) where necessary, have obtained the most recent permit/license and kept it up-to-date. • Permitting processes should be supportive of initiatives that improve environmental performance of the system. A lower score should be assigned if permitting processes for improved facilities have been unduly long and complex, while existing facilities continued to operate with much lower levels of (or no) environmental control. • For all sites it should include incoming waste volumes, weights and categories; at least occasional monitoring of waste composition and relevant properties; control of 'nuisance' (including windblown litter, flies, vermin, birds and 'mud' leaving the site on vehicle tyres); and control of odour, site fires, and emission of potential greenhouse gases (particularly methane and nitrous oxides, as well as carbon dioxide). • For all land disposal: ground and surface water. • For engineered and sanitary landfills: leachate and landfill gas management. • For thermal treatment: moisture content and calorific value of incoming wastes; temperature, residence time, emissions to air (including those of nitrogen oxides (NO), sulphur dioxide (SO2), hydrogen chloride (HCl), heavy metals and dioxins), effluent treatment and disposal, and the quantities and management methods of both fly ash and bottom ash. • For biological treatment: input waste controls (to protect both the process and the product quality); process control (temperature, residence time, mixing); product quality control; emissions controls; and greenhouse gas controls (particularly methane and nitrous oxides).	
	a. No compliance	0 is scored
	b. Low compliance	5
	c. Medium Compliance	10
	d. Medium/High compliance	15
	e. High compliance	20

***Table 2:** Score card for treatment and disposal facilities*

	Level of Control	Score	Land disposal	Thermal treatment
a.	**None**	0	Uncontrolled dumping–no controls	Uncontrolled burning lacking most 'control' functions
b.	**Low (Semi-controlled facility)**	5	Site staffed; waste placed in designated area; some site equipment	Site staffed; some containment and management of combustion process; basic operating procedures to control nuisance
c.	**Medium (Controlled facility)**	10	Waste compacted using site equipment; waste covered (at least irregularly)	Emission controls to capture particulates; trained staff follow set operating procedures; equipment properly maintained; ash properly managed
d.	**Medium/high (Engineered facility)**	15	Engineered landfill site: use daily cover material; some level of leachate containment and treatment; collection of landfill gas	High levels of engineering and process control over residence time, turbulence and temperature; emission controls to capture acid gases and capture dioxins; active management of flyash.
e.	**High (State-of-the-art facility)**	20	Fully functional sanitary landfill site: properly sited and designed; leachate containment (naturally consolidated clay on the site or constructed liner); leachate & gas collection; gas flaring and/or utilization; final cover; post closure plan	Built to and operating in compliance with international best practice including eg. EU or other similarly stringent stack and GHG emission criteria Flyash managed as a hazardous waste using best appropriate technology.

3. Comments and limitations

Collection of data for the indicator is not infeasible but it will require training and capacity development. The data on total municipal solid waste generation is globally available although the precision of data is disputable. In general, developed countries have solid waste data collection systems but most of the middle and low-income countries do not have data. In these countries and cities, household surveys and other complimentary surveys can be conducted for the estimation of municipal waste generation per capita.

However, one of the key challenges of data precision in the middle to low income countries is the lack of accurate population data in their jurisdiction, particularly regarding slums, where usually no waste collection service is available. In addition, collection of data such as the amount of waste adequately treated and disposed will be a challenge for many national and local governments. The judgement on the adequacy of treatment and disposal of all the waste management facilities, including composting, recycling, incineration facilities in a city, requires high level of technical capacity and large investment in human resources.

Considering the various situations on waste data availability in different countries, it would be better to have different methods to collect data from countries. For OECD or developed countries that already have data, distributing and collecting questionnaires to national officials from responsible ministries such as ministry of environment or urban development would be sufficient to collect legitimate data. For middle to low income countries without legitimate data, baseline surveys by waste management professionals together with monitoring capacity development will be necessary.

4. Disaggregation:

Data for this indicator can be disaggregated at the city and town levels.

- Disaggregation by location (intra-urban)
- Disaggregation by source of waste generation e.g. residential, industrial, office, etc.
- Disaggregation by type of final treatment and disposal

5. Data Sources

5.1 Municipal Solid Waste Generation Per Capita

For countries and cities that have the data already, data can be collected through questionnaires. For countries and cities that do not have the data, a household survey to identify daily waste generation should be done, at least two times a year in different seasons. In the household survey, liner bags would be distributed to each household to be surveyed and the household head asked to put 7 days of waste generated. The liner bags would then be collected and weighed. Determination of the households to be surveyed should be based on the income levels. Municipal waste from other sources such as markets, restaurants, hotels, schools, etc. should also be measured.

5.2 Population in the City

- Population census

5.3 Municipal Solid Waste Regularly Collected with Adequate Final Treatment and Disposal

Survey on the qualitative judgement of waste treatment and facility as well as daily amount of waste received by the facilities is required. The sheet below can be utilised.

Survey Sheet Example for Recycling and Treatment Facilities

Treatment facility name	Degree of control score	Process employed	Type of waste	Amount of solid waste received	Amount of sewage sludge	Amount of residue	Where residue is exported
	(1)			(t)	(t)	(t)	
	(2)						
	(3)						
	(1)			(t)	(t)	(t)	
	(2)						
	(3)						

Survey Sheet Example for Disposal Facilities

Landfill sites name	Landfill type	Operation start year	Degree of control score	Amount of MSW received	Amount of sewage sludge received
			(1)	(t)	(t)
			(2)		
			(3)		
			(1)	(t)	(t)
			(2)		
			(3)		

6. Data Availability

6.1 Description:

The existing global waste data collection system includes the UNSD/UN Environment Questionnaire on Environment Statistics (waste statistics), the OECD/Eurostat Questionnaire on Waste Statistics and UN-Habitat's City Prosperity Index (CPI). The existing data collection system provides many necessary statistics for calculation of this indicator. Nevertheless, further work remains to be done to provide all of the basic statistics necessary for the indicators.

The UNSD/UN Environment Questionnaire on Environment Statistics covers the non-OECD/Eurostat countries while the OECD/ Eurostat Questionnaire covers the remaining countries. They both include statistics on waste generated at the national level, municipal waste collected and treated at the national level, the composition of municipal waste, and the generation and treatment of hazardous waste.

In addition, the UNSD/UN Environment Questionnaire on Environment Statistics includes municipal waste collected and treated at the city level and currently there are data for 168 cities. Some waste data are being collected at the city level by UN-Habitat and UN Environment and published in reports such as the Status of Solid Waste Management in the World Cities (2010) by UN-Habitat and Global Waste Management Outlook (2015) by UN Environment.

These reports include solid waste data such as total waste generation, collection coverage and percentage of waste by treatment and disposal types, which have been collected in 39 cities.

6.2 Time series:

The indicator can be updated annually or biennially depending on the data source stated above.

7. Data collection and data release calendar

The data can be released annually, and the monitoring of the indicator can be repeated at annual intervals, allowing for several (15) reporting points until the year 2030. The initial data is planned for release at the city level in April 2018. Thereafter annual releases of data will be undertaken every month of April.

8. Data compilers

Name: UN-Habitat, National statistical agencies and city management teams.

National statistical agencies and city management teams will lead the compilation and reporting at the national level. Global and regional reporting will be done by UN-Habitat. The collection of the data is possible through the collaboration of international institutions (UN-Habitat, UN Environment, The World Bank, AfDB, IDB, EBRD and ADB) and bilateral donors (JICA, GDZ, etc.). Conducting surveys and capacity development on data collection systems will be required.

9. Indicator revision suggestion based on the Expert Group Meeting

In January 2017, UN Habitat organized an expert group meeting for the indicator 11.6.1 refinement inviting waste management experts worldwide. As a result, the revision of terminology both in the target and indicator was proposed as follows:

1. ***Change of the terminology from 'urban solid waste' to 'municipal solid waste' in the indicator***

In the EGM held on January 2017, many experts expressed that the monitoring scope should focus on 'municipal solid waste' because this has clear and internationally agreed definition both theoretically and practically. On the other hand, there is no internationally agreed definition for 'urban solid waste' and this will invite confusion in the monitoring at the city and country level. From the point of practicality of monitoring implementation, it was suggested that focusing on the clearly defined concept is important.

The other indicator 12.4.2 already addresses solid waste other than municipal solid waste such as hazardous and industrial waste, therefore:

2. ***Change of the terminology from 'discharge' to 'treatment and disposal' in the indicator***

Many experts agreed 'discharge' is a terminology in the wastewater treatment field, hence should be changed to 'treatment and disposal' to clearly capture the solid waste management issues.

Polluted water and a small garbage dump in Mumbai, India © picdn.net.

3. Removal of the terminology 'and other' in the target

Most of the experts agreed that the terminology between target and indicator should be consistent. It was already suggested that the monitoring scope should be 'municipal solid waste' therefore the terminology in the target should also be consistent in 'municipal solid waste'. Hence the removal of 'and other' was suggested.

Based on the suggested revision in the terminologies in both target and indicator, concepts and definition were refined as presented in the concepts and definitions section above.

10. Recommendations

In January 2018, UN Environment and UN Habitat held a joint expert group meeting on SDG waste indicators that focused on methodological development of SDG indicators 11.6.1, 12.4.2 and 12.5.1 and as a made the following recommendations:

Recommendations for Indicator 11.6.1 on Urban Solid Waste

- Municipal solid waste refers to collected waste, but for the SDGs, it is more logical to look at generated waste not only collected waste.
- Ideally, the definition of a city should include both administrative boundaries and other built up areas, particularly due to the fact that rapid urbanization, which often occurs outside administrative boundaries, is a large concern in terms of waste management.
- It is important to provide a clear guidance on which cities should be included in national aggregates and the methodology for selecting a representative sample of cities for this indicator are needed.
- Possibly consider splitting this indicator into two components related to collection rate on one hand and safe disposal on the other which may provide additional information to policy makers. Additionally, additional information on the frequency of collection may be useful.
- The terms "adequate" and "regulated" are not well defined in national legislations. Perhaps the wording should shift to "controlled".
- In the methodology, it would be useful to provide information on meaningful disaggregation of the data, including separating waste by type.
- JICA and UN Habitat will work together to provide guidelines on an estimation procedure for estimating waste generation and consult with the Expert Group participants.
- Rewording of the indicator 11.6.1 as "Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal solid waste generated, by cities".

Garbage accumulated in a city © UN-Habitat

Recommendations for the 3 indicators (11.6.1, 12.4.2 and 12.5.1)

1. Harmonization and comparability

- Harmonization in the measuring approach for 11.6.1 on urban solid waste, 12.4.2 on hazardous waste and 12.5.1 on recycling. Additionally, the indicators should also be considered in the broader context of the SDGs in terms of using harmonized language and definitions to the extent possible. It was agreed to exclude mineral wastes from all denominators.
- All indicators should provide a phased approach which will provide guidance for countries and cities with little expertise in monitoring waste to start developing a waste monitoring system, while at the same time providing guidance for those wishing to move up the ladder in terms of improving existing waste monitoring systems.
- The importance of maintaining a consistent time series for the purpose of analysis must be considered and mitigated when introducing methodological improvements.

2. Calculating generated waste and filling data gaps

- For all three waste indicators, the denominator should be based on waste generated, where 'generated' is defined not by collection but by an estimate of how much waste is produced during the time frame being considered.
- UN Habitat and OECD each have definitions but none are true reflections of municipal boundaries in the context of waste management and thus this area needs more work. Additionally, city data for all indicators would massively increase the reporting burden thus there is a need to consider either just national data or using the national sample of cities approach developed by UN Habitat.
- The global reporting for all three indicators should include country and city data which is supplemented by modeled or estimated data. The methodology should provide transparent guidance for countries on estimation methodologies. Additionally, it is beneficial to utilize academic and other experts to fill data gaps with estimates.
- A material flow approach was recommended as a method for capturing waste generation, waste flows and circular economy in a single statistical framework. The material flow account would also provide benefits in terms of linking the waste related indicators to the other SDG indicators on domestic material consumption (under SDG target 8.4 and 12.2).

Irregular garbage collection in a city © tribuneindia.com

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12. Related indicators

6.3.1: Proportion of wastewater safely treated

12.3:Global food loss index

12.4.2: Hazardous waste generated per capita and proportion of hazardous waste treated and by type of treatment

12.5.1: National recycling rate

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