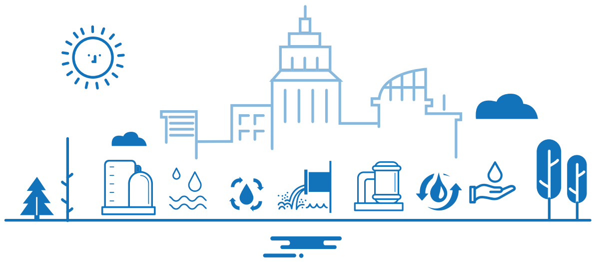
MODULE 9

SAFE WASTEWATER TREATMENT

UN-HABITAT
FOR A BETTER URBAN FUTURE



SAFE WASTEWATER TREATMENT

TARGET 6.3: *By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.*

Indicator 6.3.1*:Proportion of wastewater safely treated*

Suggested Citation:

UN-Habitat (2018). SDG Indicator 6.3.1 Training Module: Safe Wastewater Treatment. United Nations Human Settlement Programme (UN-Habitat), Nairobi.

SECTION 1:

INTRODUCTION

1.1 Background

Good water quality is essential to human health, social and economic development, and the ecosystem. However, as populations grow and natural environments become degraded, ensuring sufficient and safe water supplies for everyone is becoming increasingly challenging. A major part of the solution is to produce less pollution and improve the way we manage wastewater. A sustainable economy requires attention to value wastewater for its potential. Safe wastewater management could help protect the ecosystems.

SDG target 6.3 sets out to improve ambient water quality, which is essential to protecting both ecosystem health (target 6.6 and SDGs 14 and 15) and human health (recreational waters and drinking water sources, target 6.1), by eliminating, minimizing and significantly reducing different streams of pollution into waterbodies. The main sources of pollution include wastewater from households, commercial establishments and industries (point sources), as well as run-off from urban and agricultural land (non-point sources).

Currently, there is only a small amount of data available on wastewater treatment at the global scale, but some sources estimate about 80 per cent of all wastewater generated globally is discharged without any treatment.

Source: World Water Development Report, Wastewater: The Untapped Resource (UN-Water, 2017)

This indicator 6.3.1 aims to measure and monitor the progress in wastewater treatment and management at household and industrial levels. Wastewater generated by households can result in the spread of pathogens and detrimental nutrient loadings in receiving waters if it is discharged without treatment. Wastewater generated by economic activities such as manufacturing industries may contain a variety of pollutants, including hazardous substances. The indicator also aims at eliminating all inadequate disposal of waste (dumping) and minimizing the generation, use and discharge of hazardous substances.

The focus on recycling (such as recirculating water within an industry) and safe reuse (e.g. using wastewater in agriculture) is complementary to the focus on reducing freshwater withdrawals and improving use efficiency.

A young boy sits over an open sewer in the Kibera slum Nairobi © Wikimedia Commons

1.2 Wastewater and Cities

By 2030, global demand for water is expected to grow by 50%. Most of this demand will be in cities and will require new approaches to wastewater collection and management. Indeed, reused wastewater may help address other challenges including food production and industrial development.

Mainly in low-income areas of cities and towns within developing countries, a large proportion of wastewater is discharged directly into the closest surface water drain or informal drainage channel, sometime without or with very little treatment.

In addition to household effluent and human waste, urban-based hospitals and industries such as small-scale mining and motor garages, often dump highly toxic chemicals and medical waste into the wastewater system. Even in cities where wastewater is collected and treated, the efficiency of treatment may vary according to the system used.

Traditional wastewater treatment plants may not remove certain pollutants, such as endocrine disruptors, which can negatively affect people and the ecosystem.

Case Study

Dual distribution systems delivering reclaimed water. Since 1977 in St Petersburg, Florida, USA, a parallel network of pipes, separate from potable water mains, has served a mix of residential properties, and commercial and industrial parks, enabling them to use recycled water for irrigation, laundry, vehicle and building washing, and ornamental water features.

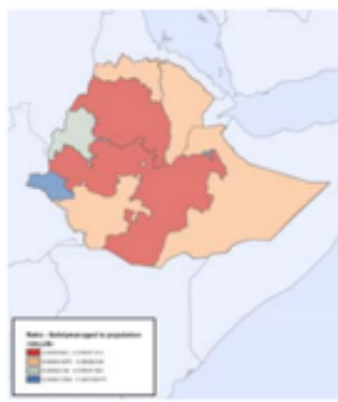
Biologically purifying wastewater before discharging. The effluent volume from Schiphol Airport, Amsterdam, is comparable to that of a small city with a population of 45,000. About half of the wastewater originates from passengers and businesses at the airport, 25% is discharged by aircraft and catering, and the remaining volume is produced by other aviation-related businesses. The on-site wastewater treatment plant biologically purifies water to a quality fit for discharge into local waterways.

An industrial ecosystem. In Kalundborg, Denmark, the by-products of one enterprise are used as a resource by other enterprises, in a closed cycle. The Asnæs Power Station receives 700,000 m^3 of cooling water from Statoil each year, which it treats and then uses as boiler feed water. It also uses about 200,000 m^3 of Statoil's treated wastewater for cleaning each year.

1.3 Rationale for Monitoring

Monitoring is not an end but rather a means to implement more effectively and efficiently. High-quality data helps policy and decision makers at all levels of government to identify challenges and set priorities, identify interlinkages across sectors to harness synergies, manage potential conflicts and learn about good practices. Data communicates progress over time, or lack thereof; helps ensure accountability between governments and their citizens; and helps raise awareness and gain political support, all of which stimulate investment.

The availability of safe and sufficient water supplies is inextricably linked to how wastewater is managed. Increased amounts of untreated sewage, combined with agricultural runoff and industrial discharge have degraded water quality and contaminated water resources around the world. Globally, 80% of wastewater flows back into the ecosystem without being treated or reused, contributing to a situation where around 1.8 billion people use a source of drinking water contaminated with faeces, putting them at risk of contracting cholera, dysentery, typhoid and polio. Far from being something to discard or ignore, wastewater will play a major role in meeting the growing water demand in rapidly expanding cities, enhancing energy production and industrial development, and supporting sustainable agriculture.



Population density overlaid on leakiness from variou sanitation services, Ethiopia sub-national; second figure showing proportion of safety treated wastewater per person in Ethiopia(darker colours denote less safe)

a) Monitoring and Reporting Process

DATA COLLECTION

National Statistical Agencies are responsible for data collection.

CAPACITY DEVELOPMENT

UN-Habitat and WHO will lead the global responsibility of capacity building of National governments and statistical agencies for reporting purposes.

Additionally, partners will support various components (systems, tools development and capacity strengthening, etc.) to ensure uniform standards in analysis and reporting on this indicator.

DATA RELEASE

Countries are expected to fully report on this indicator more consistently after 2-3 years.

The monitoring of the indicator will be repeated at regular intervals of 3 years, allowing for the reporting points until the year 2030.

National governments/ national statistical agencies have the primary responsibility of reporting at national level

b) Steps for Progressive Monitoring

The methodology for Indicator 6.3.1 – recognizing that countries have different starting points when it comes to wastewater monitoring – allows countries to begin monitoring efforts at a level in line with their national capacity and available resources, and from there advance progressively.

1. As a first step, the indicator can be populated based on estimation of total wastewater generation by households from household surveys and population records, and estimation of proportion of wastewater received and treated from institutional/ utility records.
2. Progressive monitoring can be achieved through initial assessments using pre-developed tools and secondary data from existing wastewater monitoring at household and service provider levels, as well as from the country-based wastewater management regulators.
3. For more advanced steps, a full assessment using household survey and service provider tools to fill gaps in secondary data or generate more reliable or more national representative data may be used as described in Part A, activity one.

It is recommended that the following organisations and institutions be consulted during the assessment:

- Organisations responsible for regulating and/or licensing emptying, transport and treatment services for wastewater and faecal sludge.
- Senior line ministry officials responsible for sanitation service provision and wastewater treatment.
- Senior level representatives in organisations responsible for emptying, transport and treatment services.
- External agencies engaged in supporting sanitation services within a given country. These could include UN Agencies, academic institutions, NGOs, donors, private investors or consultants; and
- Other persons with an interest in and/or knowledge of sanitation services in the location.

c) Concepts and Definitions

Improved water quality implies adequate quality of receiving water bodies so that they do not present risks to the environment or human health.

Reducing pollution: Pollution reduction implies both minimizing production of pollutants at source and reducing the discharge of polluting substances. Both point and non-point sources of pollution need to be considered. Point sources are frequently associated with discharges of domestic/municipal wastewater and a large proportion of non-point sources come from run off from both rural and urban areas. These sources constitute both agricultural runoff in rural areas and contaminated surface water from urban areas.

Eliminating dumping: Dumping of wastes refers to the inadequate disposal of both liquid and solid wastes. It relates to the disposal of solid wastes and associated liquid components that are leached into water resources A good example would be the leachates produced by poorly managed solid waste disposal sites. These constitute a risk from both the possibility of hazardous substances present and their oxygen-depleting capacity.

Minimizing release of hazardous chemicals and materials: This relates to the discharge of certain hazardous substances, which are currently defined in the conventions of Basel, Rotterdam and Stockholm. Management is related to waste minimization strategies , however there is a component that relates to the impact of treatment on such components, and illegal dumping.

Untreated wastewater refers to: a) Wastewater generated by households which does not undergo treatment as defined by SEEA treatment ladders: primary, secondary, and tertiary to advanced treatment. b) Wastewater generated by hazardous economic activities which does not undergo treatment as defined by SEEA treatment ladders. In particular, hazardous (as defined by ISIC) industrial wastewater discharges can be verified against discharge permits.

And increasing recycling implies recycling of water within the same industry or establishment (on site).

Safe reuse implies wastewater supplied to a user for further use with or without prior treatment, and excludes water which is recycled within industrial sites. The term ‘Safe reuse’ may be defined using a combination of treatment levels (as defined by SEEA) and use types as a proxy for 2006 WHO Guidelines for safe use of wastewater.

Percentage of wastewater safely treated refers to the proportion of wastewater generated by households and by economic activities which is safely treated as a percentage of total wastewater generated by households and economic activities.

Halving the proportion of refers to: a) Halving the proportion of wastewater generated by households which is untreated b) Halving the proportion of wastewater generated by all hazardous economic activities (based on ISIC categories) which is untreated.

2.

2.1 How do we Measure Proportion of Wastewater Safely treated?

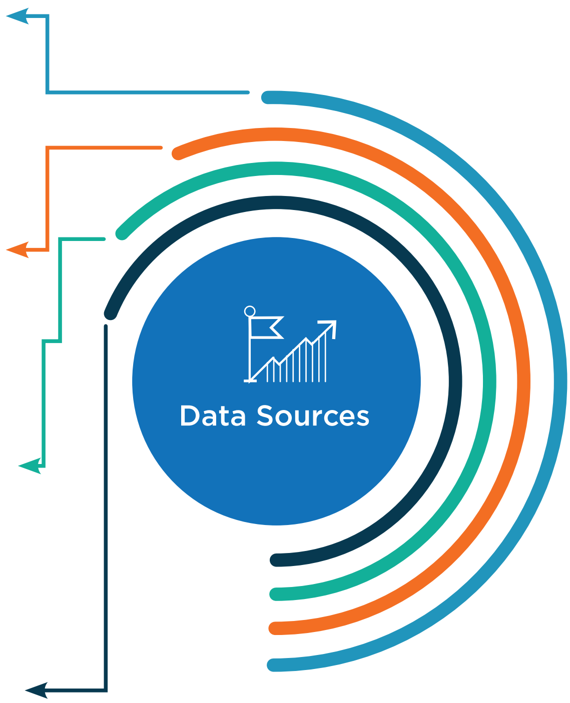
This section focuses on the potential data sources, stepwise criteria for assessing proportion of wastewater safely treated. The systematic methodology for Indicator 6.3.1 explains how to monitor the proportion of wastewater safely treated, computational steps, and recommendations on spatial and temporal resolutions.

National household surveys and censuses. These data can be aggregated and extrapolated to "percentage of population" variable - this provides the foundation on which to monitor flows along the chain

Institutional records and reports from relevant servise providers and regulators can be used to inform the "of which transported and delivered to treatment plants" variable and the " of which treated at treatment plants" variable, particularly for offsite sanitation

Useful additional data sources for these variables include the United Nations Statistica l Division(UNSD); International Benchmarking Network for Water and Sanitation(IENET) and AQUASTAT online databases

Ongoing studies and published literature can be used to establish a credible estimate for a typical percentage for each type of system in a given country, for the "of which contained" variable.



UNIT 1:
PART A; WASTEWATER FROM HOUSEHOLDS

Part A responds to the target wording "halving the proportion of untreated wastewater" by monitoring household and non-hazardous economic waste that is treated in municipal treatments plants. The methodology is dual-purpose with indicator 6.2.1 "the proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water" This approach should lead to efficiencies in data collection, allowing the fate of household wastewater from all sanitation sources to be analysed together and guide investment towards the parts of the service chain where the greatest need exists.

The key elements are further explained below:

Improved sanitation facilities	These include flush or pour flush toilets connected to a piped sewer system, septic tank, or pit latrine; ventilated improved pit (VIP) latrines; pit latrines with slab; and composting toilets.
Safely disposed/treated in situ	When pit latrines and septic tanks are not emptied, the excreta may remain isolated from human contact and can be considered safely managed. For example, with the new SDG indicator, households that use twin pit latrines or safely abandon full pit latrines and dig new facilities, a common practice in rural areas, would be counted as using safely managed sanitation services.
Treated offsite	Not all excreta from toilet facilities that is conveyed in sewers (as wastewater) or emptied from pit latrines and septic tanks (as faecal sludge) reaches a treatment plant. For instance, a portion may leak from the sewer itself or, due to broken pumping installations, be discharged directly to the environment.

Not shared with other households:

The possible negative impacts of shared sanitation facilities have long been debated.

The main concerns centre on human rights, safety and dignity, with health as an important but secondary issue. It is acknowledged that this is very much a contextual issue, and for the purposes of global monitoring WHO/UNICEF JMP will exclude shared facilities from basic and safely managed services.

Similarly, a portion of the faecal sludge emptied from containers may be discharged into open drains, to open ground or water bodies, rather than being transported to a treatment plant. Finally, even once the excreta reaches a treatment plant, a portion may remain untreated due to dysfunctional treatment equipment or inadequate treatment capacity, and be discharged to the environment. For the purposes of SDG monitoring, adequacy of treatment will be assessed through consideration of both the overall treatment effectiveness and end-use/disposal arrangements.

Therefore, the percentage of population with safely treated wastewater is computed as:

The fraction of households using a basic sanitation service whose excreta:

- Are carried through a sewer network to a designated location (e.g. treatment facility) and are treated at a treatment plant to an agreed level; or
- Are emptied from septic tanks or latrine pits by an approved method that limits human contact and transported to a designated location (e.g. treatment facility) and treated to an agreed level; or
- Are not emptied but stored on site (e.g. in a twin pit latrine) until they are safe to handle and re-use (e.g. as an agricultural input).

Data requirements to compute treatment of wastewater generated by households.

Figure 2 shows the proposed monitoring framework with the data required to calculate treatment of wastewater generated by households.

	Type of system	% of Popn (P)	Of which Contained (_C)	Of which Safely disposed insitu (_S)	Of which Emptied for trans-port (_E)	Of which Transport-ed and delivered to treatment plants (_D)	Of which treated at treatment plants (_T)	Safely managed
Improved	Piped sewers	PSP	PS_C			PS_D	PS_T	PSSM
Improved	On site sanitation (Septic tanks, improved pit latrines, or composting toilets) (OS)	OSP	OS_C		OS_E	OS_D	OS_T	OSSM
				OS_S				
Improved	Total improved (TBP)	(PSP + OSM)				Totally safely managed (SMS)		(PSSM + OSSM)
Shared or public latrines of an otherwise acceptable typr (SH)		SHP						
Unimproved facilities (UN)		UNP						
Open defecation		ODP						
Total non-basic sanitation (NBP)		(SHP + UNP + ODP)						
Total improved + total non-basic sanitation		(TBP + NBP)						

SDG 6.2 Sanitation ladder	
Safety management services	SMS
Basic services (BSS)	(TBP - SMS)
Shared services	SHP
Unimproved services	UNP
No sanitation services	ODP

Figure 2: Data requirement table for wastewater treatment generated by households

The unit of measurement for all the data points or variables (shown with abbreviations in the white cells) is the '*percentage of the population*'. So for example PSP = percentage of population using "to piped sewers"; and PS_T = percentage of population using to piped sewers whose excreta reaches a treatment plant, which is "Treated at treatment plants".

Activity One:

Systematic Data Collection and Computation of Wastewater Generated by Households.

Step 1: Data should be compiled from sources such as household surveys and censuses. This should include data on the proportions of population using each of the four basic household sanitation types/facilities and those using unimproved sanitation–shared, unimproved and open defecation

Step 2: It is recommended that an initial assessment be made using available secondary data. This can be the twitch point to have further engagement with the countries for 'full assessment' of safely managed sanitation services. The initial assessment will draw on household surveys and censuses plus a review of available secondary data provided by utilities, regulators, line ministries, researchers or other people with appropriate technical expertise, to enable estimates to be made of the proportion of households whose excreta is treated offsite or safely disposed in situ.

Step 3: Where the 'initial' assessment identifies important knowledge gaps and elements of the sanitation that require verification, a 'full' assessment involves feedback from countries filling these gaps, use of specially designed monitoring tools, like ad-hoc data collection in strategically selected countries etc. The key questions to be addressed in the initial assessment are summarized in Table 1 (see annex 1).

The 'full' assessment tools include both household questionnaires and service provider survey instruments.

Household questionnaires: Build on existing household surveys and national censuses, household surveys could be extended to include questions on:

- The immediate downstream fate of household generated wastewater (e.g. outlet is connected to a piped sewer or to an open drain or to a water body etc.);
- Emptying and transport from an onsite container, if any is used.
- Disposal in situ.

When used with a statistically robust sampling frame and sample size, the household questionnaires can be used to derive or verify the following framework variables: 'percentage of population using system connected to a particular containment type or not', 'of which contained', 'of which safely disposed in situ' and 'of which emptied for transport'.

Service provider surveys: Interviews and observation surveys can gather performance data from public and private faecal sludge emptying and transport service providers (both formal and informal service providers) as well as treatment plant service providers. Where necessary they can also be used with service providers who operate sewer networks and the associated treatment plants as well. Two types of surveys to be conducted with the service providers include;

1. The emptying and transport (E&T) service provider survey is designed for use in the same location that the household questionnaire was implemented, and will be used to inform the 'of which emptied for transport' and 'of which transported to treatment' variables for onsite sanitation systems. The survey includes questions on:

- The number of septic tanks and pit latrines emptied over an agreed time period.
- The disposal sites used (e.g. to a treatment plant, to a sanitary landfill or to a water body).
- The proportion of all trips made to each disposal site.

2. The treatment service provider survey which is designed for use in the same location that the emptying and service provider surveys and household questionnaires were implemented. The survey will be used to inform the 'of which safety treated at treatment plants' variable for the onsite sanitation systems. The survey includes questions on:

- Process used and level to which excreta is treated (e.g. planted drying beds)
- Installed treatment capacity (e.g. m^3/year)
- Plant performance data (e.g. volume of faecal sludge delivered to the treatment plant (m^3/year) and volume of treated faecal sludge complying with discharge limits (m^3/year)).

In absence of treatment data, as well as to validate and verify the treatment data, data from geospatial information and earth observations could be used. For example, if a treatment plant is fully operational, and supposedly treating the receiving faecal and wastewater matters, then there should not be much evidence of surface water pollution, like eutrophication, formation of harmful algae-blooms, detection of chlorophyll-a in the receiving water bodies etc..

Step 4: Prepare a simple (excel-based) spreadsheet comprising overall waste water flows from household to obtain percentage of wastewater safely treated that originates from household sources.

Example:

Results from monitoring of wastewater generated by households in a middle- income country in the Latin American and Caribbean region. The figure below diagrammatically shows the percentage of wastewater from household sources (on-site and off-site) that is safely treated - which accounts for 33% of the total waste as shown in dark green variables

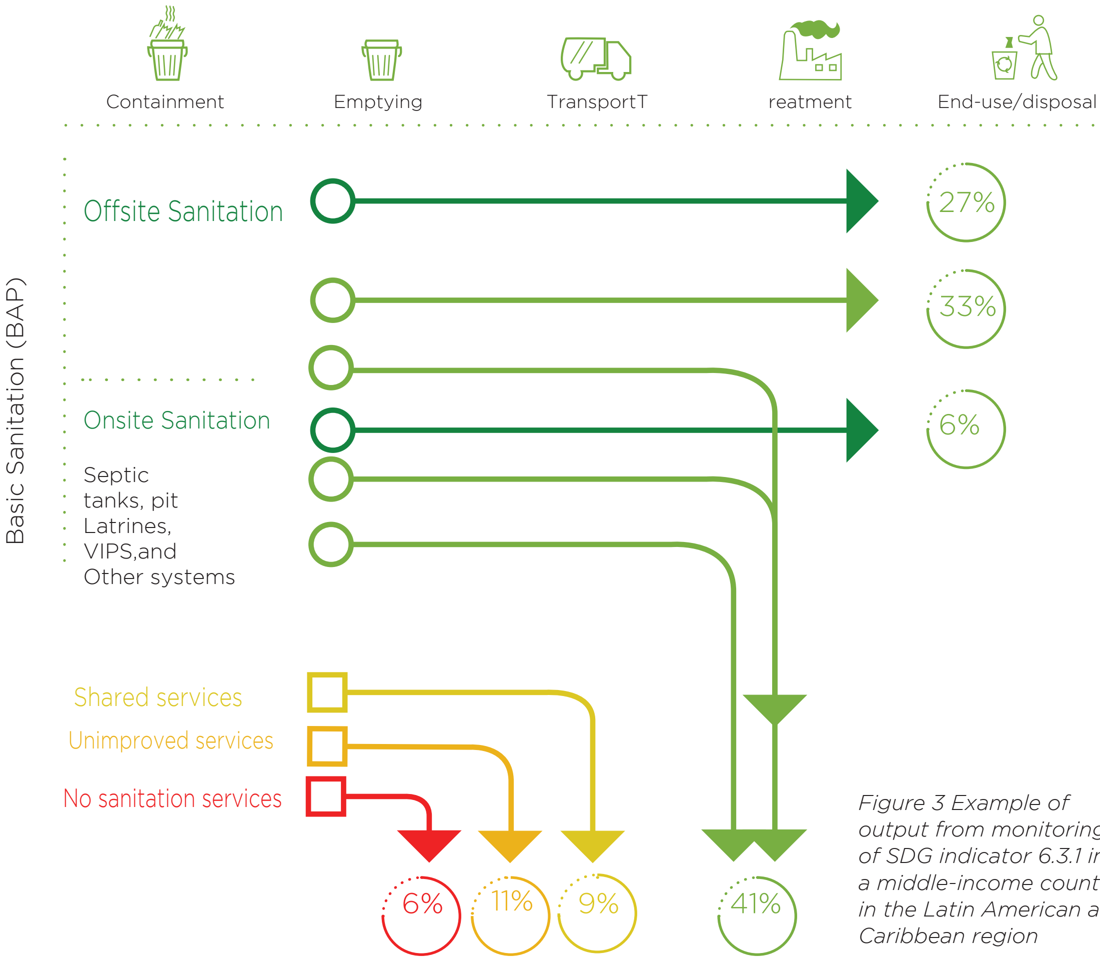


Figure 3 Example of output from monitoring of SDG indicator 6.3.1 in a middle-income country in the Latin American and Caribbean region

Monitoring the safely treated wastewater generated by households will require tracking how household wastewater and excreta are managed along the sanitation chain. Monitoring at each step of the chain captures the fate of all wastewater generated by households, not only the percentage that is treated at treatment works, but also the fraction that is safety treated in-situ, or that leaks from sewers, or that is dumped untreated in the environment.

UNIT 2:
PART B: WASTEWATER FROM ECONOMIC ACTIVITIES

Wastewater considered under this part of the monitoring framework of GEMI (Global Expanded Monitoring Initiative) addresses sources from industry and commercial activities. This includes not just productive industries and processes, but also commercial and institutional sources, of both public and private character.

Data requirements to compute treatment of wastewater generated by households

The sources of data are related to:

1. Wastewater from commercial establishments
2. Wastewater from non-hazardous industries
3. Wastewater from hazardous industries

Type of wastewater	Remarks	Data Sources
Commercial/institutional wastewater	An inventory of commercial establishments will be compiled, drawing on the various sources of information. The wastewater production capacity of the institution will be estimated/computed based on two figures. 1. A knowledge of the industry and its production processes. 2. Function of the mains water supplied.	1. Data from regulatory authorities. 2. Data from water and sanitation utilities. 3. Data computed from specific industries, based on billed water consumption. 4. Data compiled from registries of industries and or local authority records
Non-hazardous industrial wastewater	UNIDO industrial registers (available for most countries) will be used to specify the specific ISIC coded industries.	Billed water consumption data will be used to estimate where possible estimated flows.
Industrial wastewater	An inventory of industrial establishments will be compiled based on ISIC codes	The estimated production capacity will be collected from permit information an estimations of wastewater production computed. If regulatory data is available, this will also be used.

Type of wastewater	Remarks	Data Sources
Hazardous industrial wastewater	The sub-set of industries that produce hazardous wastewater, as defined by standard ISIC codes or those who use "red list" substances in their processes.	In some cases industries are allowed to discharge limited amounts if they have a permit to do so. The discharges are closely monitored

Additional remarks in data requirements

- The total volume of industrial wastewater (the denominator) can be reliably estimated from an inventory of industries, which will be available in the vast majority of member states. This can be populated from databases and records held by Ministries of Industry, Tax offices, local authority registries etc. For each industry, records will be available on the amount of water they abstract from municipal supplies or from boreholes or other sources. Given the knowledge of the type of industry (from International Standard Industrial Classification from all economic activities, revision 4, ISIC Rev4) and a mass balance of products in and out, the proportion of wastewater flow generated as wastewater can be estimated.
- The method described above might not cover small-scale or informal industries. As most of these activities occur in urban centres, or in their peripheries, available GIS tools, including high resolution remotely sensed images could be used to estimate such components.

Activity Two:
Systematic Data Collection and Computation of Wastewater Generated by Households.

Step 1: Prepare an inventory of ALL sources of economic activities (industrial and commercial, disaggregating by:

- Commercial establishments;
- Non-hazardous industries
- Hazardous industries

This should include estimate of "informal" industries using walk through audits of informal areas (note this will only give qualitative information)

Step 2: Gather data on the wastewater production from each establishment by flow, BoD, or population equivalent. Estimates of the size of wastewater production can be made using metered water supply volumes or number of employees at the establishment.

Step 3: Establish those industries from Step 1 above which under ISIC classifications are defined as hazardous OR utilising red list substances and those industries governed by permitted discharges from Local EPA registers (if any).

Step 4: Prepare a simple (excel-based) spreadsheet comprising overall waste water flows from commercial and industrial sources up-aggregate the information from each locality to obtain national estimates to record and calculate the total hazardous flows in compliance as a proportion of all hazardous flows.

Depending on the level of information available, it may be possible only to report on the proportion (or number) of industries that comply rather than computation of actual proportions based on volumetric flows.

Recommendations on Spatial and Temporal Coverage

Spatial coverage

There are often distinct differences in the manner that sanitation and wastewater services are managed in rural and urban-areas. For example, in rural areas of Africa and South Asia, people use of pit latrines and septic tanks –onsite sanitation not connected to sewers predominates- while a mix of onsite sanitation and connections to sewerage often serves households in towns and cities. In each country, it is recommended that monitoring collect data from different locations and potentially different data sources representative of both urban and rural settings in order to capture the full range of scenarios needed for a national estimate.

Temporal coverage

Temporal coverage will depend on the availability of data. The regression methods used to create estimates will allow estimates to be produced for any year desired, including years for which no data points are available. However, there will be a limitation in the duration of extrapolation after the most recent data point from household surveys and service providers.

2.2 General Limitations

Data on safe disposal and treatment remain scarce, and will not be available all countries immediately. However, sufficient data exists to make global and regional estimates of safely treated wastewater by 2018.

Data Limitations	Possible Solutions
Data on safe disposal and treatment remains scarce, and will not be available for all countries immediately	Sufficient data exists to make global and regional estimates of safely treated wastewater by 2018

References

1. WHO, & UNICEF. (n.d.). Monitoring SDG Targets for WASH and Wastewater. Retrieved from Joint Monitoring Program for Water Supply and Sanitation: https://www.wssinfo.org/fileadmin/user_upload/resources/Methodological-note-on-monitoring-SDG-targets-for-WASH-and-wastewater_WHO UNICEF_8October2015_Final.pdf
2. http://unstats.un.org/unsd/cr/registry/isic-4.asp
3. World Bank Water and Sanitation Program, 2014.
4. Baum, R., Luh, J., Bartram, J., (2013). Sanitation: a global estimate of sewerage connections without treatment and the resulting impact on MDG progress. Environ. Sci. Technol. 47, 1994–2000, http://dx.doi.org/10.1021/es304284f
5. Corcoran, E., C. Nellemann, E. Baker, R. Bos, D. Osborn, H. Savelli (eds) (2010). Sick Water? The central role of wastewater management in sustainable development. A Rapid Response Assessment. United Nations Environment
6. Programme, UN-HABITAT, GRID-Arendal. www.grida.no ISBN: 978-82-7701-075-5
7. Malik O., Hsu A., Johnson L., and de Sherbinin, A. (2015). A global indicator of wastewater treatment to inform the Sustainable Development Goals (SDGs). Journal of Environmental Science and Policy 48, 172 to 185.
8. Peal, A., Evans B., Blackett, I. Hawkins, P. and Heymans, C. (2014). Fecal Sludge Management: analytical tools for assessing FSM in cities. Journal of Water, Sanitation and Hygiene for Development 4 (3), 371–383.
9. Raschid-Sally, L. and P. Jayakody. 2008. Drivers and characteristics of wastewater agriculture in developing countries: Results from a global assessment, Colombo, Sri Lanka. IWMI Research Report 127, International Water Management Institute, Colombo. 35pp.
10. SuSanA (2015). Website of the The SFD Promotion Initiative. Managed by GIZ under the umbrella of the Sustainable Sanitation Alliance (SuSanA). Available at: http://sfd.susana.org
11. UNDESA (2012). International Recommendations for Water Statistics (IRWS). UN Water. Available at: http://unstats.un.org/unsd/envaccounting/irws/

12. UN-Water Meta data note for SDG 6.
13. WHO/JMP (2015). WHO JMP Green Paper: Global monitoring of water, sanitation and hygiene post-2015. Geneva, Switzerland
14. WHO/UNICEF/JMP (2015). WASH Post-2015: Proposed indicators for drinking water, sanitation and hygiene. Briefing note. Geneva, Switzerland.
15. Williams, A., and Overbo, A. (2015). Unsafe return of human excreta to the environment: A literature review. The Water Institute at UNC, Chapel Hill, NC, USA.
16. International Finance Corporation (IFC). (2007). Environmental, Health, and Safety General Guidelines. Washington: World Bank.
17. The World Bank Group. (1998). Pollution Prevention and Abatement Handbook 1998 - Towards Cleaner Production. The World Bank Group in collaboration with the United Nations Environment Programme and the United Nations Industrial Development Organization. Washington D.C.: The World Bank Group.
18. UN Water. (2013). Water Quality Fact Sheet for World Water Day 2013. Retrieved 2015, from UN Water.Org:
19. http://www.unwater.org/downloads/water_quality.pdf
20. UNESCO. (2009). Water in a Changing World - The United Nations World Water Development Report 3. Paris & London: UNESCO & Earthscan.
21. United Nations Economic Commission for Europe (UNECE). (2007). Environmental monitoring and reporting by enterprises. Eastern Europe, Caucasus and central Asia. Geneva: UNECE.
22. United Nations Economic Commission for Europe (UNECE). (2012). Guidelines for developing national strategies to use air and water quality monitoring as environmental policy tools for the countries of eastern Europe, the Caucases, central Asia and south-eastern Europe. Geneva: UNECE.
23. United Nations Environment Programme (UNEP). (2008). Water Quality for Ecosystem and Human Health Second Edition. Ontario: UNEP Global Environment Monitoring System (GEMS).
24. United Nations Environment Programme (UNEP). (2010). Clearing the Waters - A focus on water quality solutions. Nairobi: Pacific Institute.
25. United Nations Industrial Development Organisation (UNIDO) and United Nations Environment Programme (UNEP). (1991). Audit and Reduction Manual for Industrial Emissions and Wastes. Vienna: UNIDO.
26. World Health Organisation (WHO). (2014, July). Media Centre, Water Fact Sheet. Retrieved January 16, 2015, from WHO: http://www.who.int/mediacentre/factsheets/fs391/en/#

ANNEX

TABLE 1: KEY QUESTIONS TO BE ADDRESSED IN THE INITIAL ASSESSMENT

Proportion of the population using each system type and method	System type	Of which contained	Of which safely disposed in-situ	Of which emptied for transport	Of which transported and delivered to treatment	Of which treated at treatment plants
	Piped sewers	Do some sewer pipe connections leak or does the pipe discharge directly to an open drain, water bodies or open ground? Estimate % contained ________ %	Are some septic tanks never emptied or emptied very rarely? Are some emptied and the excreta buried? If so, is the excreta safely emptied and safely buried? Estimate % safely disposed in-situ ________ %			What is level of installed treatment capacity? Are treatment plants overloaded? What is level of treatment plant performance? Estimate % treated ________ %
	Septic tanks	Are some septic tanks damaged or flooded so that they leak and/or are they connected to open drains, water bodies or open ground rather than to soak pits or sewers? Estimate % contained ________ %	Are some septic tanks never emptied or emptied very rarely? Are some emptied and the excreta buried? If so, is the excreta safely emptied and safely buried? Estimate % safely disposed in-situ ________ %	Do sewer pipes regularly leak (e.g. exfiltration and overflow) before reaching treatment? Estimate % transported and delivered to treatment? ________ %	Does all of the proportion 'emptied for transport' reach treatment or is some discharged to open drains, water bodies or to open ground? Estimate % transported and delivered to treatment? ________ %	What is level of installed treatment capacity? Are treatment plants overloaded? What do monitoring records indicate about treatment performance? Estimate % treated ________ %
	Pit latrines with slabs and VIPs	Are some pit latrines with slabs and VIPs damaged or flooded so that they leak and/ or are they connected to open drains, water bodies or open ground? Estimate % contained ________ %	Are some pit latrines with slabs and VIPs never emptied or emptied very rarely? Are some emptied and the excreta buried? If so, is the excreta safely emptied and safely buried? Are some emptied only once the excreta is safe to handle? Estimate % safely disposed insitu ________ %	Are some pit latrines with slabs and VIPs and the excreta transported away? If so, is the emptying done safely? Estimate % emptied for transport ________ %	Does all the proportion 'emptied for transport' reach treatment or is some discharged to open drains, water bodies or to open ground? Estimate % transported and delivered to treatment? ________ %	What is level of installed treatment capacity? Are treatment plants overloaded? What do records indicate about treatment performance? Estimate % treated ________ %

	Other systems including composting toilets	Are some other systems including composting toilets damaged or flooded so that they leak and/or are they connected to open drains, water bodies or open ground rather than to soak pits or sewers? Estimate % contained ________ %	Are some other systems including composting toilets never emptied or emptied very rarely? Are some emptied and the excreta buried? If so, is the excreta safely emptied and safely buried? Are some emptied only once the excreta is safe to handle? Estimate % safely disposed insitu ________ %	Are some other systems including composting toilets emptied and the excreta transported away? If so, is the emptying done safely? Estimate % emptied for transport ________ %	Does all the proportion 'emptied for transport' reach a treatment plant or is some discharged to open drains, water bodies or to open ground? Estimate % transported and delivered to treatment? ________ %	What is level of installed treatment capacity? Are treatment plants overloaded? What do records indicate about treatment performance? Estimate % treated ________ %

UN-HABITAT
FOR A BETTER URBAN FUTURE

United nations human settlements program
P.O. Box, 30030, Nairobi, 00100 Kenya.

For any inquiry, kindly contact
Robert Ndugwa: robert.ndugwa@un.org
Chief, Global Urban Observatory Unit
Research and Capacity Development Branch
UN-Habitat
www.unhabitat.org