WASTEWATER TREATMENT		
Freshwater	**Water Quality**	

1.   INDICATOR

(a)   Name: Wastewater treatment.

(b)   Brief Definition: Proportion of wastewater that is treated, in order to reduce pollutants before being discharged to the environment, by level of treatment.

(c)   Unit of Measurement: Percentage of volume of generated wastewater treated by primary treatment, secondary treatment, tertiary treatment or not treated.

(d)   Placement in the CSD Indicator Set: Freshwater/Water Quality.

2.   POLICY RELEVANCE

(a)   Purpose: This indicator assesses the potential level of pollution from domestic and industrial/commercial point sources entering the aquatic environment, and monitors progress towards reducing this potential within the framework of integrated water resources management. It helps to identify communities where wastewater treatment action is required to protect the ecosystem.

Wastewater from households and different industries represent a significant pressure on the environment and treatment is normally required before discharge. The indicator assesses the proportion of wastewater that undergoes different (primary, secondary and tertiary) levels of treatment. It includes the volume of wastewater treated at public wastewater treatment plants, industrial wastewater treatment plants and by independent wastewater treatment systems.   For treated wastewater from households (sometimes mixed with industrial wastewater in a public collecting system) to be considered acceptable it should undergo at least secondary treatment either at a public wastewater treatment plant, an independent wastewater treatment plant or in an industrial wastewater treatment plant (where usually the industrially generated wastewater is dominating). Industrial wastewater needs to undergo a treatment process which is to remove the specific pollutants generated by the production process to a limit which does not negatively affect the aquatic environment or human uses (in the case of direct discharges), or allows a proper treatment together with wastewater originating from household activities in a public wastewater treatment plant (indirect discharges).

(b)   Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Wastewater effluents can result in increased nutrient levels, often leading to algal blooms; depleted dissolved oxygen, sometimes resulting in fish kills; destruction of aquatic habitats with sedimentation, debris, and increased water flow; and acute and chronic toxicity to aquatic life from chemical contaminants, as well as bioaccumulation of chemicals in the food chain.   Treatment plants remove varying amounts of contaminants from wastewater, depending on the level of treatment they provide. In

many countries a large proportion of wastewater is discharged to the environment with little or no treatment. This is economically, socially, and environmentally unsustainable, especially recognizing the increasing demands on finite water resources, rapidly expanding populations particularly in urban areas, industrial expansion, and the need to expand irrigated agriculture. Low water quality reduces the availability of water resources for specific uses, in particular domestic needs, and has adverse implications for public health. As well as containing organic matter and nutrients, wastewater can also contain hazardous substances. The level of treatment of these hazardous substances before discharge and the sensitivity of the receiving waters will affect their impact on the aquatic ecosystem.

(c)   International Conventions and Agreements: None

(d)   International Targets/Recommended Standards: None

(e)   Linkages to Other Indicators: This indicator has important linkages to Annual Withdrawal of Ground and Surface Water as Percent of Renewable Water, Water Use Intensity by Economic Activity, Biochemical oxygen demand (BOD) in Water Bodies, Concentration of Faecal Coliform in Freshwater, Population Growth Rate, Generation of Waste and Population with Access to Safe Sanitation.

3.   METHODOLOGICAL DESCRIPTION

(a)   Underlying Definitions and Concepts:
Wastewater treated by primary treatment + wastewater treated by secondary treatment + wastewater treated by tertiary treatment + wastewater discharged without treatment have to add up to 100% of wastewater generated. Volumes should only be accounted for under the highest treatment category to which they were subjected.
Wastewater is defined as water which is of no further immediate value to the purpose for which it was used or in the pursuit of which it was produced because of its quality, quantity or time of occurrence. However, wastewater from one user can be a potential supply to a user elsewhere.

For the purpose of this indicator on wastewater treatment it is important to refer only to the volume of wastewater generated by households and economic activities which would negatively affect the aquatic environment or human beings if pollutants are not reduced to an acceptable and widely accepted limit before discharge. Therefore, it excludes unpolluted cooling water (in this context heat is not considered as pollutant; however, discharges of heated cooling water may have negative effects on aquatic life of a particular lake or a certain downstream river stretch). It furthermore excludes wastewater which will be reused (reclaimed wastewater), because it will contribute to discharges into the environment only after the reuse by another economic unit.

Industrial (process) wastewater is water discharged after being used in, or produced by, industrial production processes and which is of no further immediate value to these processes. Where process water recycling systems have been installed, process wastewater is the final discharge from these circuits. To meet quality standards for

eventual discharge into public collecting systems, this process wastewater is understood to be subjected to ex-process in-plant treatment. For the purpose of this indicator cooling water is not considered to be industrial wastewater.

Wastewater treatment: Process to render wastewater fit to meet applicable environmental standards before being discharged to the environment. Three broad types of treatment are distinguished: primary, secondary and tertiary. For purposes of calculating the total amount of treated wastewater, volumes and loads reported should be shown only under the "highest" type of treatment to which they were subjected:

Primary treatment: Treatment of wastewater by a physical and/or chemical process involving settlement of suspended solids, or other process in which the Biological Oxygen Demand (BOD_5) of the incoming wastewater is reduced by at least 20% before discharge and the total suspended solids of the incoming wastewater are reduced by at least 50%.

Secondary treatment: Post-primary treatment of wastewater by a process generally involving biological or other treatment with a secondary settlement or other process, resulting in a Biological Oxygen Demand (BOD_5[33]) removal of at least 70% and a Chemical Oxygen Demand (COD[34]) removal of at least 75%.

Tertiary treatment of public wastewater: Treatment (additional to secondary treatment) of nitrogen and/or phosphorous and/or any other pollutant affecting the quality or a specific use of water: microbiological pollution, colour etc. For organic pollution the treatment efficiencies that define a tertiary treatment are the following: organic pollution removal of at least 95% for BOD and 85% for COD, and at least one of the following:
- nitrogen removal of at least 70%
- phosphorus removal of at least 80%
- microbiological removal achieving a faecal coliform density less then 1000 in 100 ml

In the case of industrial wastewater treatment tertiary treatment means the reduction of pollutants to a concentration not adversely affecting the aquatic environment and human water uses before direct discharge. In the case of indirect discharges into a public wastewater collecting system this means that the treatment processes (pre-treatment plus treatment in the public wastewater treatment plant) achieve standards as defined above. For both, direct and indirect discharge, in addition to removal of organic pollution and nutrients this means in particular the removal of toxic substances, acids and alkalis, hard organics or oils and greases (depending on the composition of the wastewater). Typical methods are chemical immobilisation, neutralisation or precipitation. Dilution of polluted wastewater is not considered as wastewater treatment.

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[33] BOD_5 is the Biochemical Oxygen Demand for a period of five days. It is equal to the amount of dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in water. This is measured at 20 degrees Celsius for a period of five days. The parameter yields information on the degree of water pollution with organic matter.
[34] COD is the mass concentration of oxygen equivalent to the amount of a specified oxidant consumed by dissolved or suspended matter when a water sample is treated with that oxidant under defined conditions.

Public wastewater treatment (synonym "urban wastewater treatment") is defined as treatment of wastewater in public wastewater treatment plants (PWWTPs). PWWTPs can be operated by public authorities or by private companies. Wastewater can arrive to the PWWTPs through the public wastewater collecting system or can be delivered there on trucks.

Industrial wastewater treatment can be either in form of pre-treatment before discharge into a public wastewater collecting system or as final treatment in an industrial wastewater treatment plant (as part of the production establishment or operated externally) before direct discharge to the environment. To avoid double counting, only final treatment before direct discharge should be included here. Volumes pre-treated and discharged into a public collecting system will be counted under public wastewater treatment.

Independent wastewater treatment: Systems of collection, preliminary treatment, treatment, infiltration or discharge of domestic wastewater from dwellings generally between 1 and 50 population equivalents, not connected to a public wastewater collection system. Examples of such systems are septic tanks. Excluded are systems with storage tanks from which the wastewater is transported periodically by trucks to a public wastewater treatment plant. These systems are considered to be connected to the public wastewater system. Independent wastewater treatment systems usually achieve primary or secondary treatment level.

(b)   Measurement Methods: The volume of wastewater generated by households can be calculated with population statistics and the application of per capita water use coefficients (e.g. from research centers, water associations or water suppliers). One has to take into account that water use volumes (and consequently the generated wastewater volumes) may be different for households connected to the public water supply network and those households which have to self-abstract their water.

The volume of wastewater generated by industries can be taken from industry surveys and, in the case of missing data, be calculated with the help of wastewater generation factors. In the case of industrial discharges into a public collecting system usually the operators of these systems have data on volumes wastewater collected from industries.

The volume of wastewater treated at different levels of treatment can be obtained from public wastewater treatment plants, from industrial wastewater treatment plants and from independent wastewater treatment systems. The volume of household wastewater treated in public wastewater treatment plants or independent wastewater treatment systems can also be calculated with water use coefficients on the basis of areas of a community connected to the sewerage system linked to the treatment plant and the population inhabiting these localities. The classification of the type of treatment (primary, secondary or tertiary) should preferably be based on actually achieved removal rates.

(c)   Limitations of the Indicator: This indicator provides information about wastewater volumes generated by point sources but not about wastewater volumes generated and discharged by diffuse sources.

The indicator does not give information about the quality of the wastewater discharged. Wastewater treatment plants are often overused beyond their design capacity so the quality of the treated wastewater that is discharged into the environment can also be questionable. The indicator also does not address the level of treatment required to meet the requirements of specific ecosystems.

Ideally, it would be more informative to measure an indicator such as the overall removal rates for selected parameters (e.g. BOD_5, COD, nitrogen or phosphorus) from all types of wastewater treatment plants (including industrial and independent wastewater treatment plants), including untreated wastewater from point sources and diffuse sources.

Another important information for political decision processes would be the total loads of discharges from different types of point sources (after treatment and without treatment) and diffuse sources, classified according to households and economic activities. However, in practice these data are more difficult to obtain.

(d)   Status of the Methodology: Methodologies on data generation are recommended in the Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters Tables 1 – 7 (version 2.0) of Eurostat (2006) and the UNSD International Recommendations for Water Statistics (2008, in preparation).

(e)   Alternative Definitions/Indicators: The percentage of population connected to the different levels of wastewater treatment (primary, secondary or tertiary) which is the sum of percentage of the population connected to different levels of public wastewater treatment, independent wastewater treatment and industrial wastewater treatment. This may be easier to measure but it does not consider wastewater generated by industrial or other economic activities.

4.   ASSESSMENT OF DATA

(a)   Data Needed to Compile the Indicator: The data required would be the volume of wastewater generated by households and all economic activities (excluding cooling water and reused wastewater) and the volume of wastewater treated at different levels (primary, secondary, tertiary) by public wastewater treatment plants, independent wastewater systems and directly discharging industrial wastewater treatment plants.

(b)   National and International Data Availability and Sources: At the national level, data sources would include national water or environmental authorities, municipal authorities and national statistical offices. At the international level, data are collected through two Questionnaires on environment statistics: the UNSD/UNEP Questionnaire which covers non-OECD countries and the Joint OECD/Eurostat Questionnaire which covers OECD/Eurostat countries. Data are often not available, or are incomplete.

(c)   Data References:

UNSD Web site: http://unstats.un.org/unsd/environment

OECD website: http://www.oecd.org/statisticsdata

Eurostat website:
http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136239,0_45571444&_dad=portal&_schema=PORTAL)

5.   AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a)   Lead Agency: United Nations Statistics Division. The contact point is the Chief, Environment and Energy Statistics Branch, UNSD. The fax no. (1 212) 963 0623.

(b)   Other Organizations: OECD and Eurostat

6.   REFERENCES

(a)   Readings:
Eurostat (2006): Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters Tables 1 – 7
OECD/Eurostat Joint Questionnaire 2006 on Environment Statistics – Inland Waters Section.
United Nations (2006). System of Environmental-Economic Accounting for Water (SEEAW). Final Draft.
United Nations (2008). International Recommendations for Water Statistics (forthcoming).
UNSD/UNEP Questionnaire 2006 on Environment Statistics – Water Section.

(b)   Internet site:
UNSD home page: http://unstats.un.org/unsd/environment/