PRESENCE OF FAECAL COLIFORMS IN FRESHWATER		
Fresh Water	**Water Quality**	**Core indicator**

1. INDICATOR

(a) Name: Presence of Faecal Coliforms in Freshwater.

(b) Brief Definition: The proportion of freshwater resources destined for potable supply containing concentrations of faecal coliforms which exceed the levels recommended in the World Health Organization (WHO) Guidelines for Drinking-water Quality.

(c) Unit of Measurement: %

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

2. POLICY RELEVANCE

(a) Purpose: The indicator assesses the microbial quality of water available to communities for basic needs. It identifies communities where contamination of water with human and animal excreta at source or in the supply poses a threat to health.

(b) Relevance to Sustainable/Unsuitable Development (theme/sub-theme): The concentration of faecal coliforms in freshwater bodies is an indirect indicator of contamination with human and animal excreta. Water contaminated with human and animal excreta poses a serious health risk and is therefore unsuitable for potable supply unless it has been suitably treated. Faecal indicator bacteria remain the preferred way of assessing the hygienic quality of water. *Escherichia coli (E. coli*), the thermotolerant and other coliform bacteria, the faecal streptococci and spores of sulphite-reducing clostridia, are common indicators of this type used. This measure indicates situations where treatment is required or has to be improved to guarantee safety of supply. As population density increases and/or more people are provided from a supply, the more critical the supply of safe, potable water becomes.
Diarrhoeal diseases, largely the consequence of faecal contamination of drinking-water supply, are variously estimated to be responsible for 80% of morbidity/mortality, or more, in developing countries. A prerequisite for development is a healthy community. Ill health not only reduces the work capability of community members but frequent diarrhoeal episodes disrupt children's development and education, which, in the longer term, can have serious consequences for sustainable development.

(c) International Conventions and Agreements: The United Nations Water Conference recommended that governments reaffirm the commitment made at 'Habitat' to adopt programmes with realistic standards for water-quality to provide sanitation for urban and rural areas. The goal of universal coverage was reiterated at the World Summit for Children, in 1990.

(d) International Targets/Recommended Standards: The standards are available in the WHO Guidelines for Drinking-water Quality. These have been adopted by most countries.

(e) Linkages to Other Indicators: The indicator is closely linked with several others in the environmental and socio-economic (health) categories, including annual water withdrawals, domestic consumption of water *per capita*, biochemical oxygen demand in water bodies, wastewater treatment coverage, and percent of population with adequate excreta disposal facilities.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Ideal faecal indicator characteristics are difficult to find in any one organism. However, many useful characteristics are found in *E. coli* and, to a lesser extent, in the thermotolerant coliform bacteria. For this reason, *E. coli* is the preferred/recommended faecal contamination indicator. Faecal streptococci satisfy some of the criteria and tend to be used as supplementary indicators of faecal pollution indicating both human and animal faeces.

(b) Measurement Methods: For the purposes of this indicator, the term "faecal coliforms" encompasses *Escherichia coli* and thermotolerant coliforms.
Microbiological examination provides the most sensitive, although not the most rapid, indication of pollution by faecal matter. Because the growth medium and the conditions of incubation, as well as the nature and age of the water sample, can influence microbiological analysis, accuracy of results may be variable. This means that the standardization of methods and laboratory procedures are extremely important. Established standard methods are available through the International Organization of Standardization (ISO), American Public Health Association (APHA), the UK Department of Health (DHSS), and the Guidelines for Drinking-water Quality (WHO).
Determination of sample size is the first important step in the examination. The source of the sample will determine, in the first instance, the concentration of organisms. Under normal conditions, the volume of sample for a lake or reservoir sample would be 100 ml, while in the case of raw municipal sewage, only 0.001 ml would be required. Larger samples would result in too large a number of organisms to make counting possible. Time-of-travel may often be of relevance, and changes in the bacterial characteristics of samples can be reduced to a minimum by ensuring the samples are not exposed to light and are kept between 4 and 10°C for the shortest feasible time – preferably analysed within six hours. Such precautions are particularly important in tropical climates where ambient temperatures are high and sunlight (ultra-violet radiation) is brightest.

(c) Limitations of the Indicator: Concentration of *E. coli* or thermotolerant or faecal coliforms in a water sample provides only one part of the picture with regard to water-quality. To assess the overall status of water at source and supplied for potable and other uses, it is necessary to combine the information of this indicator with complementary data on physical and chemical water quality. *E. coli* is predominantly an indicator but, under certain circumstances, can itself be a pathogen.

(d) Status of the Methodology: Not Available.

(e) Alternative Definitions/Indicators: The indicator could be shown as the proportion of the population using water source for domestic water supply that does not meet the standards. The microbiological quality of water in relation to faecal contamination can be currently defined in terms of *E. coli*, thermotolerant coliform bacteria, total coliform organisms, faecal streptococci, sulphite-reducing clostridia, bifidobacteria and coliphages. The magnitude of deviation from the WHO guideline value for microbial water quality, expressed as the average concentration in a water resource, could also indicate the degree or magnitude of contamination of a water supply.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Records of water authorities laboratories, hydro-geological institutes, universities, municipal public health laboratories, research institutes, and special studies, which show the level of *E. coli,* or thermotolerant coliform bacteria.

(b) National and International Data Availability and Sources: Data are normally available from municipal water supply authorities on a routine basis. Ministries of Health in many countries often check on the bacterial quality of new sources when they are being considered for supply purposes. The data are available from national water authorities and water supply utilities, Ministries of Health, and research institutes.

(c) Data References: Not Available.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). The contact point is the Coordinator, Water, Sanitation and Health, Department of Protection of Human Health, WHO; fax no. (41 22) 791 4159.

(b) Other Contributing Organizations: Other organizations contributing to the development of this indicator include: the Water and Environmental Sanitation Section, United Nations Children's Fund (UNICEF); United Nations Centre for Human Settlements (HABITAT); Land and Water Division, Food and Agriculture Organization of the United Nations (FAO); and the United Nations Environment Programme Global Environment Monitoring System for Freshwater (UNEP GEMS/Water)**.**

6. REFERENCES

(a) Readings:

WHO. *Guidelines for Drinking-Water Quality*. Second Edition, Volume 1 Recommendations, WHO, Geneva, 1993, and Volume 3: Surveillance and Control of Comments Supplies, WHO, Geneva, 1996.

American Public Health Association, American Water Works Association, and Water Pollution Control Federation. *Standard Methods for the Examination of Water and Wastewater*. 17th Edition, 1989.

International Organization for Standardization. *Water Quality: Detection and Enumeration of the Spores of Sulphite-reducing Anaerobes (clostridia*). Part 1: Method by Enrichment in a Liquid Medium. ISO 646171.

International Organization for Standardization. *Water Quality: Enumeration of Viable Microorganisms – Colony Count by Inoculation in or on a Nutrient Agar Culture Medium.* ISO 6222.

International Organization for Standardization. Water Quality: Detection and Enumeration of Coliform Organisms, Thermotolerant Coliform Organisms and Presumptive Escherichia coli, ISO 9308-2; Part 1 Membrane Filtration Method, Part 2 Multiple Tube. ISO 9308-1.

International Organization for Standardization. *Water Quality: Detection and Enumeration of Faecal Streptococci*; Part 1 Method by Enrichment in a Liquid Medium, Part 2 Method by Membrane Filtration. ISO 7899/2.

(b) Internet site:

World Health Organization (WHO). http://www.who.int
WHO website on water, sanitation and health:
http://www.who.int/water_sanitation_health/en/