

## Methodological note

### Estimate of pollution load of waste water in terms of population equivalent.

‘Population equivalent’ refers to the organic biodegradable load produced by domestic and commercial activities. Population equivalent is conventionally defined as the average amount of pollution load produced and introduced into waste water by a permanently resident inhabitant within a day. This value means the organic biodegradable load having a five-day biochemical oxygen demand (BOD5) of 60 g of oxygen per day as defined by current legislation on water pollution protection and treatment (Council Directive 91/271/EEC of 21 May 1991).

The number of total urban population equivalent (TUPE) is estimated taking into account waste water discharged into the urban sewer system from different sources that generate the pollution that are then converted into population equivalent using specific numerical coefficients. These sources are: resident population, domestic and assimilable activities as well as from hotel, tourist, educational and micro-enterprise facilities generally operating within urban centres which present qualitative characteristics equivalent to those produced by the human metabolism or to domestic activities and in which the pollutants consist primarily of biodegradable material.

The number of total population equivalent (TPE) is estimated taking into account all waste water including that discharged from manufacturing industries in the municipal area and which is assimilable to domestic effluent after treatment in order to remove inorganic material.

Pollution load generated from each industrial sector is extremely heterogeneous: the presence and concentration of different pollutants in waste water generated during production process depends on industrial processes. Evaluation of volume and level concentration of pollutants is a very complex operation: for this reason coefficients set by the Water Research Institute of the National Research Council (Irsa - Cnr) are utilized in order to estimate pollution loads. These coefficients allow a theoretical evaluation of the polluting load of industrial activities and refer to the content of organic substance present in industrial effluent in terms of the quantity of oxygen demanded for purification and they are referred to employees or unit of production. Multiplying coefficients by employees allows to compute potential pollution of the different commercial activities.

These estimates, therefore, only partially take into account the actual pollution share of industrial effluent which often also contains toxic material.

In order to compute data referred to the period 2005 – 2008, coefficients, determined according to classifications of commercial activities 1991 (ATECO 1991 classification), were multiplied by employees of commercial activities according to ATECO 2002 classification (after transcoding of economic activities in the new classification). In order to compute 2009 data, coefficient were multiplied by employees of commercial activities according to ATECO 2007 (after transcoding of economic activities in the new classification) Transcoding operations can bring about a modification, with respect to the first formulation, in composition of productions of economic activities related to the same code.

The tables indicate data referred to the year 2009. The estimates are made at municipal level so as to better capture specific territorial requirements. For each source considered, the most recent year for which data are available is used as reference.

The generating sources considered are listed below:

#### – Resident population

this component of the load refers to the resident population in the year  $t$ ; no coefficients of equivalence are applied and each inhabitant constitutes one unit of the total population.

#### – Dwelling population resident in another Municipality/Ato/Region

population domiciled in a Municipality/Ato/Region other than that of registered residence according to the 2001 Population and Housing Census; also in this case no coefficients of equivalence are applied and each

inhabitant constitutes one unit of the total population. Since the most recent reference year is 2001, the estimate of pollution load of this generating source shows the same value in the period 2005- 2009.

– **Occupants of scattered houses**

population resident or domiciled in locations classified as isolated housing areas according to the 2001 Population and Housing Census. This population is subtracted from the resident population when calculating the total urban population equivalent in that pollutant waste water from scattered houses is not normally discharged into the public sewer system. Since the most recent reference year is 2001, the estimate of pollution load of this generating source shows the same value in the period 2005-2009.

– **Commuting population (students or workers)**

the polluting load generated by commuters is estimated on the basis of the population that in the 2001 Population and Housing Census stated it makes daily journeys from its municipality of residence or domicile to another municipality for work or study purposes. The estimated related polluting load is subtracted from the municipality of departure and added to the municipality of destination and refers to a period of 8 hours within the 24 hours for workers and 6 hours for students; the coefficient used is equal to 8 out of 24 hours for workers and 6 out of 24 hours for students. Since the most recent reference year is 2001, the estimate of pollution load of this generating source shows the same value in the period 2005-2009.

– **Potential population present in collective accommodation establishments**

the polluting load generated in collective accommodation establishments is estimated from data on the available bed places (source: Istat, Capacity of collective accommodation establishments; year 2008) of hotels, boarding houses, campsites, holiday villages and private homes rented seasonally as a business undertaking or otherwise; conversely, the sleeping capacities of farm holiday facilities and mountain refuges are not taken into account;

– **Potential population present in private dwellings (unoccupied dwellings/second homes by average municipal occupancy)**

the potential population present for tourism or holiday purposes in private dwellings is estimated by multiplying unoccupied private dwellings/second homes by the average number of persons in occupied dwellings in the same municipality; this calculation does not include unoccupied dwellings in locations classified as isolated housing areas and unoccupied seasonally rented private dwellings. The coefficient used in the estimate is 0.8 (less than 1 to allow for the fact that on average not all second homes are occupied at the same time). Since the most recent reference year is 2001, the estimate of pollution load of this generating source shows the same value in the period 2005-2009.

– **Population equivalent in hotels, cafes and restaurants**

the polluting load of hotels, cafes and restaurants is estimated by multiplying the number of employees (source: Istat, Italian Statistical Business Register (ASIA) - Local units; year 2007) by the Irsa-Cnr coefficient for various food production activities.

– **Population equivalent in enterprises with up to 5 employees**

the polluting load of industrial activities, broken down by type of business, is estimated by multiplying the total number of employees in local industrial units with less than 6 employees (source: Istat, Italian Statistical Business Register (ASIA) - Local units; year 2007) by the related Irsa-Cnr coefficient. Calculation is performed according to type of business activity code, classes, groups or divisions and in relation to the corresponding type used by Irsa-Cnr;

– **Population equivalent in enterprises with 6 or more employees**

the polluting load of industrial activities in local units with at least 6 employees, broken down by type of business, is calculated according to type of business activity code, classes, groups or divisions and in relation to the corresponding type used by Irsa-Cnr. The number of employees is sourced from Istat, Italian Statistical Business Register (ASIA)- Local units; year 2007.