2005 Emission Inventory

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Table of Contents

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The emission factors

An emission factor represents an emission referred to a unit of activity of the source, expressed for instance as a quantity of pollutant emitted per product unit, or as a quantity of pollutant emitted per fuel unit consumed, etc.

The choice of the emission factors signifies a particularly critical aspect and it presents troubles of reliability.

Emission factors has to be chosen following the characteristics of the plant, obtaining data from literature and adapting them to the particular actual situation.

Data are generally available by type of process, combustion and abatement techniques; it derive from measurement campaigns on representative sources: if not expressed data are intended to be prior to the abatement system. If specified, emission factors could be referred to emissions at the stack, that is already inclusive of the effects of the abatement systems.

For some combustions (i.e. fuel oil, coal, etc.) it is possible to obtain the emission factors of some pollutants (SO_2, heavy metals) from the chemical composition of the fuel.

In the evaluation of emission from a category of sources (for instance a complete industrial sector) the emission factor can be derived as a geometric mean of factors related to different types of technology, giving weigh to the technologies through coefficients which represent the "penetration" of that technology in the sector. In other words the emission can be estimated by a formula as the following:

$$\mathbf{Q = A * \#_i(FE_i * P_i)}$$

where:

Q = emission flow of the pollutant (i.e. g/hour);

A = activity indicator (i.e. kg of product/hour);

$\mathbf{FE_i}$ = emission factor for technology i (i.e. g/kg of product);

$\mathbf{P_i}$ = penetration of technology i in the sector (-).

In this manner it is possible to distinguish the economic component (A) that derives from the general development of the sector, from the technical term (FE) and from the "compartmental" term (P), that derives from the plant typology of the sector.

This formula can be utilized also to project emissions trends in a sector owing to the adoption of different technologies.

Among the most complete references for emission factors are the Environmental Protection Agency reports, and in Europe the emission factors collected and proposed by the Corinair project, illustrated in three successive versions of its Guidebook, which present the best characteristics of completeness and reliability.

These reports are more and more available as databases, freely available on CD-ROM or from the Internet sites of EPA or European Environmental Agency.

Different uncertainties are connected with the use of emission factors. Besides what explained above, the causes could be the following ones:

factors processing tests referred to a little period of time and thus not representative of long term emissions, for the entire life of the plant; emission data obtained from a few number of plants, statistically not representative; the definition of a "medium" emission factor for a certain category of sources does not take into account of the actual penetration of the different technologies inside the sector; the actual efficiency of the measurement systems is minor of that foreseen, declared by the builder in "ideal" conditions; non consideration of the control efficiency, quality of maintenance, characteristics and age of plants; possibilities of accidental emissions not comprised in emission factors. At last, even though it seems necessary to stress that these are estimates, which could be more or less precise but not equivalent to measured data, on the other hand it should be taken into account that the acceptability of the simplification adopted depends on the use of the results.

In the framework of this emission inventory, being necessary to arrange reliable emission factors, data from the sources described above have been collected and compared, besides the emission factors supplied by APAT.
Per tornare ai dati rilasciati al pubblico cliccare su:
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per tornare alla gestione dei risultati:
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oppure tornare alla pagina iniziale cliccare su:
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