ESTIMATION OF NON-POINT POLLUTION LOADS COMING FROM SOURCES AND LAND-BASED ACTIVITIES OF THE WIDER CARIBBEAN REGION

The indirect estimation of polluting emissions into the marine environment through non-point sources of pollution can be carried out with the use of emission factors (EF), based on relevant data gathered and expertise.

An emission factor (EF), is an estimation of the amount of pollutants discharged as result of a specific activity. In most cases, the EF is just a number with a lineal relationship between the emission and the activity in a well-known targeted area. The EF can be seen as simple mathematical models with a direct relationship between an emission and a unique indicator. Each EF should be adapted to local conditions in each country.

INDICATORS OR MINIMUM PARAMETERS THAT SHOULD BE MEASURED FOR POLLUTION LOADS ESTIMATION:

Compulsory	*Optional*
BOD_5	Oil and Grease
COD	Pesticides
TKN	Copper, Lead, Zinc and Total Mercury
TP	

Required information for pollution loads estimation in rural areas

The information should be obtained from Environmental Agencies, Ministries, or official organizations of each country.

1. Inventory of pollution sources (wastewater and solid waste)
2. Meteorology (average annual rainfall)
3. Rainfall from meteorological station
4. Related population and growth patterns
5. Sanitary coverage
6. Hydrological pattern
7. Irrigation practices in rural areas
8. Fertilizers used in cultivation areas (type and quantities)
9. Persistent pesticides (e.g. insecticides for vectors control, or herbicides; type and quantities).
10. Soil management (area dedicated to crops, shepherding, forests and to the industry or urban activity),
11. Solid wastes level on the soil surface
12. Topographical and soil characteristics and weather season.

Surface run off

The surface run off is important to determine the water accumulation and the basin water volume contribution to the river or coastal waters (Caribbean Sea). The US EPA (Environmental Protection Agency) formula will be considered.

$$E_m = ACP_m$$

where:

Em: Average run off (Thousands of m^3)
A: Basin drainage area (m^2). Should be calculated using topographic maps, aerial photos or field work.
C: Run off coefficient.
Pm: Average annual rainfall according to the nearest meteorological station (mm).

Estimated Values of run off coefficient, C

Topography and Vegetation	Soil Texture		
	Coarse	Medium	Fine
Forests			
Plain (0.5% slope)	0.10	0.30	0.40
Hilly (6-10% slope)	0.25	0.35	0.50
Scarp (11-30% slope)	0.30	0.50	0.60
Grasslands			
Plain (0.5% slope)	0.10	0.30	0.40
Hilly (6-10% slope)	0.15	0.36	0.55
Scarp (11-30% slope)	0.22	0.42	0.60
Crops			
Plain (0.5% slope)	0.30	0.50	0.60
Hilly (6-10% slope)	0.40	0.60	0.70
Scarp (11-30% slope)	0.52	0.72	0.82

Emission Factor determination

1. To determine the Emission Factor (EF) is needed, previously, the location and characterization of the study area (basins or minor-basins) regarding to population, rainfall level, topography, etc.

2. Once the areas of interest are established (scenarios), the EF for those parameters or indicators reflecting higher impacts to the Caribbean Sea are estimated by the assignment of *presumptive values*, according to the existent relationship between the emission and the activities, defining maximum and minimum values for each EF.

3. To give *presumptive values* of this EF, a detailed analysis of all the gathered information should be previously done. For that analysis the use of interaction matrices among the selected area components is the most effective tool. Therefore, knowing the related population and the natural conditions interactions, the emission contributions of overall activities can be determined.

4. In those countries having treatment plants, it is also necessary to consider the removal rate and therefore to adapt the proposed value for each EF.

Pollution loads determination

Pollution load (ton.year^{-1}) = Related area (m^2) x EF (ton.m^{-2}.year^{-1})

Note: The measure units can be equivalents, according to the purpose wanted (restricted linked areas or open ones and with a daily or yearly basis).

Reporting

Once the pollution loads of the selected indicators had been estimated, the results should be processed by economic sectors, as well as for relevant pollution sources, if possible.

The results will be presented based on numbers and graphics of pollution loads of the main indicators.

Independent pollution sources

The rivers will be considered as independent sources, since they are one of the most important pollution sources to the Caribbean Sea. Duplication of loads estimations should be avoided and therefore, point and non-point sources inputs to the rivers would no be included in the analyses of independent loads.

For marine pollution sources (ships), the Report of the International Maritime Organization (IMO) will be considered.

General recommendations

- To know the areas with higher impacts to the Caribbean Sea (basins or minor basins)

- To know the inventory of the main pollution sources focusing on those with higher pollution loads contributions

- To rise the Governments awareness about the need of information

- To consider the groundwater's, if possible.

- To consider the marine pollution sources (ships). Check information related with the ships in the Report of the International Maritime Organization (IMO), 1998.