

Analytical Support for Cost-Effective Pollution Control

Analytical tools have been developed by the World Bank Group to estimate rapidly the extent and impacts of pollution in a given situation and to support decisions on pollution management. These tools help decisionmakers overcome the frequent lack of data concerning emissions from different sources, their impact on ambient quality, and mitigation alternatives.

Decision Support System for Integrated Pollution Control (DSS)

What Is the DSS?

The Decision Support System for Integrated Pollution Control (DSS), developed by the World Bank in collaboration with the World Health Organization (WHO) and the Pan American Health Organization (PAHO), allows a rapid assessment of the pollution situation in a specific geographic location, such as a metropolitan area or water basin. The DSS is designed to assist in the analysis of alternative pollution control strategies and policy options. It is a personal computer software program and database that has been developed from the approach and parameters provided in the 1989 WHO working document on management and control of the environment. The DSS generates estimated pollution loads in a study area by applying emissions factors to data on economic activities. This load data can then be further processed to estimate areawide concentrations or to examine the impacts and costs of selected pollution control measures. Full details of the system, the basic assumptions, and the base parameters are given in the manual that accompanies the software.

The following databases are included, compiled by medium of discharge:

- Pollution-intensive technological processes across all sectors of economic activity, including mining, manufacturing industries, energy, transport, and municipal sectors, grouped ac-

ording to the United Nations International Standard Industrial Classification (ISIC) at the four-digit level

- Principal control options available for each process, including “good housekeeping” and waste prevention programs
- Emissions factors associated with these processes and “process-control option” combinations
- Normalized costs and parameters for control technologies
- Health guidelines for air and water pollutants, where applicable.

Editing and calibration features of the software allow adjustment of the default data to local conditions when actual information is available.

Computation modules enable the user to estimate:

- Air, water, and solid waste emissions, based on an inventory of economic activities for a given location
- Ambient concentrations of air and water pollutants, obtained by using simple (screening) dispersion models with minimum meteorological and hydrological data
- Total costs of control options, derived by using standardized engineering-type cost functions
- Long-run marginal cost schedules for achieving a certain level of emissions reduction (or decline in ambient concentration) for a chosen pollutant.

What Are the Uses of the DSS?

The DSS can be used by Bank staff, environmental agencies, pollution engineers, economists, and policy analysts for the following tasks:

- Obtaining information on typical emissions factors and control costs (at a generalized level)
- Managing data on economic and industrial activity and related pollution loads
- Estimating impacts and analyzing options
- Conducting training in pollution economics and management.

Each task is discussed in detail below.

Information. The DSS database can provide information on pollutants, emissions factors, technological processes, control options, and unit costs that can be independently applied in other models or studies or can serve as a point of reference. However, the range and variability of the parameters included is frequently large, and the database should be validated or adjusted for local conditions wherever possible.

Data management. The DSS helps to estimate pollution conditions in the absence of monitored data on emissions and ambient concentrations and permits identification of the major pollution sources. It can also help to highlight gaps in the existing system of data collection by providing a framework for organizing the information-gathering process systematically and presenting the information in a convenient format as a table, chart, or map. The system requires a detailed inventory of industries in a given area, including data on key inputs and outputs in physical units and the types of existing pollution controls. This type of data is often more readily available than actual pollutant emissions or concentrations.

When such an inventory is not possible within the limited time and resources available, the Industrial Pollution Projection System (IPPS), which has less demanding data requirements, can be used to estimate pollution loads from manufacturing industries for a number of air and water pollutants. The IPPS is described in greater detail below.

Analytical tool. The DSS is designed to help develop a cost-effective pollution control strategy across various pollution sources for a given area and identify priority investments in specific

industries and in the municipal sector. The system supports integrated approaches to airshed management and wastewater treatment by capturing and evaluating the effect of all kinds of sources on pollution load and ambient quality. The computer-driven analysis of pollution sources and abatement options highlights variations in marginal costs of abatement across industries and other sources. It defines the control levels and associated investments that should be adopted for different industries to achieve a desired pollution abatement target (in terms of either emissions reduction or concentration decline of a particular pollutant) at least cost for the area as a whole. Specifically, the system estimates the amount of pollution that can be reduced without costly investments, just by improving management, operation, and maintenance. The software can also be used to support the selection of alternative locations for new industries or industrial zones, as well as for urban development and expanding municipal services. It can estimate the possible effects of different policies on the pollution situation and the associated costs of compliance with environmental regulations in each proposed location.

As a first step in analyzing pollution control policies, such as policies setting environmental standards or applying economic instruments, the DSS can be used to:

- Estimate the costs of attaining proposed emissions standards or ambient standards in an area
- Estimate the impact on ambient quality of proposed emissions standards or technological standards
- Allocate emissions limits across pollution sources in an area in a cost-effective way
- Estimate the incentive level of an emissions charge rate needed to achieve a certain environmental target in the area or watershed (using long-run marginal cost schedules)

Educational tool. The DSS helps to make key issues and causal links in pollution management transparent. It can demonstrate the comparative effect on pollution load and ambient quality of a number of factors that can be affected by sectoral and environmental policies. It can promote public participation and consensus building by informing various stakeholders about the key

pollution problems, major pollution sources, and principal mitigation measures in the area.

In applying the DSS, it is important to remember that the system is a rapid and rough assessment tool that can only indicate where problems are likely to occur, the relative significance of different pollution sources, and the order of magnitude of the costs and effects associated with alternative pollution control strategies. Its main advantage is in helping to create a comprehensive picture of the pollution problems in an area and to focus further analysis on specific priorities.

Implementing the DSS System

The DSS software runs under Windows and can be closely linked to Microsoft Excel. The database is established using Access software but can be manipulated directly through the DSS system. The minimum data for starting the system are industrial output or input for major industries (at the four-digit ISIC level), together with basic information on municipal services and traffic.

From this minimum information, the system can estimate emissions loads, using the default coefficients. The estimates can be improved with further knowledge on the levels of industrial pollution control and local emissions factors, which can be used to refine the default values. The system also includes simple air and water dispersion models that can offer estimates of pollutant concentrations if basic geographic data are provided.

In addition, the system can generate total and marginal costs for the reduction of pollution loads. These costs are also based on default values; the results can be refined by introducing locally specific economic data.

The system database covers 150 industry processes and other polluting activities and 30 air and water pollutants, as well as solid wastes. An expanded database covering about 1,500 activities and over 300 pollutants is also available.

Industrial Pollution Projection System

The Industrial Pollution Projection System (IPPS) is a modeling system that uses manufacturing industry or trade data to generate profiles of industrial pollution for countries, regions, or urban areas. Most developing countries have little or

no reliable information about their own emissions, but many of them have relatively detailed industry survey information on employment, value added, or output. IPPS converts any of these measures of manufacturing activity into estimates of the associated pollution output.

The IPPS initially combined extensive U.S. databases on manufacturing activity (Census Bureau data) and industrial emissions (USEPA data) to produce sectoral measures of “pollution intensity”—the level of emissions per unit of manufacturing activity. Pollution intensities have been developed for seven criteria air pollutants, two key water-pollution indicators, and several total indices of toxic pollution. The high level of sectoral detail in the U.S. databases and the great diversity of U.S. industry make it possible to match IPPS data with the industrial profile of virtually any country, but the data are being refined on the basis of information from other countries.

The IPPS exploits the fact that levels of industrial pollution are closely related to the scale and sectoral composition of industrial activity and to the level of control. The system is easy to use, in conjunction with macroeconomic or sectoral projections at various spatial levels, to trace the potential environmental implications of industrial growth and for rough screening of current industrial emissions when more specific information is not available.

The outcomes of the IPPS should be used primarily for estimating a *relative* change in emissions according to different scenarios of industrial activity rather than for drawing conclusions about absolute levels of industrial emissions.

Compatibility of the DDS and the IPPS

The DDS and the IPPS are broadly compatible because they operate at different levels of aggregated data. The IPPS can be used to quickly assess the relative magnitude of emissions from different industries in cases where the application of DSS is constrained by lack of data on inputs and outputs in physical units. However, since the IPPS is limited to manufacturing industries, it has to be supplemented with other assessment tools when analyzing the pollution situation in urban areas. Where local industrial, municipal, and transport data are available or can

be collected, the DSS provides a greater capability for estimating loads and concentrations and analyzing control strategies.

Additional Resources

DSS

Urban, Industry, and Energy Team
Environment Department
World Bank
Washington, D.C.

IPPS

Environment, Infrastructure, and Agriculture
Division
Policy Research Department
World Bank
Washington, D.C.

or check the environmental section on the World Bank Group's Website (www.worldbank.org).