

Industrial Pollution Projection System (IPPS)

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It is generally recognized that environmental regulators in developing countries often lack the necessary information to set priorities, strategies, and action plans. Plant-level monitoring of air, water, and toxic emissions is at best imperfect, monitoring equipment is often obsolete, data collection and measurement methodology are questionable, and there is usually a lack of trained personnel on industrial sites. A large number of developing countries and countries in transition are similarly characterized.

As a response to this insufficiency of information, the Infrastructure and Environment team of the Development Research Group of the World Bank has developed the Industrial Pollution Projection System (IPPS) to exploit the fact that industrial pollution is heavily affected by the scale of industrial activity and its sectoral composition. IPPS operates through sector estimates of pollution intensity (usually defined as pollution per unit of output or pollution per unit of employment). These estimates have been obtained from merging production and emissions data from 200 000 factories in the United States. Results from IPPS have been used in various countries where insufficient data on industrial pollution proved to be an impediment to setting-up pollution control strategies and prioritization of activities.[1] Typically, pollution intensities obtained in IPPS are used to estimate the pollution load of diverse industrial sectors.

Below, we first briefly explain the nature of the IPPS system and then provides an example on how to use IPPS to estimate industrial pollution loads using publicly available databases.

BIPES GIS/MIS Software Interface : A brief Note

BIPES GIS/MIS software is completely an independent stand-alone software package that is built using the most current object-oriented GIS and database technology such as Microsoft's Visual Basic for Application (VBA) and ESRI's MapObjects. It is a fully GUI based software interface running under Windows 98/2000 and NT and is fully Y2K compliant system. The user interface integrates the both GIS and textual database and query system in a tasks-oriented manner by keeping a maximum level of flexibility in terms of formulating the queries in interactive ways by the users. A main menu with a number of options and pull-down menus and query Wizards and forms constitutes the software system in addition to Windows/HTML based comprehensive Help System.

The developed BIPES software interface incorporates the following basic software capabilities and functions:

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- Input and updating (data entry and editing) of manufacturing industry data, import of IPPS Industrial Pollution Coefficients and resource data, etc.
- Calculating pollution loads by industry sectors and administrative districts;
- Calculating pollution impacts on selected resources by administrative districts;
- Making queries to find out pollution loads distribution across districts;
- Making queries to identify the sources (industry sectors) of pollution both at district and national level;
- Making queries to identify the dirties districts and dirtiest industry sectors in Bangladesh which contribute high percentage of pollution
- Viewing and Printing the query results (both theme maps and tabular reports)
- A Windows/HTML type Help System
- A number of tools for Maps viewing, windows manipulation, etc.

Individual menu options, Wizards and forms are explained in details along with step-by-step procedures in respective sections under titles of the menus, Wizards and forms.

BIPES : Data Sets

The database that has been developed and built into the BIPES contains the following four major data sets:

i) Industry Data: 4-digit BSIC sector wise district level data (no of establishment, total person engaged, gross value of production and gross value adding, etc.) from the Census of Manufacturing Industries (CMI) in Bangladesh that was carried out in 1991 and published in 1993 by the Bangladesh Bureau of Statistics (BBS).

ii) Administrative GIS map of Bangladesh (district boundaries, geocode, areas etc.) along with other base maps such as river networks and major standing water bodies, major roads/embankment and urban boundaries.

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iii) Resource data such as human population, cultivable land, wet land and fish and agriculture production at district level.

iv) IPPS 4-digit ISIC industry sector wise pollution intensities (coefficients) for toxic chemical, toxic metal, air and water pollutants.

It has been found that there are 169 different industry sectors (at 4-digit BSIC level) identified in the CMI across all 64 district of the country which are converted into 73 equivalent ISIC 4-digit industry sectors.

The above four types constitute the fundamental data sets of the BIPES. There are a number of other auxiliary data sets such as geocode, user definable ranges of pollution loads and pollution impacts that are explained in respective sections. To get details about those please search out your desired item using Index of the Help system.

Calculating Pollution Impacts

Pollution impacts to any particular resources are estimated based on the pollution loads quantity to the volume of available resources in a particular district. For example, impact of CO on human population in Gazipur district is estimated by multiplying the population density of Gazipur district with the CO loads in Gazipur. Then, the results are presented in terms of percentage over national total impact to human population.

The above approach of impact estimation says that if district A is polluted at higher extent (say 4) but has lower population density (say 500) and district B is polluted at the level of 3, but has higher population density (say 1000), then

$$\text{Impact for district A} = 4 \times 500 = 2000$$

$$\text{Impact for district B} = 3 \times 1000 = 3000$$

Therefore, district B is at higher pollution risk to human population than district A.

Note:

The estimated impacts is not expressed in measurable unit and the impacts are presented simply in terms of percentage of national total.

Similarly, impacts on other resources namely, total fish production, cultivable land and wet lands are also estimated following the above approach.

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! Important

Run this function only when you have updated your resource data or recalculated the pollution loads using updated data.

Calculating Pollution Loads

Whenever you update the industry data such as total person engaged in an industry or the IPPS coefficients are updated by IPPS , you must do the pollution load calculation again. This function will automatically recalculate the pollution loads for respective pollutants using the employment data and the pollution coefficients for all districts and generate a number of system tables that are used for making your queries, etc.

Lower Bound employment-based pollution intensity coefficients (Table 1 below) were used to calculate pollution loads in terms of kilogram per 1000 employees per year.

For each district, for each pollutant (16 different parameters), the calculation is:

Pollution load = IPPS coefficient for each sector X (total employment in each sector) / 1000

Table 1: Data calculation for pollution load (e.g. CO)

District Industry sector (ISIC code) Lower bound coefficient for CO Total persons engaged/1000 CO load (unit)

District	Industry sector (ISIC code)	Lower bound coefficient for CO	Total persons engaged/1000	CO load (unit)
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! Important

Run this function only when you have updated your industry data or the IPPS coefficients.

Note:

Although the system calculate pollution loads in terms of kilogram, but for more meaningful presentation purposes, the query results are presented only in relative terms (e.g. CO load in a Dhaka district is 23% of national load of CO)

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Updating Data

BIPES contains functions for updating all source data right from this data input menu. You can update the following data sets:

- Industry data by district and industry sectors (no of establishment, total person engaged, gross outputs, gross value adding, etc.)
- Resource data by district (population, fish production, wetlands, gross cultivable land, etc.)
- Industry sector equivalency conversion : BSIC to ISIC
- Pollution load ranges
- Pollution impacts ranges
- Administrative unit
- IPPS coefficients

Note:

1 All the existing data are provided in the system. Should you need to change any data sets, you must use Edit functions under data Input submenu.

2 You may view the existing data by using View/Print function from the data input submenu.

Classification methods

Some of the map rendering in BIPES uses Standard Deviation classification method for Graduated Color. The purpose of classification is twofold: to make the process of reading and understanding a map easier and to show something about the area you're mapping that is not self-evident.

Standard Deviations

When you classify data using the standard deviations method, BIPES finds the mean value and then places class breaks above and below the mean at intervals of either 1 standard deviations until all the data values are contained within the classes. BIPES will aggregate any values that are beyond three standard deviations from the mean into two classes, greater than three standard deviations above the mean (" > 3 Std. Dev.") and less than three standard deviations below the mean (" < -3 Std. Dev.").

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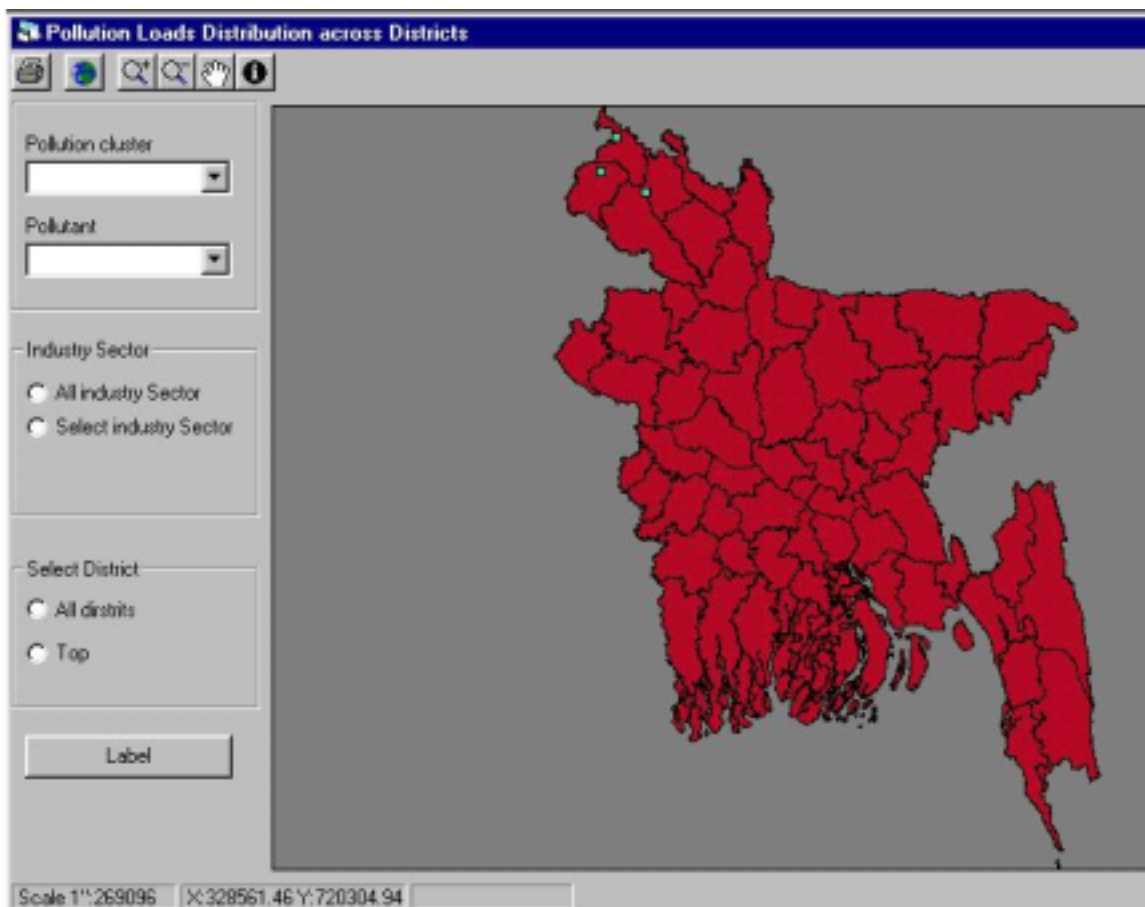
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Formulating/Building your Query

BIPES enables formulating/building your queries using four independent Query Wizards to seek answer to the following questions:

Distribution of Pollution Loads

Pollution load distribution across 64 districts of Bangladesh e.g. air pollution load for selected pollutant (e.g. SO₂) from all industry sectors. A map showing district-wise SO₂ loads in terms of percentage to national pollution load of SO₂ will be displayed in a map that you may also print.



Note:

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1. You are given option to see pollution loads for selected pollutant from a selected industry sector too.
2. Instead of distribution across all 64 districts, you may view and print only a top X numbers of districts too.

Sources of Pollution

Sources of Pollution: You may make a query to find out the sources of pollution loads (industry sectors that contribute pollution loads) in a selected district for a particular pollutant or group of pollutants. A table showing industry sector and their contribution of pollution load in term of percentage to District total pollution loads will be generated, which you may also print.

Pollution Sources at National Level

Formulate your query

Toxic chemical by medium Air pollutant

Toxic metal by medium Water pollutant

All pollutants

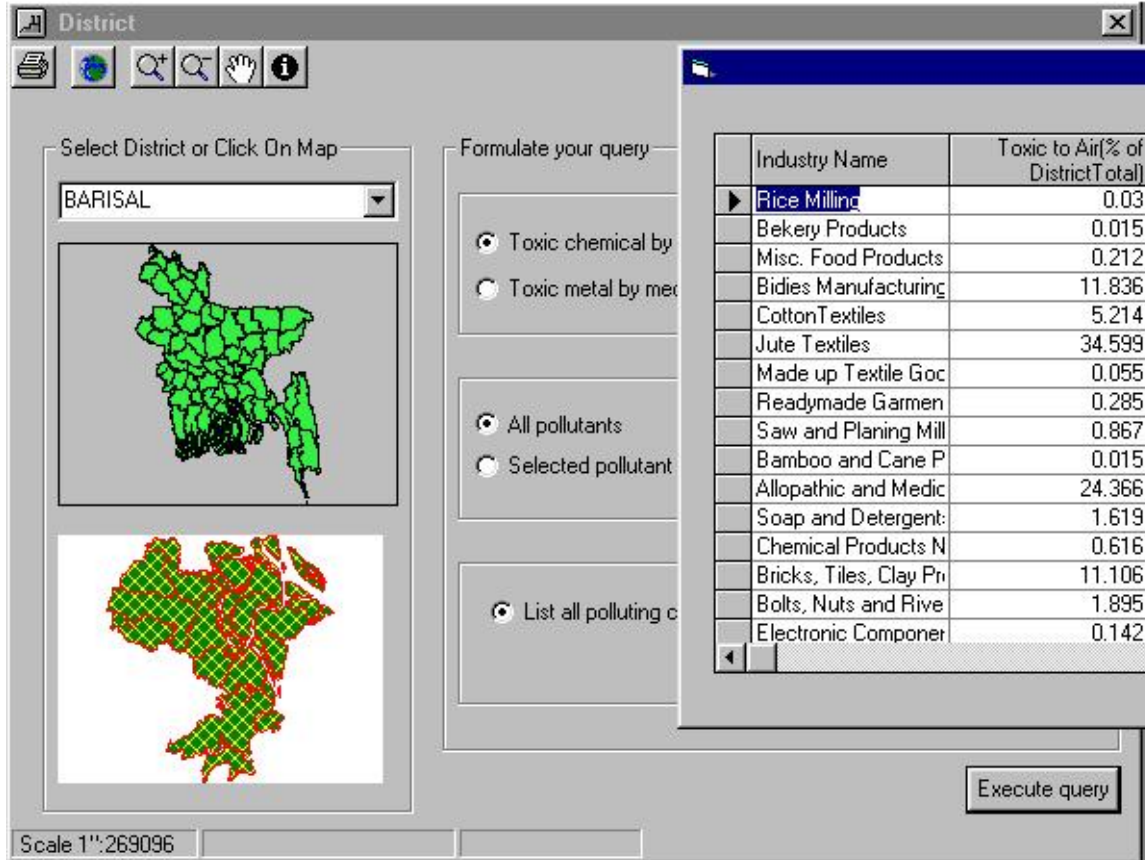
Selected pollutant

List all polluting contributors (Industry Sector)

Execute query

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Industry Name	Toxic to Air(% of DistrictTotal)
Rice Milling	0.03
Bekery Products	0.015
Misc. Food Products	0.212
Bidies Manufacturing	11.836
CottonTextiles	5.214
Jute Textiles	34.599
Made up Textile Goc	0.055
Readymade Garmen	0.285
Saw and Planing Mill	0.867
Bamboo and Cane P	0.015
Allopathic and Medic	24.366
Soap and Detergent:	1.619
Chemical Products N	0.616
Bricks, Tiles, Clay Pr	11.106
Bolts, Nuts and Rive	1.895
Electronic Componer	0.142

Note:

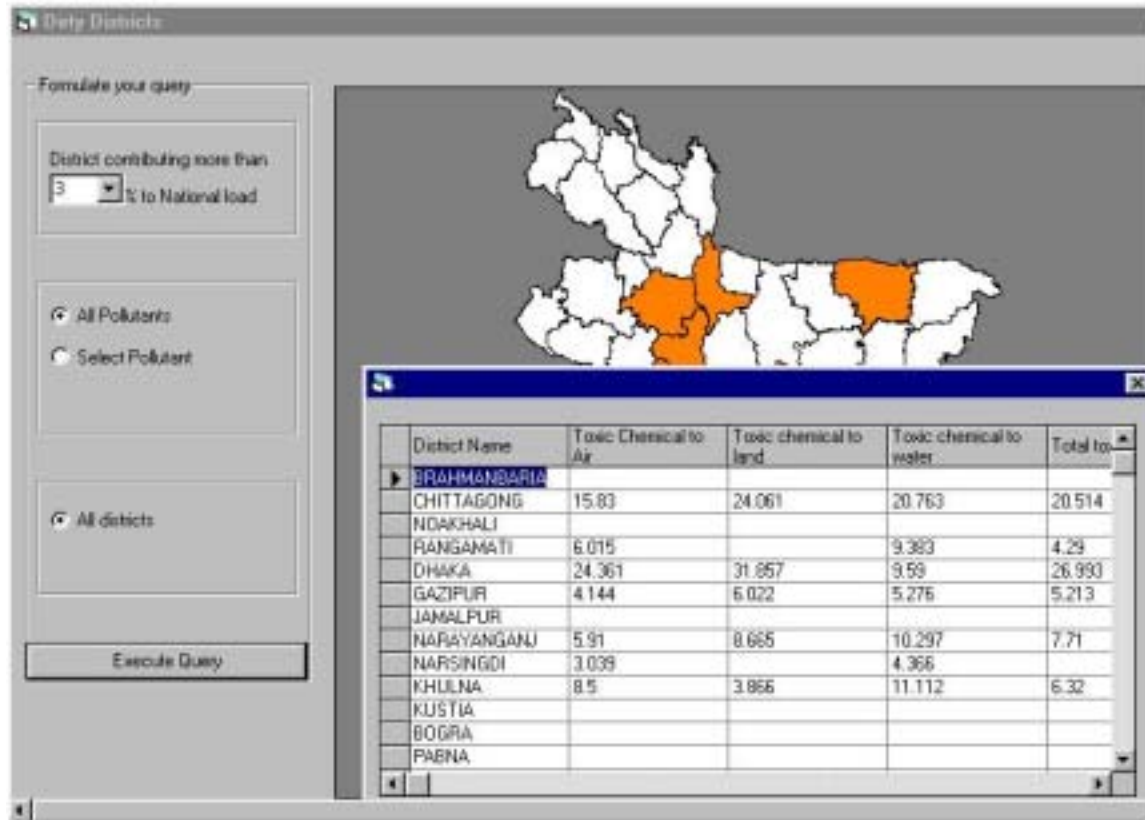
1. You may select your desired district from the pop-up or by clicking on the map.
2. You may ask to identify sources for all pollutants or a particular pollutant.
3. You may ask to list all contributing sources (industry sectors) or a top X contributors.

Dirty Districts

Dirty Districts: this query is built to identify the districts that contribute more than X percentage of pollution to national pollution loads for a particular pollutant (e.g. more than 10%). A map showing those districts that fulfil the given criteria along with a tabular report will be produced.

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Note:

1. You may assign any percentage as your lowest value of contribution.
2. You may ask to show all districts that contribute more than given percentage for any one of 16 pollutants or for a particular pollutant.
3. You may ask to show all districts or top X number of districts (e.g. top most 5 districts).

Dirty Sectors

Dirty Sectors: this query is built to identify the industry sectors that contribute more than X percentage of pollution to national pollution loads for a particular pollutant (e.g. more than 10%). A table will be produced showing those sectors that fulfil the given criteria along with actual percentage of contribution.

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Dirty Industry Sectors

Industry sectors contributing more than % to National loads

All Pollutants
 Select Pollutant

All Sectors
 Top

List

Note:

1. You may assign any percentage as your lowest value of contribution.
2. You may ask to show all industry sectors that contribute more than given percentage for any one of 16 pollutants or for a particular pollutant.
3. You may ask to show all industry sectors or top X number of sectors (e.g. top most 5 industry sectors).