Pechan Introduces New Web-Based Inventory System

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ABSTRACT

Pechan has developed a web-based system for developing, storing, analyzing, reporting, and exporting non-point/area source air pollutant emissions data. The system is called the Nonpoint Data Management System (NDMS). NDMS is a data driven application which is supported by a backend database in which data are stored, edited, and retrieved by the user through the web interface. The web interface allows for multiple users to work in the system at the same time.

NDMS supports the development of emission inventories for criteria air pollutants (CAPs), toxic (including hazardous) air pollutants, and greenhouse gases. Among the system features, NDMS can export emissions data into the U.S. Environmental Protection Agency's (EPA's) National Emissions Inventory (NEI) Input Format (NIF) and SMOKE input formats.

The system features a comprehensive geographic information system (GIS) interface that allows users to review the spatial allocation of emissions, activity data, and control data for their area of interest. The system requirements are simply a computer and web browser. During the summer of 2005, 10 state and local agencies reviewed NDMS as a part of EPA's "Rapid Inventory Development Pilot Project" for improving the development and reporting of nonpoint source inventory data.

INTRODUCTION

Nonpoint inventories are difficult and time consuming to develop and until now, no comprehensive system existed to develop emission estimates for nonpoint sources. NDMS was developed as a solution to the development of Nonpoint inventories.

The Consolidated Emissions Reporting Rule (CERR) specifies reporting thresholds for area CAPs, which vary depending on the pollutant and the attainment status of a county. The Clean Air Act also includes a specific definition of area hazardous air pollutant (HAP) sources for the purpose of identifying regulatory applicability. In particular, the Clean Air Act defines an area HAP source as "any stationary source that emits or has the potential to emit considering controls, in the aggregate, less than 10 tons per year of any HAP or 25 tons per year of any combination of HAPs." Sources that emit HAPs above these thresholds are categorized as "major sources." To reduce confusion between these two sets of area source definitions, EPA has adopted the term "nonpoint" to refer to all CAP and HAP stationary emission sources that are not incorporated into the point source component of the NEI.

NDMS was developed with two primary objectives:

1. *Developing Comprehensive and U.S. EPA National Emissions Inventory Format (NIF) Compliant Non-Point Inventories:* inventories developed with the system will be comprehensive in terms of both source and pollutant coverage. The system supports the development of inventories for criteria air pollutants (CAPs), toxic air pollutants (TAPs), and greenhouse gases (GHGs); and

2. *Incorporating the Data Needed for Air Quality Modeling:* the system is populated with temporal allocation profiles (monthly, weekly, diurnal), volatile organic compounds (VOC) and particulate matter (PM) speciation profiles, and spatial allocation data. These data are often used in the development of emission estimates and can be exported in formats needed by air quality modelers.

The system is pre-loaded with emission factors, temporal profiles, speciation data, growth factors, and control factors. Input tools are also provided along with default activity data sets for many source sectors. These input data are used by the system to calculate annual, summer season daily, and winter season daily emission estimates.

BODY

NDMS includes the following eight modules for building the inventories:

1. Data Management;
2. Data Import & Export;
3. Inventory Development;
4. Support Data;
5. Reporting & Analysis;
6. Maps & GIS Data;
7. Administrative; and
8. Self Help.

For each of the sub-menus there is a choice of *Add New* or *Edit/View*. *Add New* is used to directly enter a new set of data into the system using the screen interface, while *Edit/View* is used to manage data the user imports into the system under the DATA IMPORT & EXPORT menu or data the user has previously created using the *Add New* feature.

DATA MANAGEMENT MENU

This menu is where the user creates the underlying data files for calculating emissions. The underlying data files are created or edited through the following sub-menus shown on the right side of the screen:

- Activity data;
- Activity Allocation Data (or County Level Allocation Data);
- Emission Factors;
- Control Data;
- Temporal Allocation Factor Files;

- Spatial Allocation Data;
- Growth Factors; and
- Speciation Profiles.

The following provides a brief summary of each sub-menu.

Activity Data
This sub-menu is where activity data imported into the system or created using the web interface are viewed and edited by year, state, county, sector, sub-sector, and source classification code (SCC).

If a user wants to add a new set of activity data into the system, the user may use the *Add New* feature to enter, view, and edit activity data by year, state, county, sector, sub-sector, and SCC. Total activity data are entered for each county. If sources in the point source inventory account for any of the activity in a county, enter the point source activity for each county and the system will calculate and display the net activity (total minus point activity) in a separate field on the screen.

Alternatively, total state-level activity can be entered and the system will allocate the activity to counties using state-to-county allocation data created in the County Level Allocation Data sub-menu. After entering total state activity, the next screen provides the state activity data allocated to each county. Adjustments to total activity can then be made for each county to account for point source activity.

If a source category requires more than one type of activity data, the user must calculate the aggregate activity data value external to NDMS and then import the aggregated activity for each county into the system. The user may also enter the aggregated activity data directly into the system through the screen interface.

Activity Allocation Data
This sub-menu is where state-to-county allocation factors are developed and stored to support the allocation of state-level activity data to counties (e.g. population, employment). The values must be stored in decimal form with values ranging from 0 to 1.

Emission Factors
This sub-menu is where emission factors are entered at a state, county, SCC, and pollutant level. The unit in the denominator should match the units of the activity data so the units cancel when the NDMS multiplies the emission factor by the activity data under the INVENTORY DEVELOPMENT menu.

For emission factor equations, the aggregate emission factor must be calculated external to the system and then imported or entered directly into the system.

Control Data
Control efficiency, rule effectiveness, rule penetration, control device codes and description are viewed or added on a state, county, SCC, and pollutant code basis in this sub-menu.

Temporal Allocation Factor Files
This sub-menu is used to create and edit temporal allocation factor data needed to calculate daily emissions or to prepare input files for emissions processors for air quality modeling. The system provides for the addition of monthly, weekly, and daily profiles. The system comes preloaded with default profiles from EPA's Emissions Modeling Clearinghouse.

Growth Factors
This sub-menu is where growth factors can be entered for the purpose of developing future year inventories. Default growth factors can be provided to users based on existing State or Regional Planning Organization inventories.

Spatial Allocation Data
This sub-menu will hold data for allocating emissions from the county-level to the modeling grid needed to support air quality modeling. It will also be set-up to hold geocoded data (i.e., coordinates) for source categories as available. The system does not in itself prepare gridded inventories.

Speciation Profiles
This sub-menu will allow the user to develop the SCC-to-speciation profile cross-reference file. The file will be exported and used as input to emission processors to speciate VOC and PM emissions for air quality modeling. Default speciation profiles from EPA's latest updates to the SPECIATE system are included.

DATA IMPORT & EXPORT MENU

This menu is used to import data into and export data out of the system. This menu includes the following sub-menus for importing data:

Data Import
The data import sub-menus determine the way data are brought into the system. Each sub-menu page provides a file shell that the user must download and populate and then import into the system. The file shell format ensures that all of the data are organized for the system to correctly use the imported data. The sub-menus are as follows:

- NIF 3.0 Inventory Data
- Activity Data
- Control Data
- Emission Factors
- Temporal Allocation Data
- Speciation Profiles
- Spatial Allocation Data

After importing the data, the user can review and edit data using the DATA MANAGEMENT menu. The user can also import a NIF 3.0 inventory and append it to inventory data for other categories using the INVENTORY DEVELOPMENT menu.

Data Export
The following formats are currently supported:

- NIF 3.0
- SMOKE 2.1 IDA
- SMOKE 2.1 ORL

INVENTORY DEVELOPMENT MENU

This menu is used to calculate emissions for the user's inventory and prepare the files for export to NIF 3.0 and/or SMOKE input files. The following provides a brief summary of each of the three sub-menus under this menu:

Emissions Inventory
The *Add/New* feature is used to select and link the activity, emission factor, and control data together to calculate emissions and create the inventory data to be exported to NIF or SMOKE input format.

The *Data Cloning* feature is used to copy and modify an existing inventory so that repetitive work can be minimized.

The *Pending* feature is used to resume work on data files for which work was not completed during a prior session.

The *Edit/View* feature is where an existing inventory can be examined and changed.

Project Future Year Emissions Inventory
This sub-menu is where the user will enter data for applying the growth and control factors to base year emissions to create future-year inventories.

Quality Assurance / Quality Control
This sub-menu will include QA/QC checks to ensure that the format requirements for creating NIF and SMOKE files are met. Currently, there are no plans to include the EPA QA software into NDMS. The user will need to export inventories to NIF 3.0 and run the EPA QA software on the inventory prior to submitting it to EPA through CDX.

REPORTING AND ANALYSIS (GRAPHS & TABULAR DATA)

This menu is used to display and review the emissions data by graphs or in tabular format after creating or importing the inventory for one or more source categories. Before analysis can begin, an inventory must be defined (using the INVENTORY DEVELOPMENT menu). NDMS supports the following types of summaries:

- Emissions Summary by state, county, SCC.
- Area Sources Emissions Top 10 Reports
- Tier-level Emissions Summary by State

Additional summaries can be added or modified as requested by a State or local agency.

MAPS AND GIS DATA

This is a comprehensive GIS module that brings up a US map which defaults to center on the state specified by the user name. This map displays emissions based on the inventories saved (INVENTORY DEVELOPMENT menu). It also has overlay capabilities to show overlays of different data like gas stations, political subdivisions, or industrial or commercial/institutional employment. In addition to emissions data, the user can review the spatial allocation of activity and control data, which provides valuable QA capability.

- first GIS based online system that performs real time analysis of activity data or emissions;
- uses state of the art Scalable Vector Graphics (SVG) mapping that is huge cost savings over ArcGIS engines and uses the same ESRI shape files;
- Pechan has already converted ESRI shape files and preloaded them; more can be customized upon request;
- Use XML/text to transfer data over web, hence its really fast and reliable.

SUPPORT DATA MENU

This menu is where data which do not change from year to year are found.

Base Data

This sub-menu provides access to the following underlying data as it exists in NDMS: Common data sets such as population, employment, fuel consumption (e.g. Department of Energy), etc. Source classification codes (SCCs), pollutant codes, units, source sub-sectors or tiers, States, and counties.

Guidance Documents

Provides a list of websites referring to documents, software, and databases to support development of emission inventories.

NIF Code Tables

This sub-menu contains an Excel Workbook file with all of the NIF 3.0 reference codes that are valid for use in preparing NIF 3.0 files for submittal to the U.S. EPA.

SCC Master List

This contains the latest U.S. EPA’s master list of SCCs (dated February 2004).

Sector to Sub Sector
This sub-menu is where the user assigns sub-sectors to sectors.

Sub Sector to SCC List
This sub-menu is where the user assigns SCCs to sub-sectors.

ADMINISTRATION MENU

User Administration
Site Administration

SELF HELP MENU

Frequently Asked Questions (FAQs)
Documents
Email Bug

CONCLUSION

Pechan has completed the development of a new web-based system to create non-point/area source air pollutant emissions databases. The system is data driven and operates through a web interface. The system features a comprehensive GIS interface and makes the development of nonpoint inventories easy and efficient. This system is the first comprehensive system developed to create emission estimates for Nonpoint sources.

Features include:

- ✓ Easy to use;
- ✓ Reduces QA issues commonly encountered;
- ✓ Centralizes storage of data;
- ✓ Maintains historical data sets;
- ✓ Prepares fully compliant EPA submissions;
- ✓ Featured in EPA's Rapid Inventory Development Pilot (RID) Project – 10 States;
- ✓ Only requirements are a computer and internet connection.

KEY WORDS
EPA
NONPOINT INVENTORIES
NIF
NEI
SMOKE
GIS
WEB-BASED

ACKNOWLEDGEMENTS

We would like to thank Doug Soloman of EPA for featuring NDMS in the Rapid Inventory Development Pilot Project during the summer of 2005. Comments received during that review were valuable to the on-going development of the NDMS application.