Technical Report No. 9

Air Emissions Inventory for the Greater Metropolitan Region in New South Wales

Emissions Data Management System (EDMS v1.0): User's Manual

Prepared jointly by

Department of Environment and Climate Change NSW
Pacific Air & Environment Pty Ltd

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1 INTRODUCTION

The Department of Environment and Climate Change NSW (DECC) has completed a three year air emissions inventory project (DECC, 2007a; DECC, 2007b; DECC, 2007c; DECC, 2007d; DECC, 2007e; DECC, 2007f; DECC, 2007g; DECC, 2007h; & DECC, 2007i). The base year of the inventory represents activities that took place during the 2003 calendar year and is accompanied by emission projections in yearly increments up to the 2031 calendar year. The area included in the study covers greater Sydney, Newcastle and Wollongong regions, known collectively as the Greater Metropolitan Region (GMR).

The study region defined as the GMR measures 210 km (east-west) by 273 km (north-south). The study region is defined in Table 1.1 and shown in Figure 1.1.

Table 1.1: Definition of Greater Metropolitan, Sydney, Newcastle and Wollongong regions

Region	South-west corner MGA[1] co-ordinates		North-east corner MGA[1] co-ordinates	
	Easting (km)	Northing (km)	Easting (km)	Northing (km)
GREATER METROPOLITAN	210	6159	420	6432
SYDNEY	261	6201	360	6300
NEWCASTLE	360	6348	408	6372
WOLLONGONG	279	6174	318	6201

[1] *MGA = Map Grid of Australia based on the Geocentric Datum of Australia 1994 (GDA94) (ICSM, 2002).*

The air emissions inventory includes emissions from biogenic (i.e. natural) and anthropogenic (i.e. human derived) sources.

The anthropogenic source groups included in the air emissions inventory are as follows:

- Commercial businesses (i.e. non-EPA-licensed);
- Domestic-commercial activities;
- Industrial premises (i.e. EPA-licensed);
- Off-road mobile (i.e. non-registered off-road vehicles and equipment); and
- On-road mobile (i.e. registered on-road vehicles).

The pollutants inventoried include criteria pollutants specified in the *Ambient Air Quality NEPM* (NEPC, 2003), air toxics associated with the *National Pollutant Inventory* (*NPI*) *NEPM* (NEPC, 2000) and the *Air Toxics NEPM* (NEPC, 2004) and any other pollutants associated with state specific programs, including: *Load Based Licensing* (*Protection of the Environment Operations (General) Regulation 1998* (PCO, 1998)); and *Protection of the Environment Operations (Clean Air) Regulation 2002* (PCO, 2005).

The Emissions Data Management System (EDMS v1.0) (Bawden, 2008) is an overarching air emissions inventory database that links to individual source-specific databases comprising all the data necessary to service policy and technical related queries. The EDMS uses the Microsoft® SQL Server 2005™ relational database management system (Microsoft, 2008) which is a comprehensive, integrated data management and analysis software package.

This document is a User's Manual that explains the navigation and use of all the features contained in the EDMS.

Figure 1.1: Definition of Greater Metropolitan, Sydney, Newcastle and Wollongong regions

2 THE DATABASE

The EDMS is started by navigating to “Start” in Windows and selecting the EDMS database program.

When the EDMS is started, the “EDMS - Splash Screen” appears as shown in Figure 2.1.

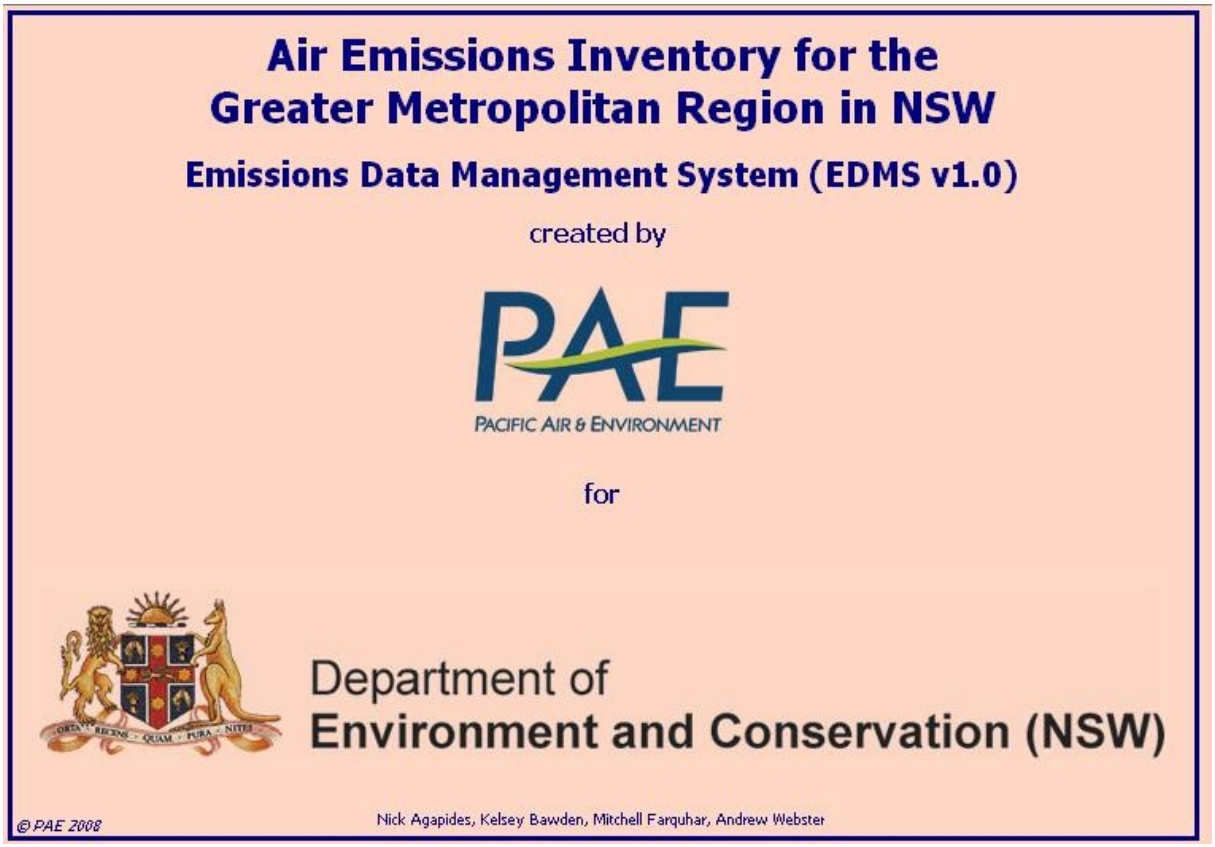

Figure 2.1: “EDMS - Splash Screen”

The "EDMS - Splash Screen" is displayed for approximately 5 seconds and then the "EDMS - Switchboard" appears as shown in Figure 2.2.

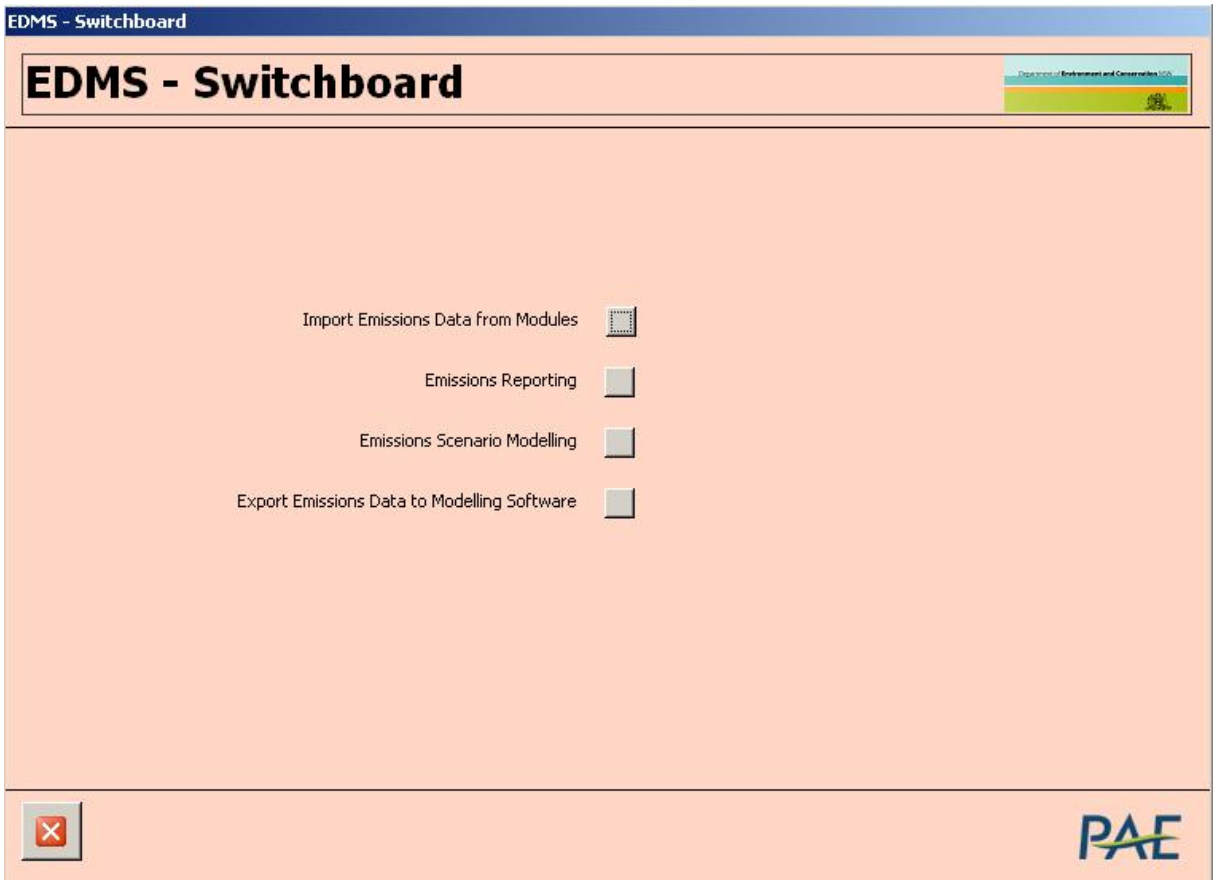

Figure 2.2: "EDMS – Switchboard"

The "EDMS - Switchboard" is the main form of the EDMS where users can choose which type of functions they would like to perform. From the "EDMS - Switchboard", users can navigate to forms which provide the following functions:

- Import emissions data from emissions inventory modules (i.e. "Import Emissions Data from Modules", see Section 2.1);
- Generate reports and charts from emissions inventory data (i.e. "Emissions Reporting", see Sections 2.2 and 2.3);
- Apply factors to change emissions and test policy scenarios (i.e. "Emissions Scenario Modelling", see Section 2.4); and
- Export data compatible with modelling software (i.e. "Export Emissions Data to Modelling Software", see Sections 2.5 and 2.6).

2.1 Importing Data

Users must import data into the EDMS from each of the air emissions inventory module databases i.e.:

- Biogenic emissions inventory;
- Commercial emissions inventory;
- Domestic-Commercial emissions inventory;
- Industrial emissions inventory;
- Off-Road Mobile emissions inventory; and
- On-Road Mobile emissions inventory.

To import data into the EDMS, the user must select the "Import Emissions Data from Modules" button from the "EDMS - Switchboard" shown in Figure 2.2. The file format specifications for imported data are provided in Appendix A. Users must then select the folder where the import files have been stored from the "Import Emissions Data from Modules" form shown in Figure 2.3 and click on the button shown on the form. **Note!: After data has been imported from a module, into the EDMS, the database must be closed down and reopened again.**

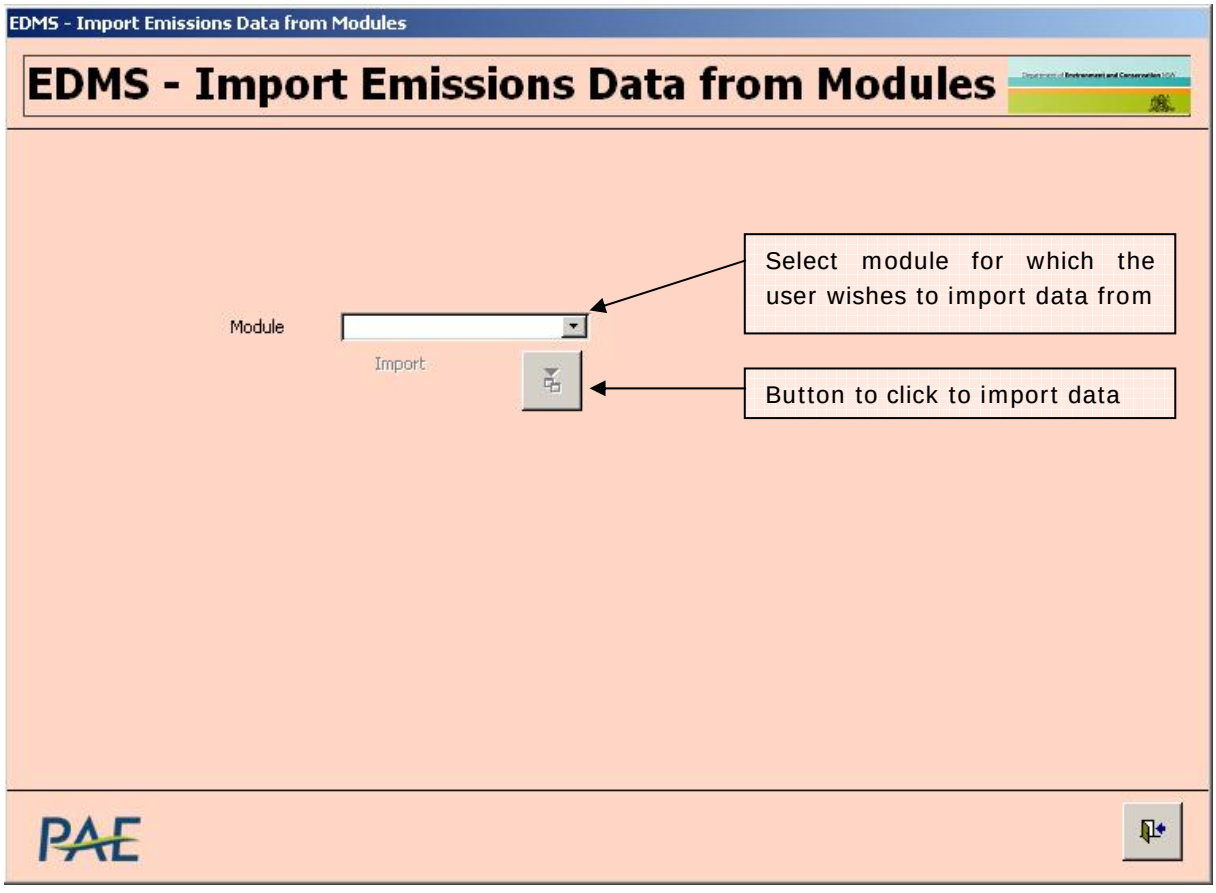

Figure 2.3: "EDMS - Import Emissions Data from Modules"

2.2 Reporting Functions

To generate reports and charts, the user must select the "Emissions Reporting" button from the "EDMS - Switchboard" shown in Figure 2.2.

From the "EDMS - Emissions Reporting" form shown in Figure 2.4, users can perform either of the following tasks:

- Generate a "Source Details Report" (Section 2.2.1);
- Generate a "Source Emissions Report" (Section 2.2.2);
- Generate an "Emissions to Area Report" (Section 2.2.3);
- Specify "Substances for Report" (Section 2.2.4);
- Generate a "Substance Details Report" (Section 2.2.5);
- Generate a "Source Apportionment Pie Chart" (Section 2.3.1); and
- Generate an "Emission Trend Line Chart" (Section 2.3.2).

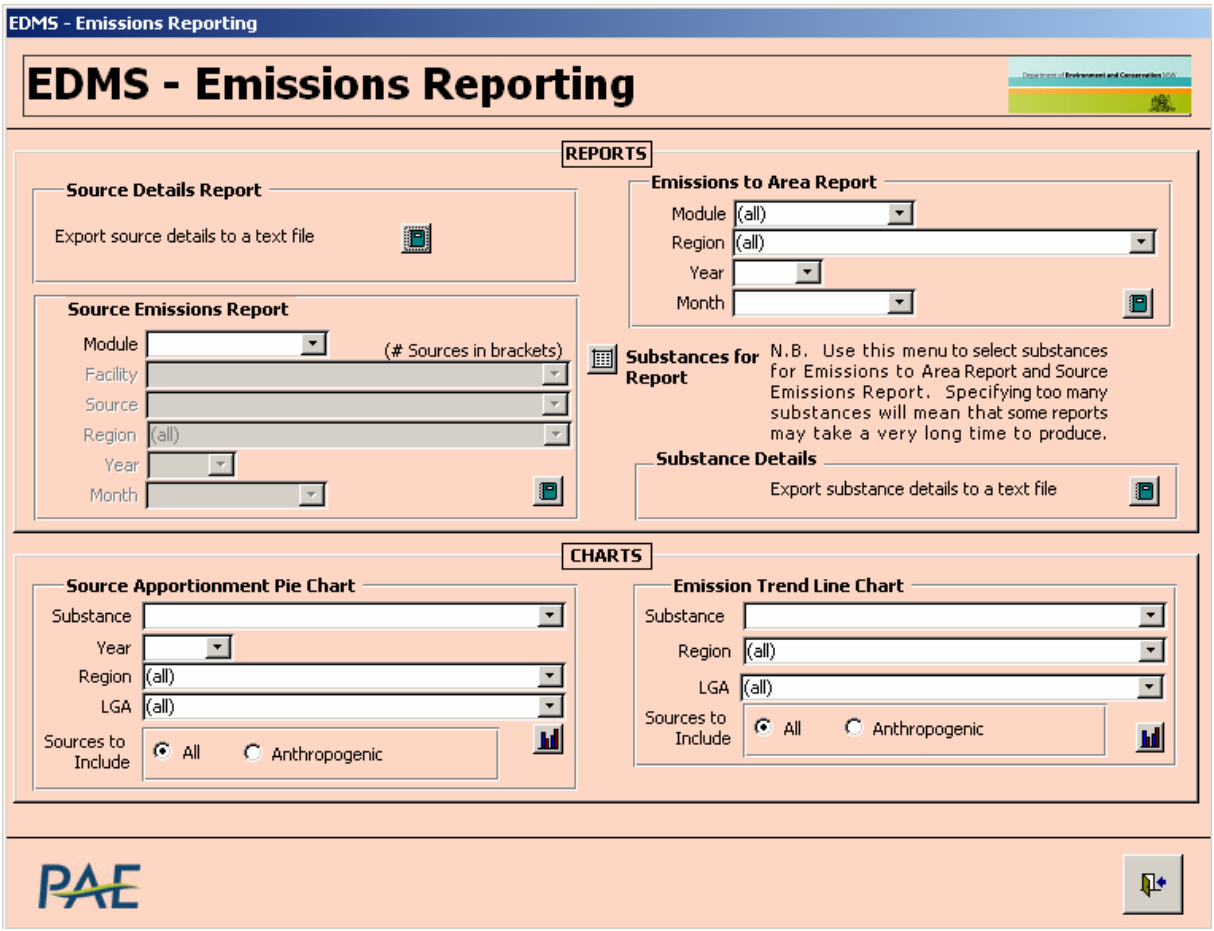

Figure 2.4: "EDMS - Emissions Reporting"

2.2.1 Source Details Report

The “Source Details Report” details all emission sources included in the emissions inventory. The “Source Details Report” includes the following parameters for each emission source:

- Module_ID (i.e. 1 = Industrial, 2 = Commercial, 3 = Off-Road Mobile, 4 = Biogenic, 5 = Domestic-Commercial, and 6 = On-Road Mobile)
- Module_Name (i.e. name of the Module where the emission source is categorised within)
- Facility_ID (i.e. Facility identifier for the emission source. Note that the Facility_ID is only unique to each module (i.e. there could be 6 facilities with an ID of 1 within all the complete emissions inventory, one for each module))
- Facility (i.e. Facility name for industrial and commercial facilities, and emission source name for all other inventory modules)
- Source (i.e. the emission Source name)
- Source_Type (either Point, Fugitive or Area)
- NSW_Activity_Code (i.e. the Code to specify the Schedule of EPA licensed activities specified in the *Protection of the Environment Operations Act 1997*. A NSW_Activity_Code of 0 is assigned to emission sources that are not from EPA licensed premises)
- Activity (i.e. name of the Activity where the emission source is categorised within)
- ANZSIC_Class_Code (i.e. the Class Code from the Australian and New Zealand Standard Industrial Classification (ANZSIC) system where the emission source is categorised within. An ANSZIC_Class_Code of 0 is assigned to emission sources that are not categorised (e.g. fugitive/windborne emission source from the biogenic module)
- ANZSIC_Class (i.e. the name of the ANZSIC Class where the emission source is categorised within)

To generate the “Source Details Report” users must click on the “Export source details to a text file“ button to the right of the “Source Details Report” sub-form and select a location to save the file (see Figure 2.5). The file produced is in comma separated variable format (*.csv)

The steps described above are graphically shown in Figure 2.5.

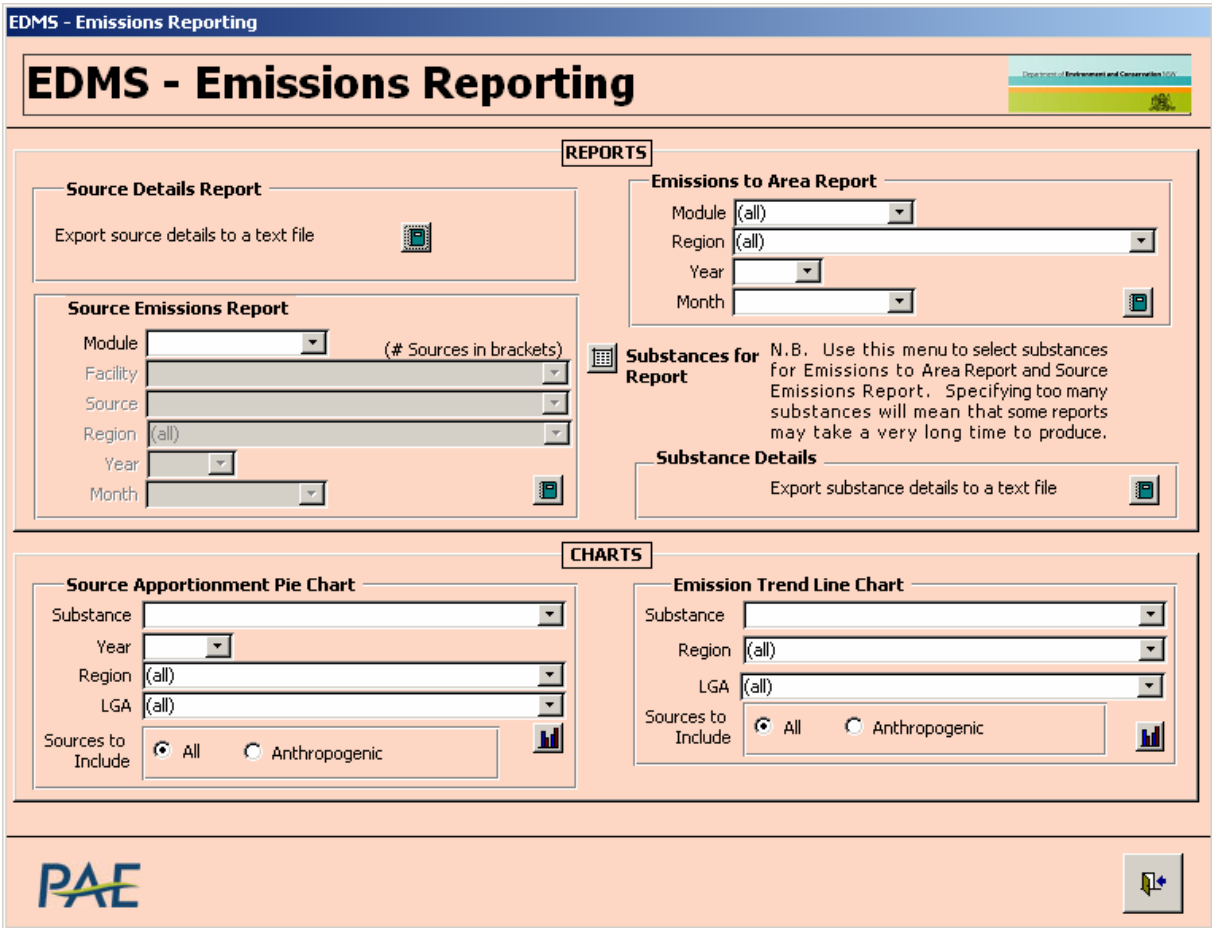

Figure 2.5: "EDMS - Emissions Reporting" – "Source Details Report"

2.2.2 Source Emissions Report

The "Source Emissions Report" details emissions for a specified emission source. Emissions are output to the file and detail emissions of all Substances from the emission Source in units of kilograms per year, kilograms per month, kilograms per week day and kilograms per weekend day.

Each inventory module defines emission sources uniquely. Industrial and commercial emission sources are defined as either point or fugitive sources that occur at a specific location (point sources) or in a defined 1 km by 1 km grid square (fugitive sources). Biogenic, domestic-commercial, off-road mobile and on-road mobile emission sources are defined as area sources that occur in a defined 1 km by 1 km grid square. The "Source Emissions Report" generates a report that details emissions from either a specific emission source within the industrial or commercial modules or an emission source type within the biogenic, domestic-commercial, off-road mobile or on-road mobile modules (i.e. all emissions in a specified region from a specified emission source type).

Industrial and Commercial sources:

The "Source Emissions Report" includes the following parameters for each emission source:

- Module_ID (i.e. 1 = Industrial, and 2 = Commercial)
- Module_Name (i.e. name of the Module where the emission source is categorised within)
- Month (i.e. January to December)
- Year (i.e. 2003 to 2031)
- LGA (i.e. Local Government Area)
- Region (i.e. Sydney, Newcastle, Wollongong and Non-Urban)
- Facility_ID (i.e. Facility identifier for the emission source)
- Facility (i.e. Facility name for industrial and commercial facilities)
- Source (i.e. the emission Source name)
- Substance (i.e. Substance name)
- kg/week day
- kg/weekend day
- kg/month
- kg/year

To generate a "Source Emissions Report", users must perform the following steps:

- Select the inventory module for the emission source (i.e. either Industrial or Commercial)
- Select the "Facility" or emission identifier (i.e. Facility name for Industrial and Commercial facilities)
- Select the emission source name
- Select the year of interest
- Select the month of interest
- Click on the button to the right of the "Source Details Report" sub-form and select a location to save the file (see Figure 2.6). The file produced is in comma separated variable format (*.csv)

The steps described above are graphically shown in Figure 2.6.

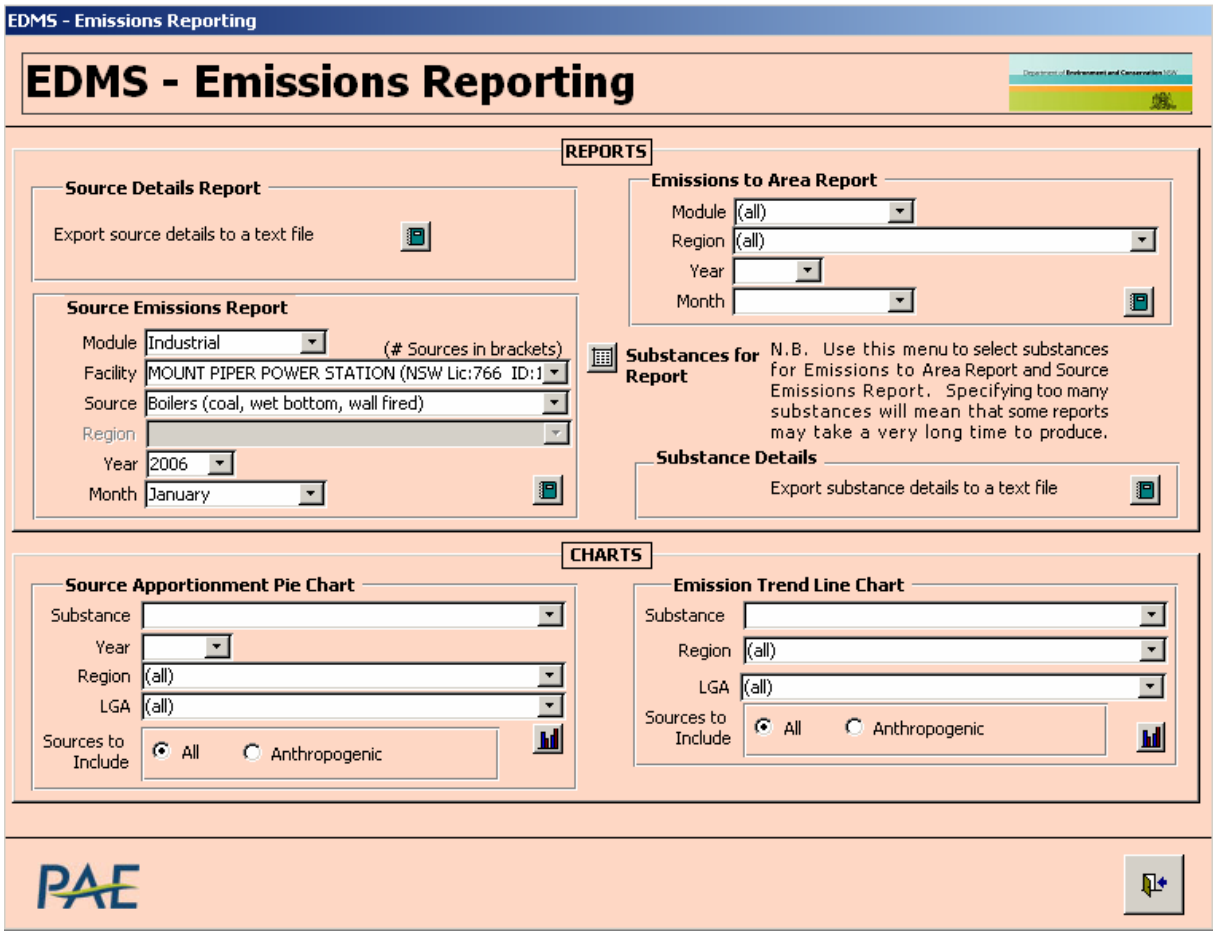

Figure 2.6: "EDMS – Emissions Reporting" – "Source Emissions Report" for Industrial and Commercial Modules

Biogenic, Domestic-Commercial, Off-Road Mobile and On-Road Mobile sources:

The "Source Emissions Report" includes the following parameters for each emission source:

- Module_ID (i.e. 3 = Off-Road Mobile, 4 = Biogenic, 5 = Domestic-Commercial, and 6 = On-Road Mobile)
- Module_Name (i.e. name of the Module where the emission source is categorised within)
- Month (i.e. January to December)
- Year (i.e. 2003 to 2031)
- LGA (i.e. Local Government Area)
- Region (i.e. Sydney, Newcastle, Wollongong and Non-Urban)
- Facility_ID (i.e. Facility identifier for the emission source. Note that the Facility_ID is only unique to each module (i.e. there could be 6 facilities with an ID of 1 within all the complete emissions inventory, one for each module))
- Facility (i.e. Emission source name for Biogenic, Domestic-Commercial, Off-Road Mobile and On-Road Mobile sources)
- Source Type (i.e. the emission Source Type name)
- Substance (i.e. Substance name)
- kg/week day
- kg/weekend day
- kg/month
- kg/year

To generate a "Source Emissions Report", users must perform the following steps:

- Select the inventory module for the emission source (i.e. either Biogenic, Domestic-Commercial, Off-Road Mobile or On-Road Mobile)
- Select the "Facility" or emission identifier (i.e. emission source name for Biogenic, Domestic-Commercial, Off-Road Mobile and On-Road Mobile sources)
- Select the "Source Type"
- Select the "Region" of interest (i.e. GMR, Sydney, Newcastle, Wollongong or Non-Urban)
- Select the year of interest
- Select the month of interest
- Click on the button to the right of the "Source Details Report" sub-form and select a location to save the file (see Figure 2.7). The file produced is in comma separated variable format (*.csv)

The steps described above are graphically shown in Figure 2.7.

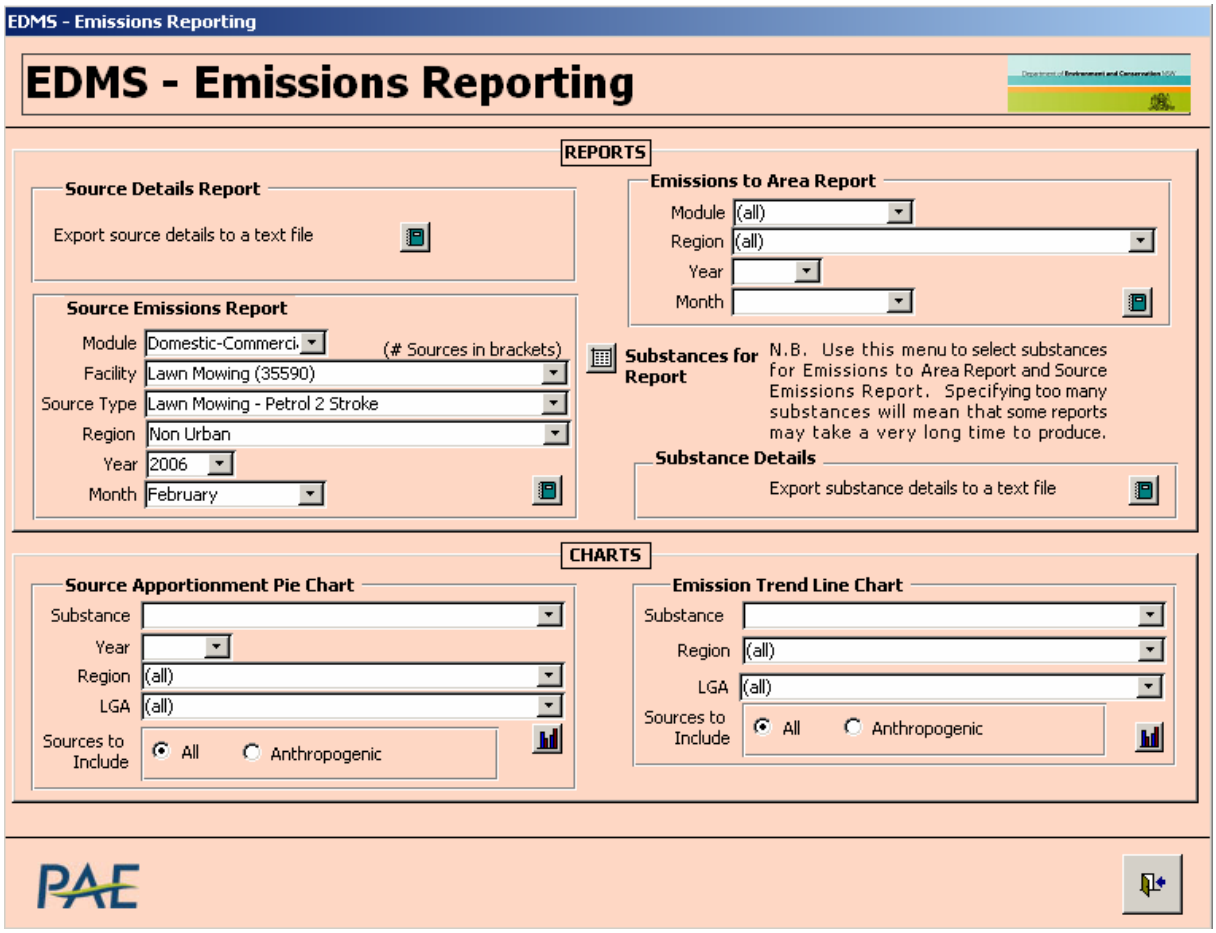

Figure 2.7: "EDMS – Emissions Reporting" – "Source Emissions Report" for Biogenic, Domestic-Commercial, Off-Road Mobile and On-Road Mobile Modules

2.2.3 Emissions to Area Report

The “Emissions to Area Report” details emissions of specified substances to a specified area within the Greater Metropolitan Region (GMR). The “Emissions to Area Report” includes the following parameters:

- Module_ID (i.e. 1 = Industrial, 2 = Commercial, 3 = Off-Road Mobile, 4 = Biogenic, 5 = Domestic-Commercial, and 6 = On-Road Mobile)
- Module_Name (i.e. name of the Module where the emission source is categorised within)
- Month (i.e. January to December)
- Year (i.e. 2003 to 2031)
- LGA (i.e. Local Government Area)
- Region (i.e. Sydney, Newcastle, Wollongong and Non-Urban)
- Activity (i.e. name of the Activity where the emission source is categorised within)
- Substance (i.e. Substance name)
- kg/week day
- kg/weekend day
- kg/month
- kg/year

Emissions are output to the file and detail emissions of all Substances from all Activities in units of kilograms per year, kilograms per month, kilograms per week day and kilograms per weekend day. Emissions are categorised into separate Local Government Areas and Activities in the exported report.

Users must perform the following steps to generate the “Emissions to Area Report”:

- Select the emissions inventory module
- Select the region of interest (either entire region i.e. GMR or either Sydney, Newcastle, Wollongong or Non-Urban regions)
- Select a year
- Select a month
- Click on the button to the right of the “Emissions to Area Report” sub-form and select a location to save the file (see Figure 2.8). The file produced is in comma separated variable format (*.csv)

The steps described above are graphically shown in Figure 2.8.

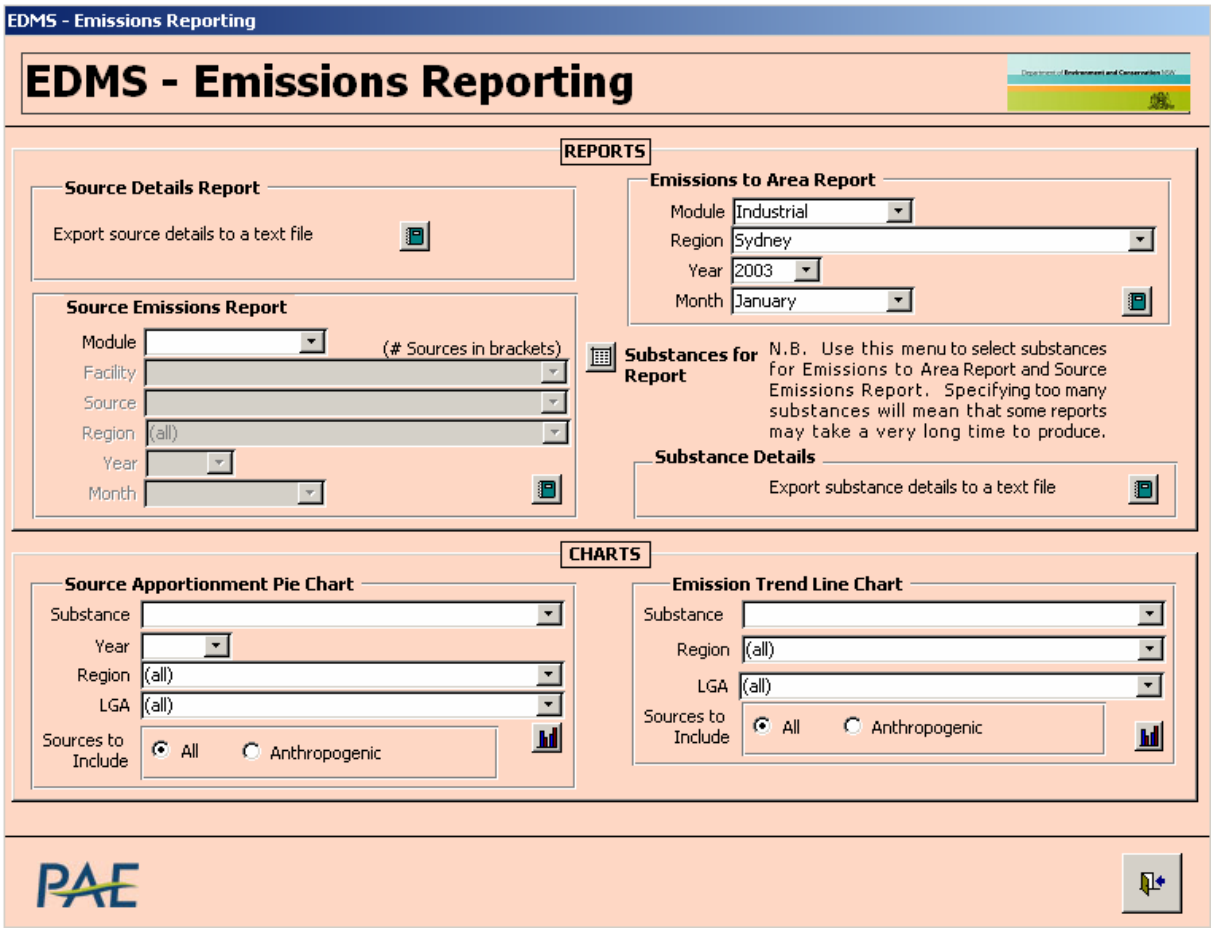

Figure 2.8: "EDMS - Emissions Reporting" – "Emissions to Area Report"

2.2.4 Specifying Substances for Reports

For the "Source Emissions Report" and "Emissions to Area Report", the substances to be reported must be selected by the user by clicking the "Substances for Report" button from the "EDMS - Emissions Reporting" form. This generates the "Substances for Report" form as shown in Figure 2.9.

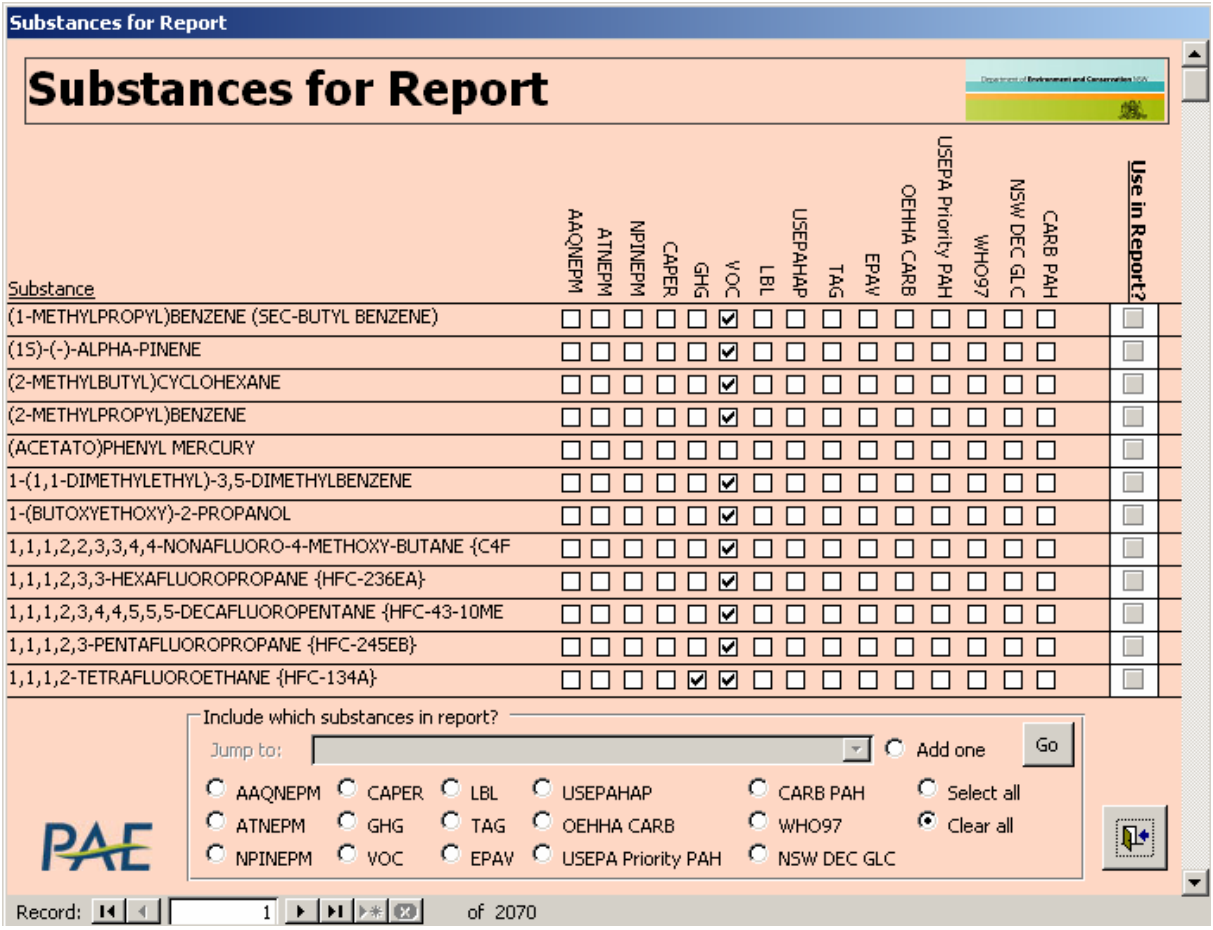

Figure 2.9: "Substances for Report"

Users can perform the following functions:

- Clear all substances previously selected. To do this users must:
  - Check the "Clear all" button and select the "Go" button.
- Select a group of substances, such as all substances that are in the Ambient Air Quality NEPM (AAQNEPM). To do this users must:
  - Check the group of substances that the user wishes to report on and select the "Go" button.
- Add a single substance to the reports. To do this users must:
  - Select the "add-one" radio check box, select a single substance from the drop-down list and select the "Go" button.

Acronyms used to describe substance groups are described in Table 2.1.

Table 2.1: Substance Group Acronyms used in the Database

Acronym	Definition
AAQNEPM	Pollutants included in the *Ambient Air Quality NEPM* (NEPC, 2003)
ATNEPM	Pollutants included in the *Air Toxics NEPM* (NEPC, 2004)
NPINEPM	Air pollutants included in the *NPI NEPM* (NEPC, 2000)
CAPER	Pollutants associated with the *Protection of the Environment Operations (Clean Air) Regulation 2002* (PCO, 2005)
GHG	Greenhouse gas substances (where estimated) (IPCC, 2001)
VOC	Substances considered volatile organic compounds (Carter, 2003)
LBL	Air pollutants associated with the *Protection of the Environment Operations (General) Regulation 1998* (PCO, 1998)
TAG	Commonwealth Government Air Toxics Program Technical Advisory Group (13 March 2000) priority air pollutants (DEH, 2001)
EPAV	Environment Protection Authority of Victoria air toxic pollutants sourced from Hazardous Air Pollutants - A Review of Studies Performed in Australia and New Zealand (EPAV, 1999)
USEPAHAP	U.S. Environmental Protection Agency list of 189 Hazardous Air Pollutants (USEPA, 2005)
OEHHA_CARB	Air pollutants included in the Office of Environmental Human Health Assessment (OEHHA)/Air Resources Board (ARB) 'hot spots' list (CARB, 2005)
USEPA Priority PAH	USEPA 16 priority polycyclic aromatic hydrocarbons (PAHs) (Keith et. al., 1979)
CARB PAH	Air pollutants included in the Office of Environmental Human Health Assessment (OEHHA)/Air Resources Board (ARB) 'hot spots' list (CARB, 2005)
WHO97	WHO97 polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) (Van den Berg et. al., 1998)
NSW DEC GLC	DEC regulated pollutants with design ground level concentrations (DEC, 2005)

2.2.5 Substance Details Report

From the "EDMS - Emissions Reporting" form users can export the "Substance Details Report". The "Substance Details Report" includes data for all substances contained within the emissions inventory. Click on the button to the right of the "Substance Details Report" sub-form and select a location to save the file (see Figure 2.10). The file produced is in comma separated variable format (*.csv).

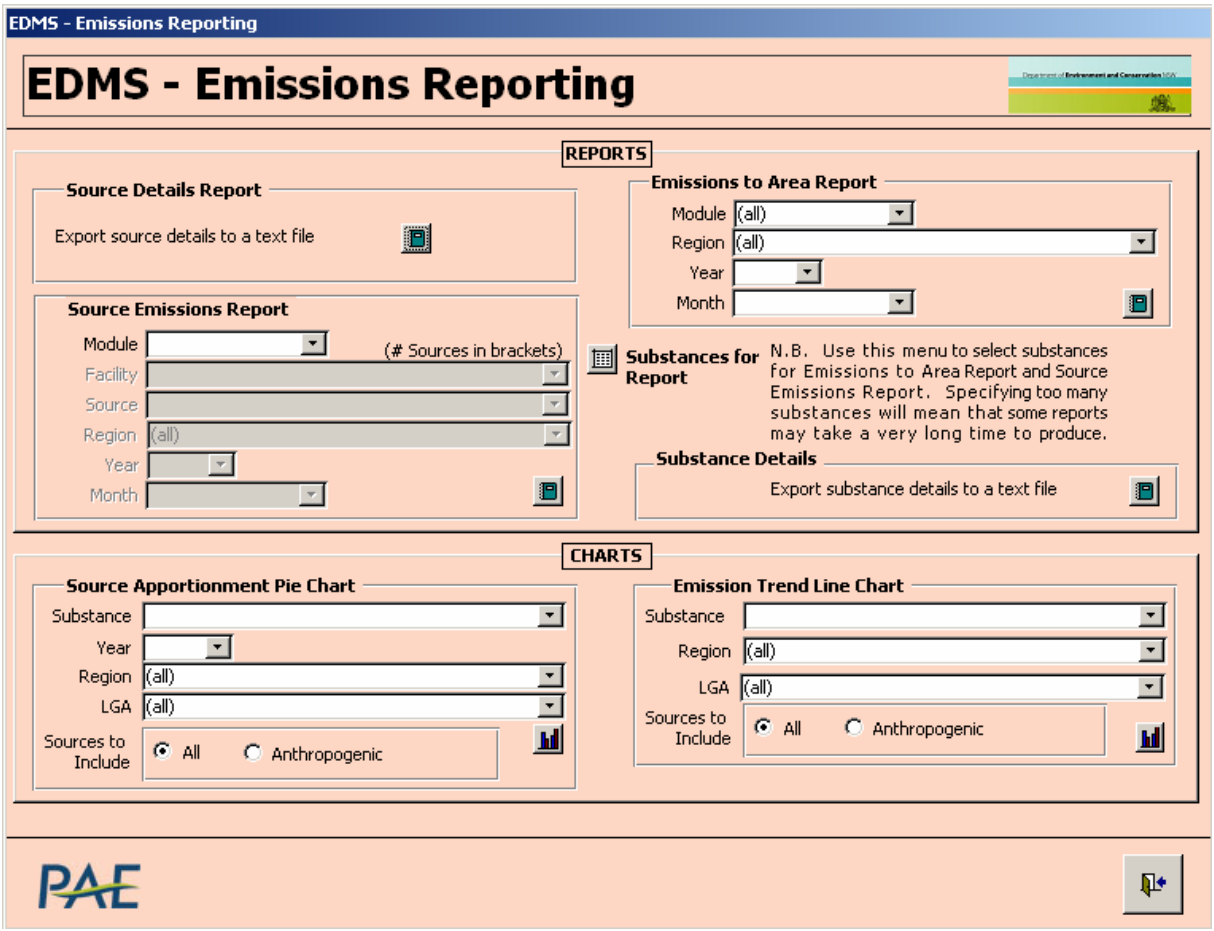

Figure 2.10: "EDMS - Emissions Reporting" – "Substance Details Report"

The data that is exported in the "Substance Details Report" is detailed in Table 2.2.

Table 2.2: Data Exported in Substance Details Report

Acronym	Definition
Substance_ID	Unique identifier for each substance in the emissions inventory
Substance_Name	Unique substance name for each substance in the emissions inventory
CASR_Number	Chemical Abstract Series Registry Number for each substance in the emissions inventory
CBIV_Carbon_Number	Number of carbon atoms contained in the substance used to calculate Carbon Bond IV photochemical groupings
CBIV_Molecular_Weight	Molecular weight (g/g.mole) for each substance used to calculate Carbon Bond IV photochemical groupings
MIR	Maximum Incremental Reactivity (g ozone/g substance) (Carter, 2003)
Substance_Group_ID	1 = Particulates, 2 = Organics,, 3 = Oxides of nitrogen, 4 = Sulfur dioxide, 5 = Carbon monoxide, and 6 = Others
IS_AAQNEPM	Pollutants included in the *Ambient Air Quality NEPM* (NEPC, 2003) (indicated by a TRUE value)
IS_ATNEPM	Pollutants included in the *Air Toxics NEPM* (NEPC, 2004) (indicated by a TRUE value)
IS_NPINEPM	Air pollutants included in the *NPI NEPM* (NEPC, 2000) (indicated by a TRUE value)
IS_CAPER	Pollutants associated with the *Protection of the Environment Operations (Clean Air) Regulation 2002* (PCO, 2005) (indicated by a TRUE value)
IS_GHG	Greenhouse gas substances (where estimated) (IPCC, 2001) (indicated by a TRUE value)
IS_VOC	Substances considered volatile organic compounds (Carter, 2003) (indicated by a TRUE value)
IS_LBL	Air pollutants associated with the *Protection of the Environment Operations (General) Regulation 1998* (PCO, 1998) (indicated by a TRUE value)
IS_TAG	Commonwealth Government Air Toxics Program Technical Advisory Group (13 March 2000) priority air pollutants (DEH, 2001) (indicated by a TRUE value)
IS_EPAV	Environment Protection Authority of Victoria air toxic pollutants sourced from Hazardous Air Pollutants - A Review of Studies Performed in Australia and New Zealand (EPAV, 1999) (indicated by a TRUE value)
IS_USEPAHAP	U.S. Environmental Protection Agency list of 189 Hazardous Air Pollutants (USEPA, 2005) (indicated by a TRUE value)
IS_OEHHA CARB	Air pollutants included in the Office of Environmental Human Health Assessment (OEHHA)/Air Resources Board (ARB) 'hot spots' list (CARB, 2005) (indicated by a TRUE value)
IS_USEPA Priority PAH	USEPA 16 priority polycyclic aromatic hydrocarbons (PAHs) (Keith et. al., 1979) (indicated by a TRUE value)
IS_CARB PAH	Air pollutants included in the Office of Environmental Human Health Assessment (OEHHA)/Air Resources Board (ARB) 'hot spots' list (CARB, 2005) (indicated by a TRUE value)
IS_WHO97	WHO97 polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) (Van den Berg et. al., 1998) (indicated by a TRUE value)
IS_NSW DEC GLC	DEC regulated pollutants with design ground level concentrations (DEC, 2005) (indicated by a TRUE value)

2.3 Charting Functions

2.3.1 Source Apportionment Pie Chart

The "Source Apportionment Pie Chart" displays the proportion of total emissions from each emission source category (i.e. biogenic, commercial, domestic-commercial, industrial, off-road mobile and on-road mobile sources) for a specified area within the study region. This function also produces a *.csv file that details the emissions from each module so that users can recreate the "Source Apportionment Pie Chart" in other programs (e.g. Microsoft® Excel™ 2003).

Users are required to:

- Select a substance from the drop-down list
- Select a year (either base year (2003) or a projected year)
- Select a region within the air emissions study area from one of the following:
  - GMR;
  - Sydney;
  - Newcastle;
  - Wollongong; or
  - Non-Urban
- Select an LGA within the selected Region
- Select the Sources to Include. Users can choose to produce a chart that shows emissions from all emission source modules or only emissions from anthropogenic sources (i.e. emissions from all modules excluding biogenic)
- Select the "Chart" button shown at the bottom right corner of the "Source Apportionment Pie Chart" sub-form
- Choose a location to save the *.csv file that is produced by this function

Figure 2.11 shows the selection of appropriate fields to generate a "Source Apportionment Pie Chart".

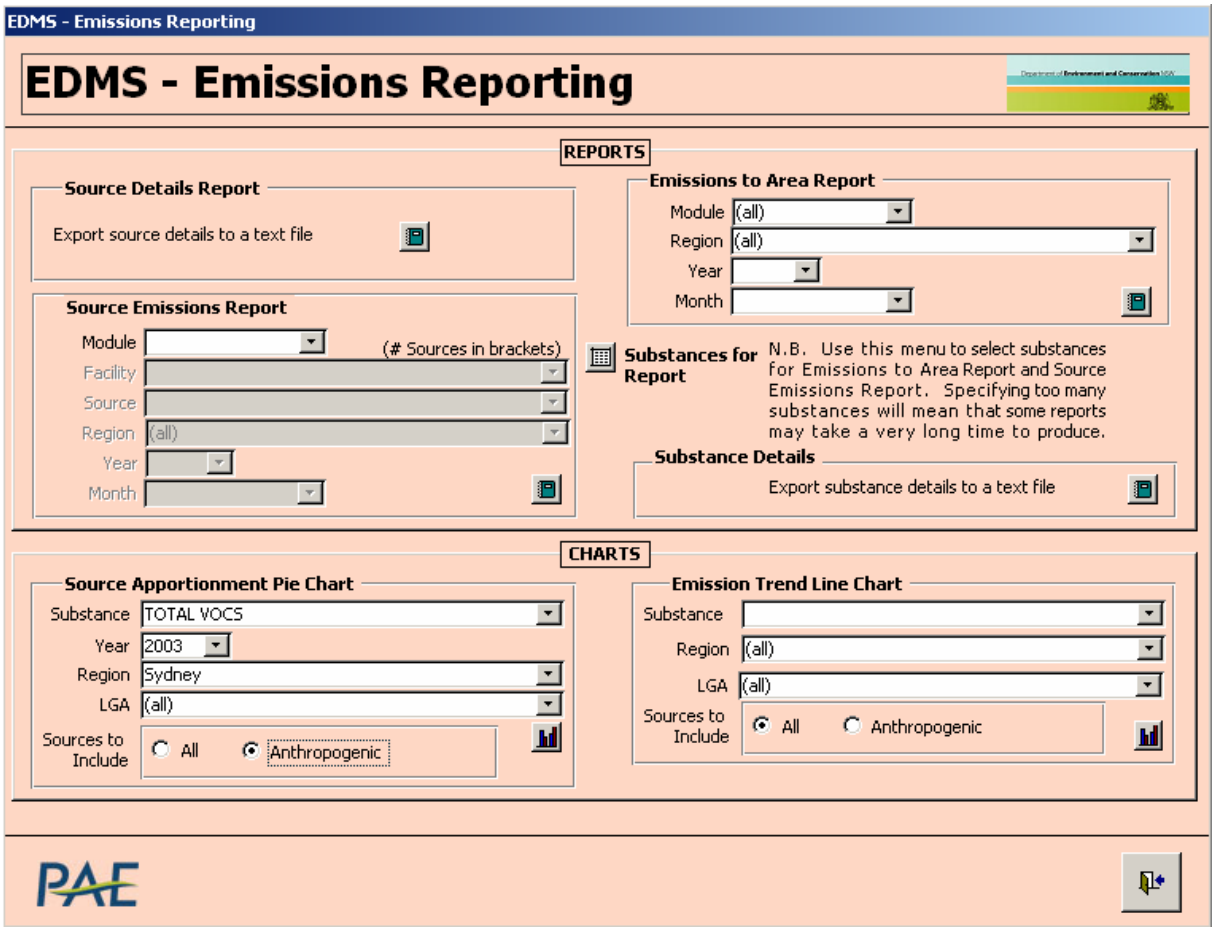

Figure 2.11: "EDMS – Emissions Reporting" – "Source Apportionment Pie Chart" Form

Figure 2.12 shows a typical “Source Apportionment Pie Chart”.

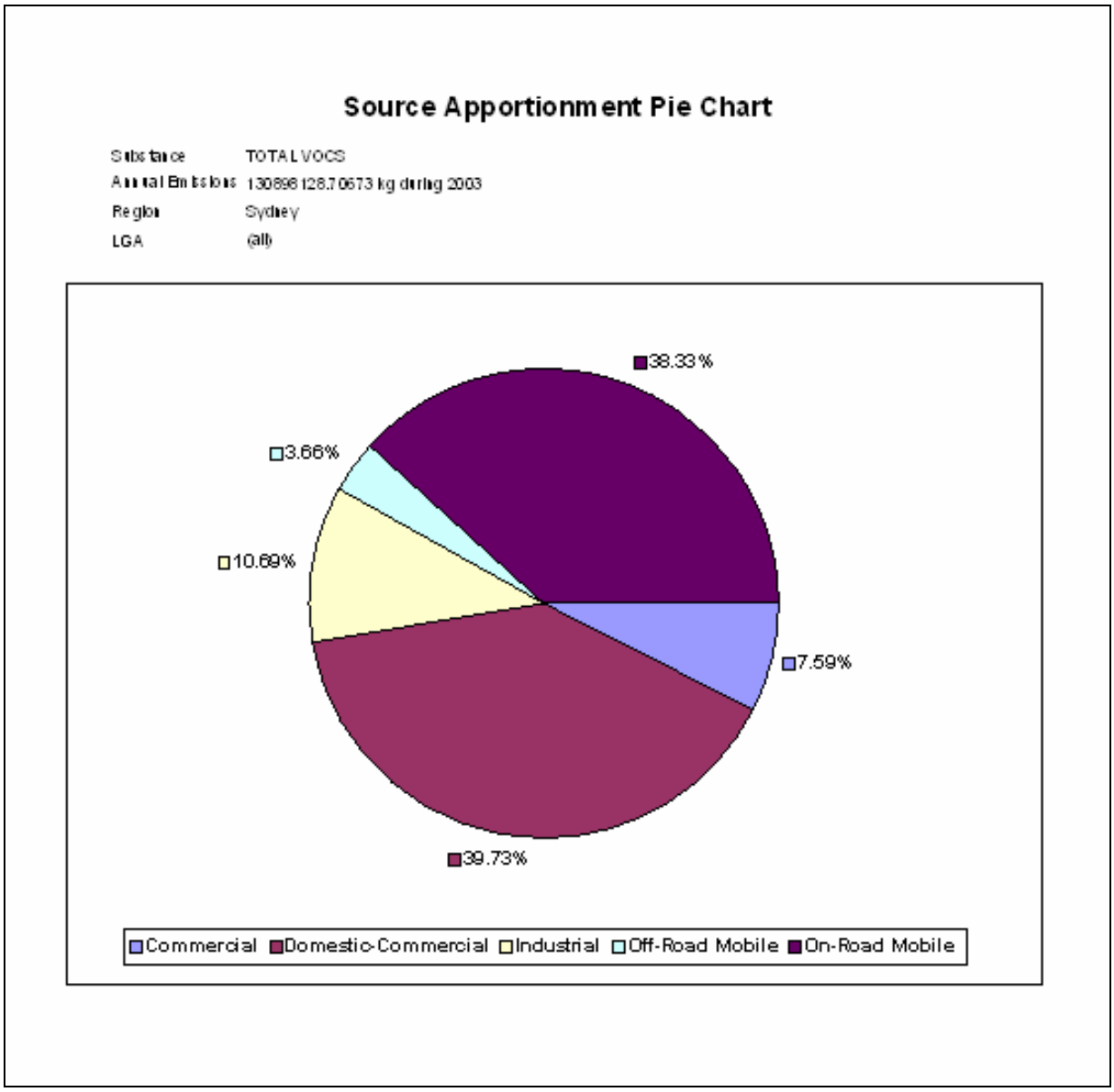

Figure 2.12: “EDMS – Emissions Reporting” – “Source Apportionment Pie Chart” Example

2.3.2 Emission Trend Line Chart

The "Emission Trend Line Chart" displays total emissions from each emission source category (i.e. biogenic, commercial, domestic-commercial, industrial, off-road mobile and on-road mobile sources) for a specified area within the study region for all annual periods (i.e. 2003 to 2031 inclusive). This function also produces a *.csv file that details the emissions from each module so that users can recreate the "Emission Trend Line Chart" in other programs (e.g. Microsoft® Excel™ 2003).

Users are required to:

- Select a substance from the drop-down list
- Select a region within the air emissions study area from one of the following:
  - GMR;
  - Sydney;
  - Newcastle;
  - Wollongong; or
  - Non-Urban
- Select an LGA within the selected Region
- Select the Sources to Include. Users can choose to produce a chart that shows emissions from all emission source modules or only emissions from anthropogenic sources (i.e. emissions from all modules excluding biogenic)
- Select the "Chart" button shown at the bottom right corner of the "Emission Trend Line Chart" sub-form
- Choose a location to save the *.csv file that is produced by this function

Figure 2.13 shows the selection of appropriate fields to generate an "Emission Trend Line Chart".

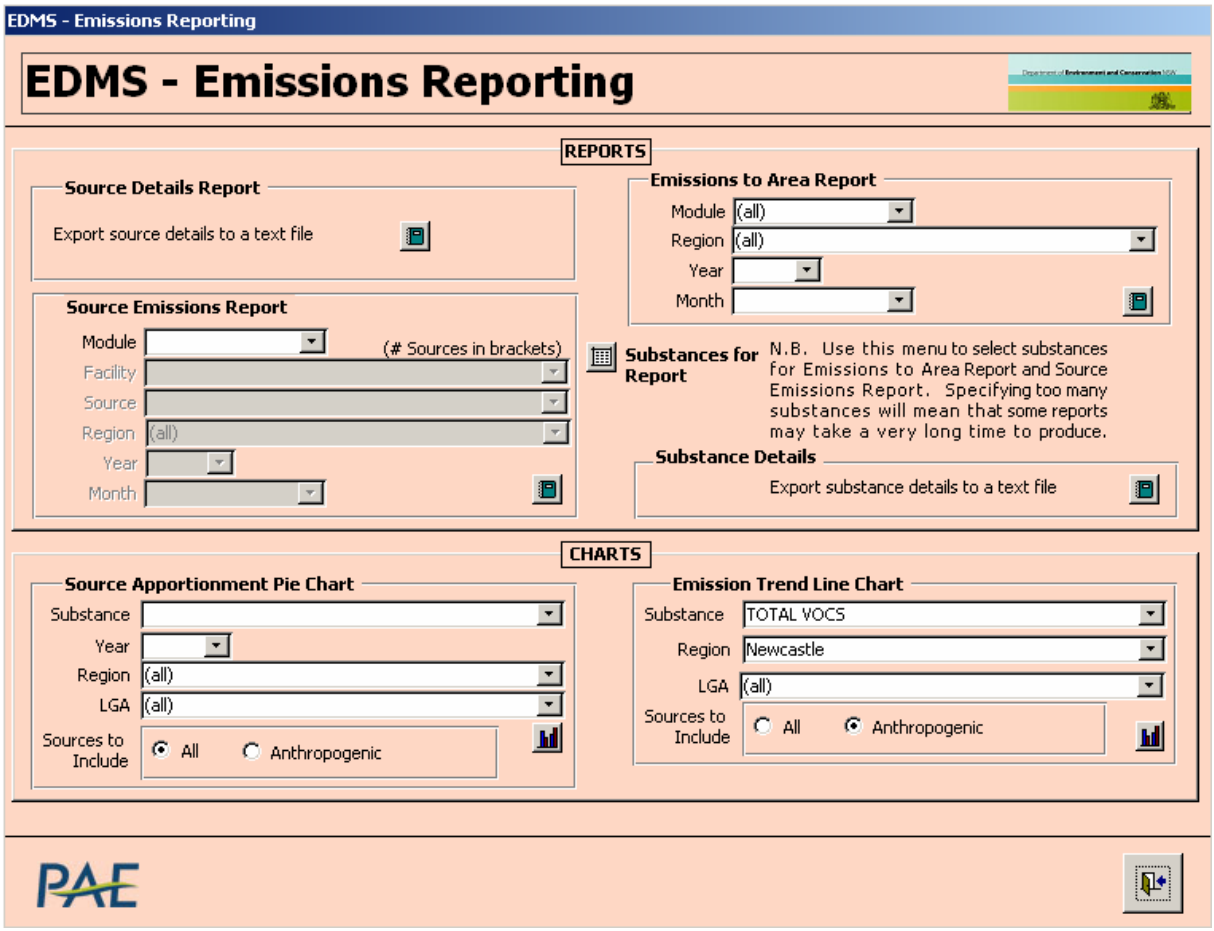

Figure 2.13: "EDMS – Emissions Reporting" – "Emission Trend Line Chart" Form

Figure 2.14 shows a typical "Emission Trend Line Chart".

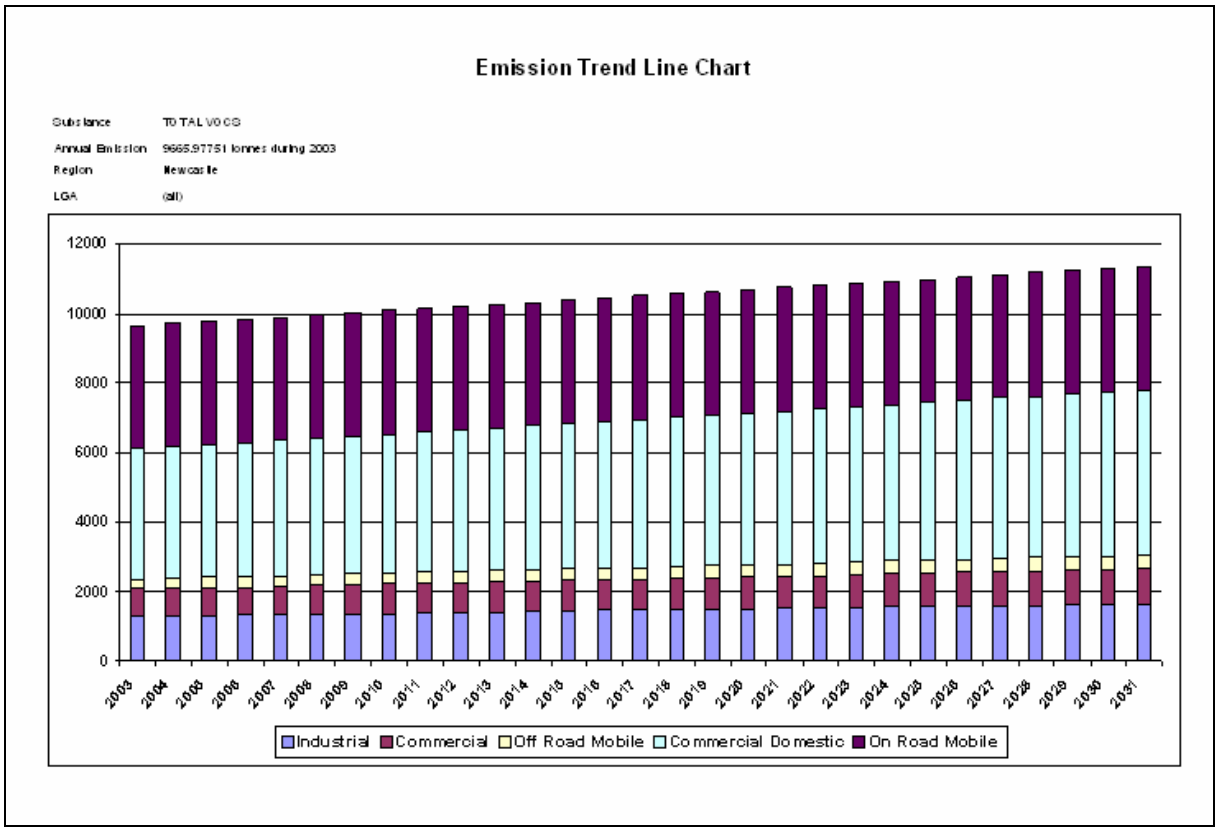

Figure 2.14: "EDMS – Emissions Reporting" – "Emission Trend Line Chart" Example

2.4 Emissions Scenario Modelling

The EDMS is able to perform "Emissions Scenario Modelling" to test out policy scenarios. "Emissions Scenario Modelling" is defined as the ability to increase or decrease emissions from a specified source at the users discretion.

The EDMS can vary emissions of each pollutant group[1] by a specified ratio to:

- All emission sources
- Each emission source module (for example, one ratio applied across all industrial sources)
- All emission sources from a specified Activity
- All emission sources within a selected Region (i.e. GMR, Sydney, Newcastle, Wollongong or Non-Urban)
- All emission sources within a selected LGA
- All emission sources from a selected facility
- Individual sources

To perform "Emissions Scenario Modelling", users must select the "Emissions Scenario Modelling" button from the "EDMS - Switchboard" shown in Figure 2.2.

[1] Pollutant groups have been defined as: particulates, organics, oxides of nitrogen, oxides of sulfur, carbon monoxide and others. Users can determine which substances are classified in each substance group by producing a "Substance Details Report".

The "Emissions Scenario Modelling" form is shown in Figure 2.15.

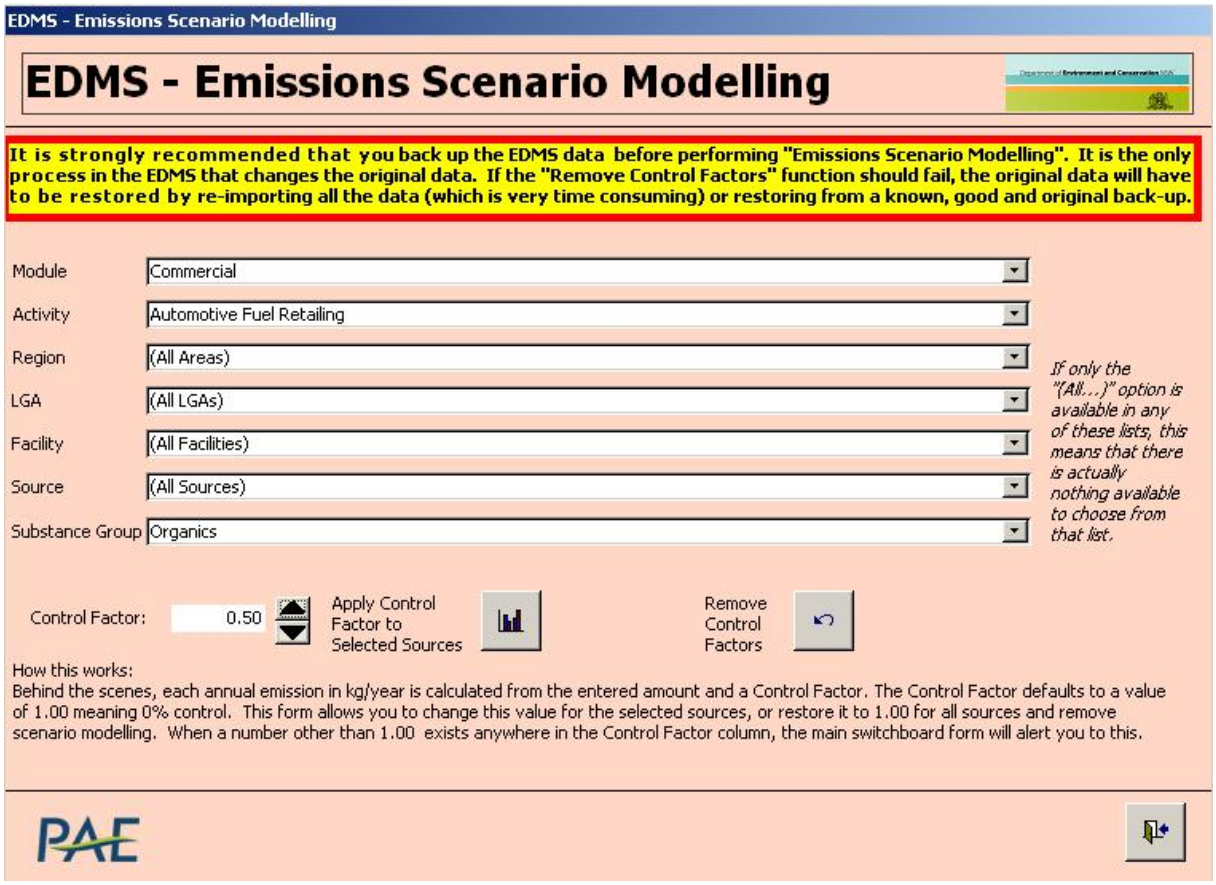

Figure 2.15: "EDMS – Emissions Scenario Modelling"

To apply a scenario users must:

- Select a module to apply the emissions ratio
- Select an Activity type to apply the emissions ratio
- Select a Region to apply the emissions ratio (users can select GMR, Sydney, Newcastle, Wollongong or Non-Urban)
- Select an LGA (users can select "All LGAs")
- Select a Facility (users can select "All Facilities")
- Select a Source (users can select "All Sources")
- Select a Substance Group

Once all options have been selected for the appropriate emission sources, users must enter a ratio into the "Control Factor" field by clicking on the up and down buttons to the right of the Control Factor field and select the "Apply Control Factor to Selected Sources" button. The control factor cannot be less than 0.00 or greater than 9.99. This will change all emissions of all pollutants in the EDMS by the selected factor. Behind the scenes, each annual emission in kilograms per year is calculated from the entered amount and a Control Factor. The Control Factor defaults to a value of 1.00 meaning 0% control, while a Control Factor 0f 0.70 indicates 30% reduction of the emission. The EDMS will produce a pop-up message informing the user that the control factors have been applied to the selected sources. Once this is complete the user can apply more scenarios to the adjusted data (i.e. multiple scenarios can be applied).

Once an “Emissions Scenario” has been modelled, users can generate charts, reports and modelling files with the emissions changed to the relevant scenario.

To remove any or all scenarios, users must select the “Remove Control Factors” button. This will remove all scenarios applied to the emissions data and returns all emissions to the baseline. The EDMS will produce a pop-up message to inform the user that all control factors have been removed. The user must wait until the EDMS produces the pop-up message before proceeding to run any other EDMS functions.

2.5 Air Pollution Model Data

The EDMS can produce a variety of emission input files for a selection of air quality models.

Emissions input files can be produced for the following air quality models:

- CALPUFF (Section 2.5.1);
- TAPM (Section 2.5.2);
- CIT (Section 2.5.3); and
- CTM (Section 2.5.4).

Users can navigate to the "EDMS - Export Emissions Data to Modelling Software" form by selecting the "Export Emissions Data to Modelling Software" button from the "EDMS – Switchboard" shown in Figure 2.2.

The "EDMS - Export Emissions Data to Modelling Software" form is shown in Figure 2.16.

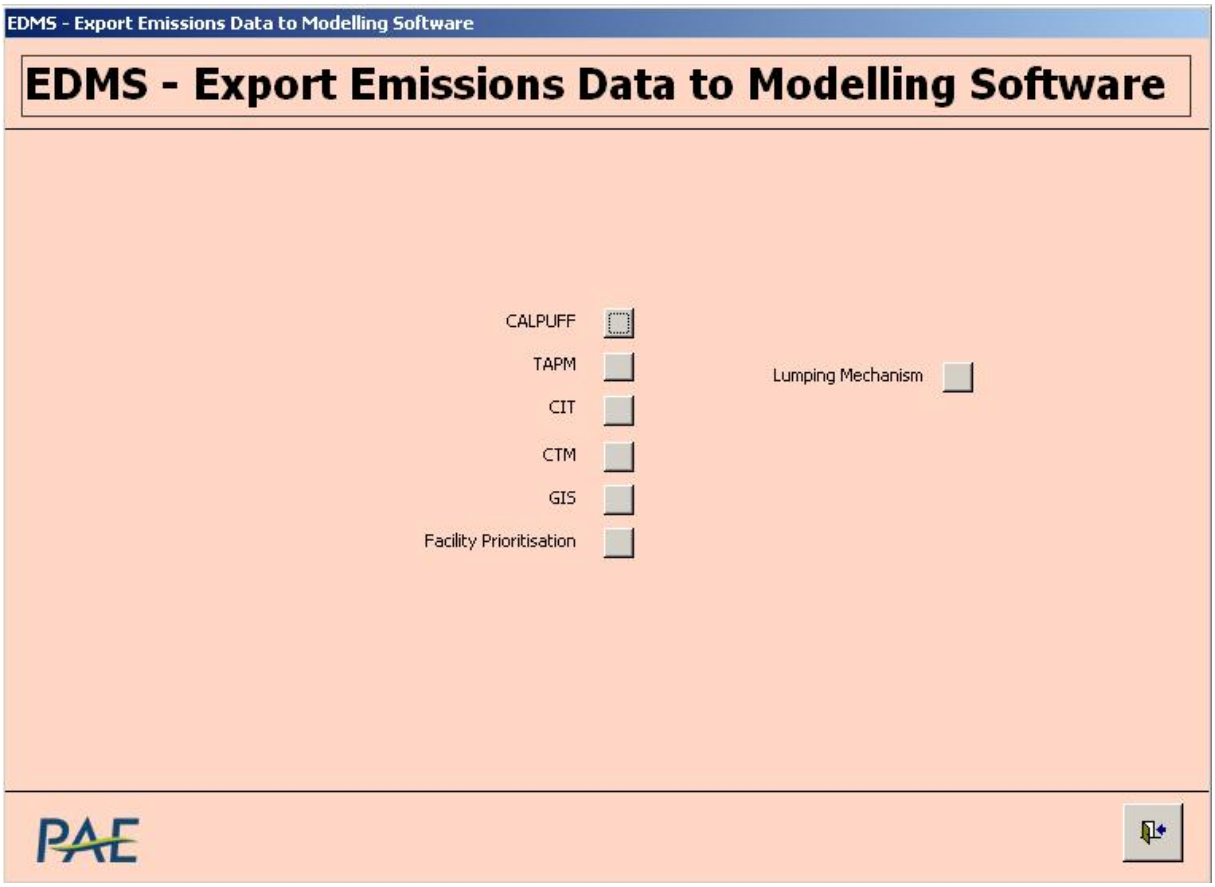

Figure 2.16: "EDMS – Export Emissions Data to Modelling Software"

2.5.1 CALPUFF Modelling Files

Users must click on the "CALPUFF" button from the "EDMS - Export Emissions Data to Modelling Software" form to navigate to the "CALPUFF Specifications" form shown in Figure 2.17.

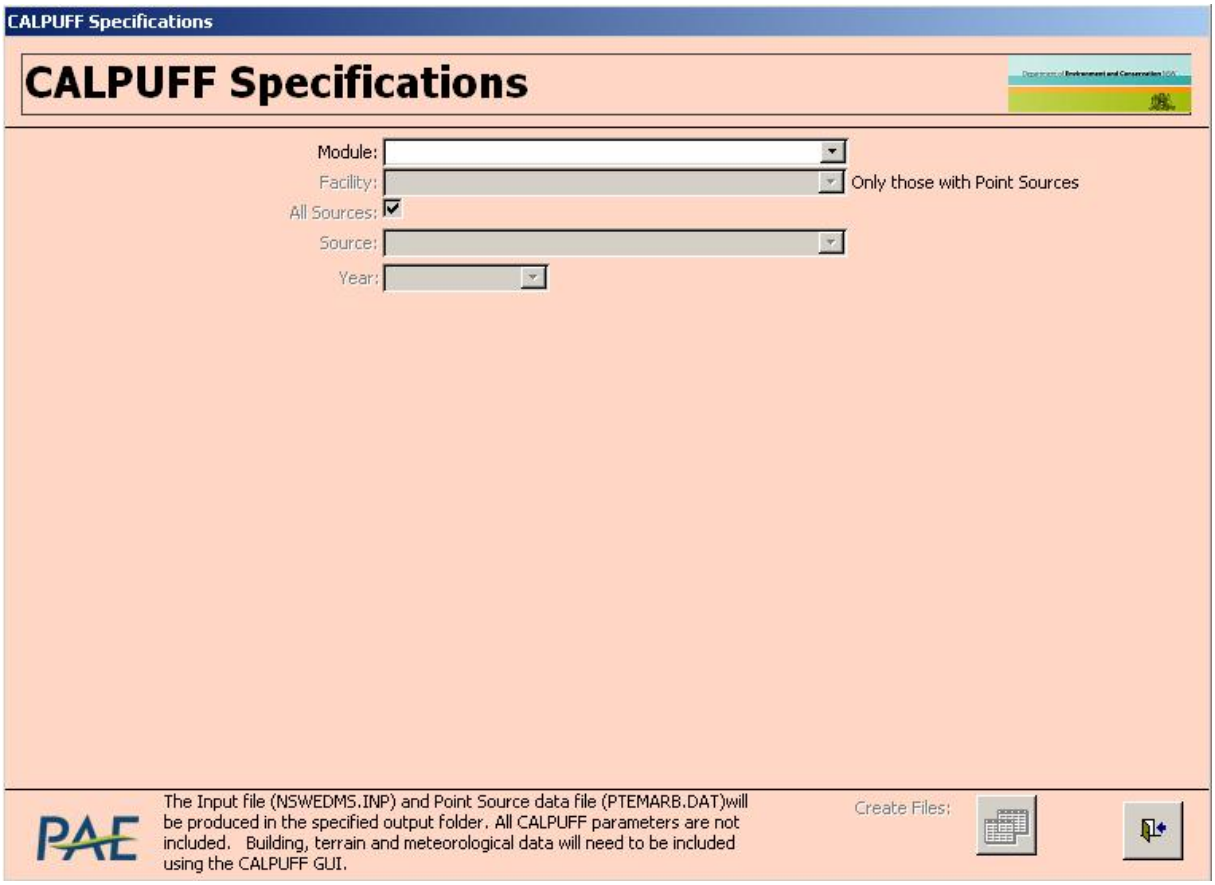

Figure 2.17: "CALPUFF Specifications" Form

To generate CALPUFF modelling files, the user must perform the following steps (these steps are shown in Figure 2.18):

- Select a module to generate an emissions file (**Note!: This can only be either industrial or commercial, since the model input files have been designed for only industrial and commercial emission sources and only for stack sources**)
- Select the facility the user would like to model
- Either select all sources or uncheck the all sources box and select a specific emission source
- Select a year to model

- Choose the substances the user would like to include in the model input file by highlighting substances shown in the box on the left side of the form and clicking the arrow button so that the substances appear on the right side box. It is wise to model as few substances as possible at once (**Note!: Generating the CALPUFF emissions file takes a considerable amount of time**). CALPUFF can model a maximum 20 substances at a time
- Select the "Create Files" button located at the bottom left of the form and select a location to save the model input files

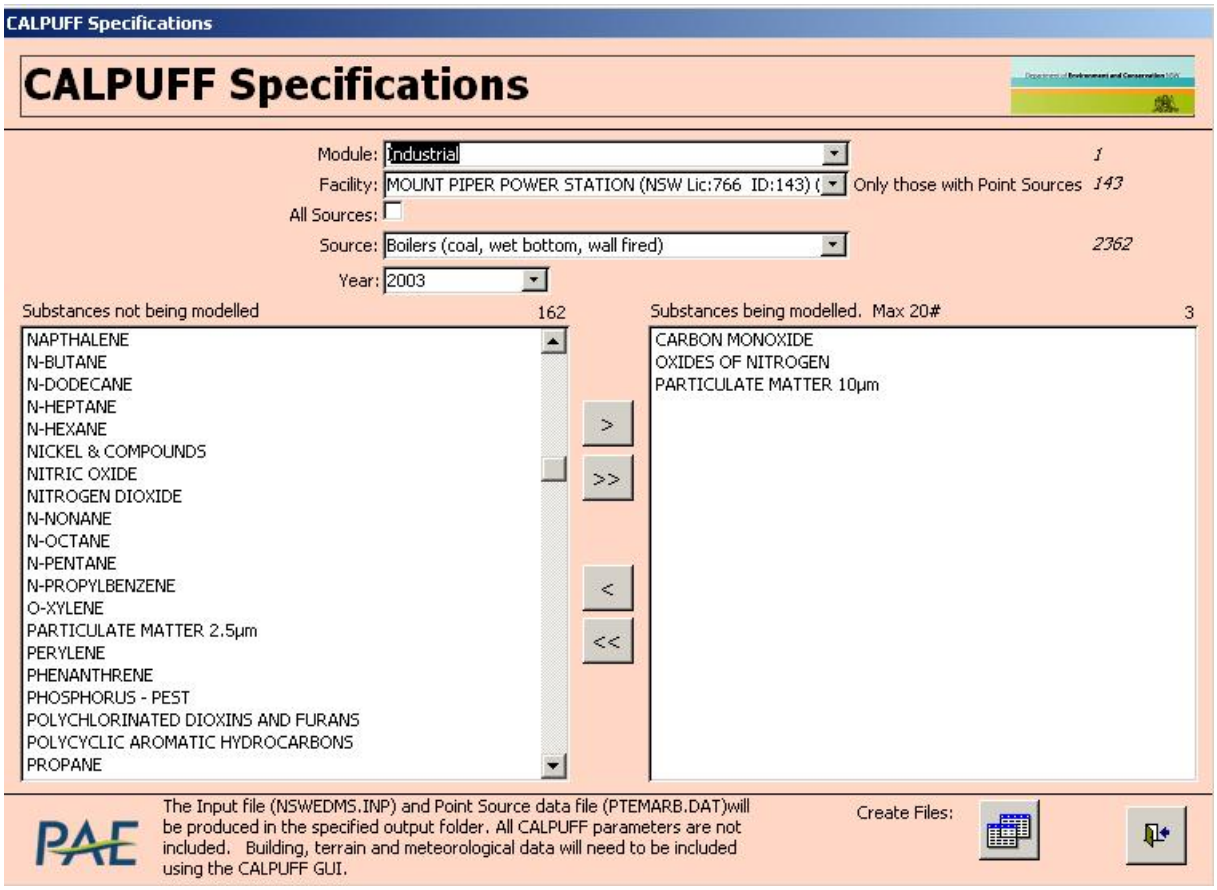

Figure 2.18: "CALPUFF Specifications" – "Create Files"

Files generated for CALPUFF modelling are not "Ready to Go".

- Only a control file and a varying emissions file are generated
- Substance IDs are used in the control file and not substance names, due to the restrictions on the length of substance names in the input files. Users can cross reference substance IDs to substance names by producing a "Substance Details Report"
- Users are required to provide building, terrain and meteorological data before CALPUFF can be executed
- All values in the generated CALPUFF control file are set to the default value and may require changes through the CALPUFF GUI to account for site-specific conditions
- Please refer to the CALPUFF (Scire et. al., 2000) user manual for specific details

2.5.2 TAPM Modelling Files

Users must click on the "TAPM" button from the "EDMS - Export Emissions Data to Modelling Software" form to navigate to the "TAPM Specifications" form shown in Figure 2.19.

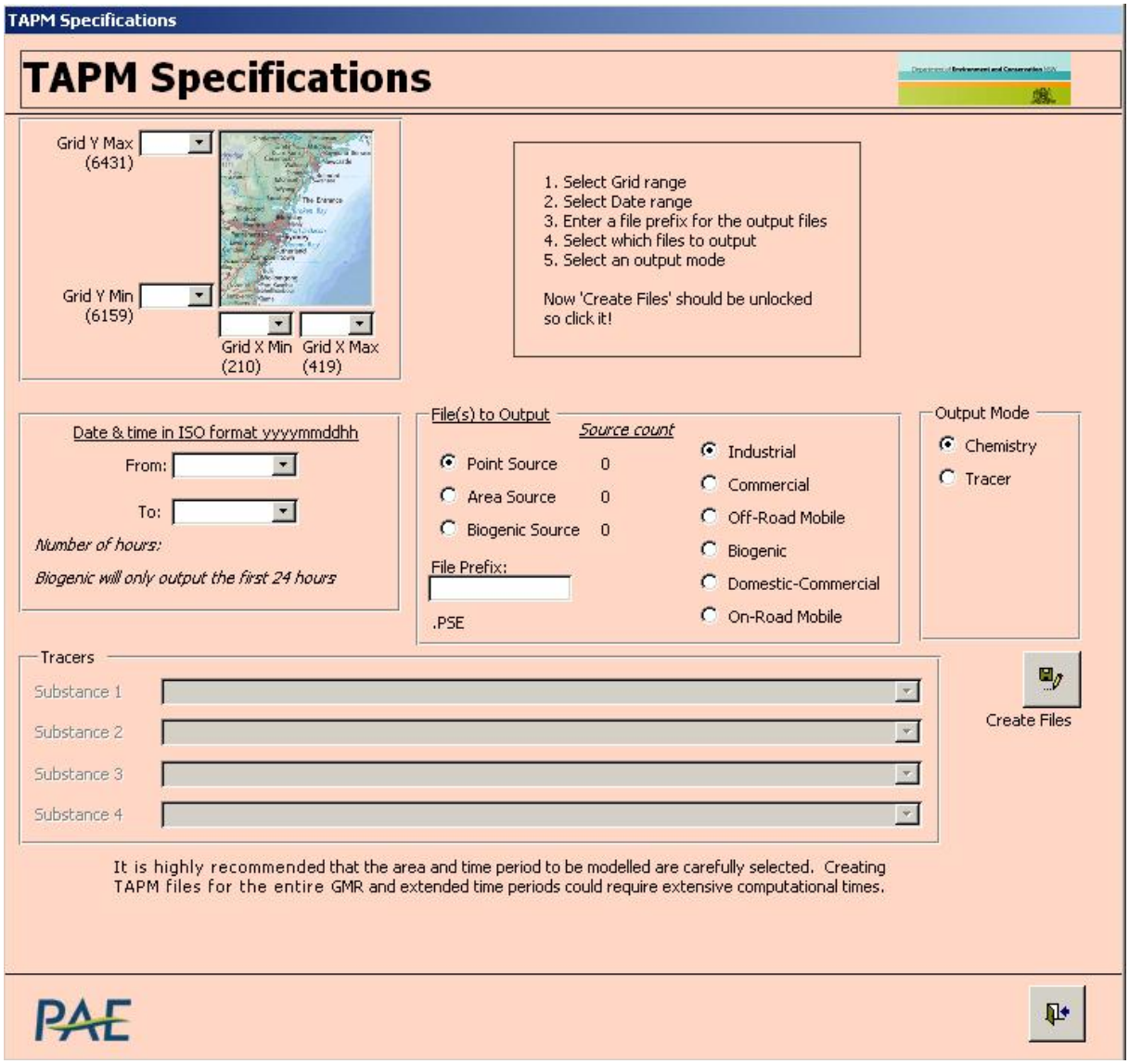

Figure 2.19: "TAPM Specifications" Form

TAPM files can be generated in chemistry mode or in tracer mode. For further details on the differences in TAPM modes please refer to the TAPM user manual (Hurley, 2005a).

To generate TAPM modelling files users must perform the following steps:

- Select the grid dimensions that are to be modelled:
  - Select a maximum Northing (Y) coordinate
  - Select a minimum Northing (Y) coordinate
  - Select a minimum Easting (X) coordinate
  - Select a maximum Easting (X) coordinate
- Select a time period to model
  - Choose a start date and time (using ISO format)
  - Choose an end date and time (using ISO format)
- Select the emission files that are to be generated
  - Check the point source check box to generate a point source emissions file (i.e. *.pse)
  - Check the area source check box to generate an area (i.e. gridded) source emissions file (*.gse)
  - Check the biogenic source check box to generate a biogenic source emissions file (*.bse)
- Enter a filename prefix (e.g. "Scenario_1" produces file names of Scenario_1.pse, Scenario_1.gse and Scenario_1.bse)
- Select the emission sources to include in the generated file. Only emissions from one module at a time can be outputted to TAPM files
- Select the output mode, either chemistry or tracer mode. Example selections for each mode are shown in Figure 2.20 and Figure 2.21, respectively
- If tracer mode is selected, the user must select four substances to export emissions data for the TAPM tracer emission files
- Select the "Create Files" button and choose a location to save the generated TAPM files

Files generated for TAPM modelling are not "Ready to Go".

- Only varying emissions files are generated
- Users are required to provide meteorological and other data before TAPM can be executed

Please refer to the TAPM (Hurley, 2005a) user manual for specific details.

Users should be aware that TAPM uses the Generalised Reaction Scheme (GRS) photochemical model. To calculate reactive organic compounds (ROC) for the GRS photochemical model, the Carbon Bond IV (CBIV) photochemical groupings have been used and the procedure is detailed in the EDMS design documentation (Bawden et. al., 2004). Emissions for GRS photochemical groupings are calculated by the EDMS during the importation of data into the EDMS, using the procedure detailed in the EDMS design documentation (Bawden et. al., 2004). Users should refer to Section 2.5.5 for further details.

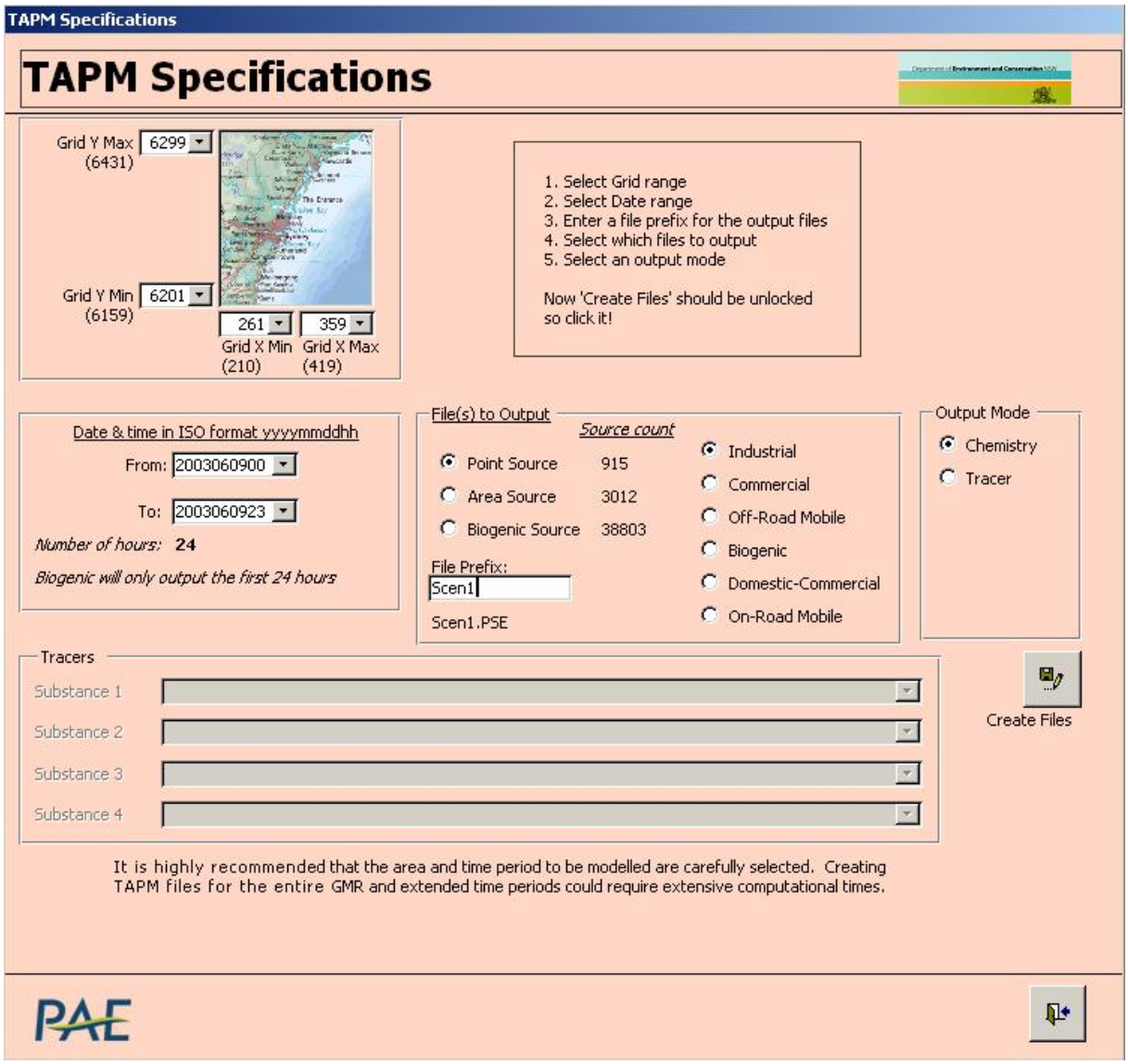

Figure 2.20: "TAPM Specifications" – "Create Files" Chemistry Mode

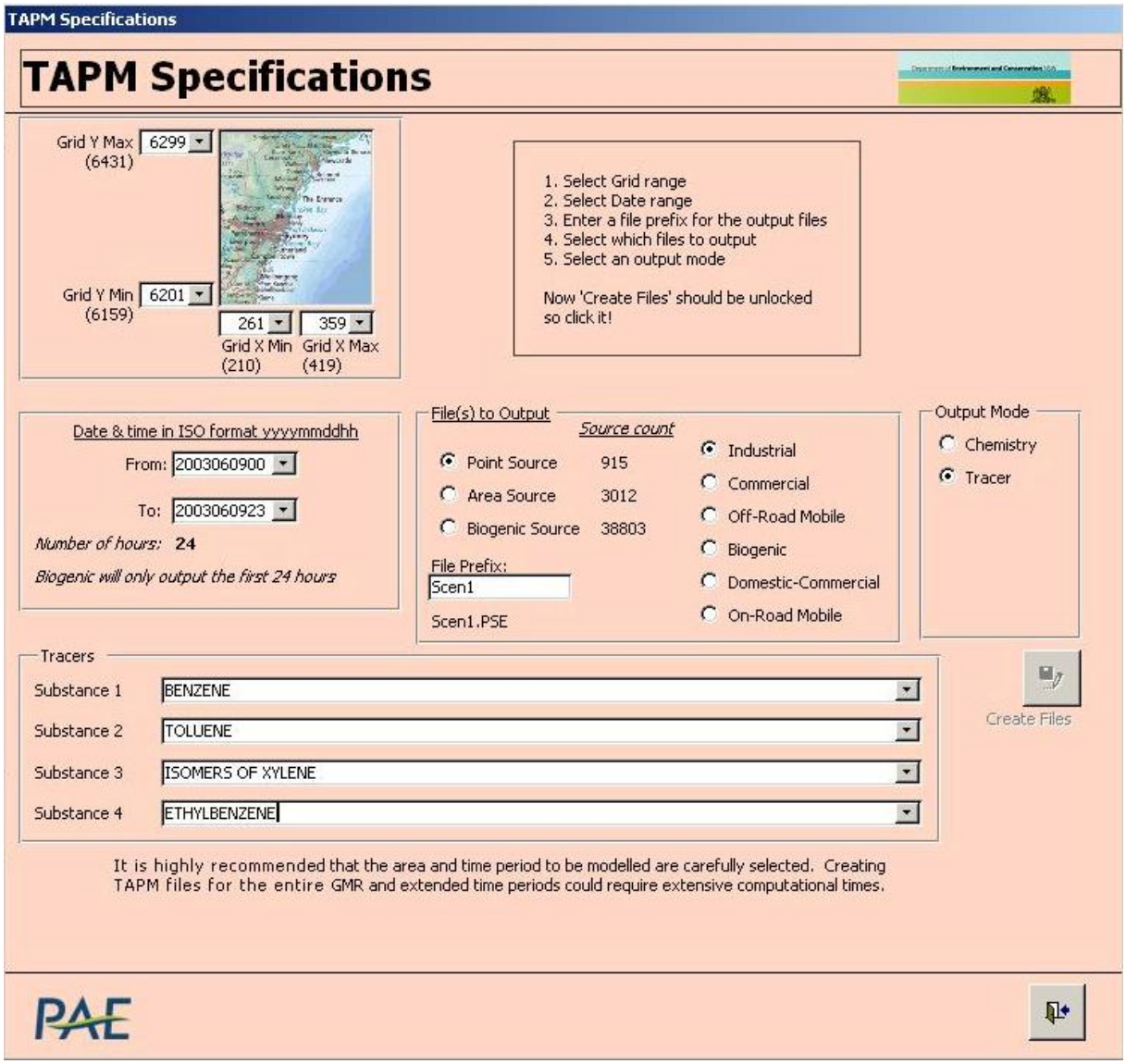

Figure 2.21: "TAPM Specifications" – "Create Files" Tracer Mode

2.5.3 CIT Modelling Files

Users must click on the "CIT" button from the "EDMS - Export Emissions Data to Modelling Software" form to navigate to the "CIT Specifications" form shown in Figure 2.22.

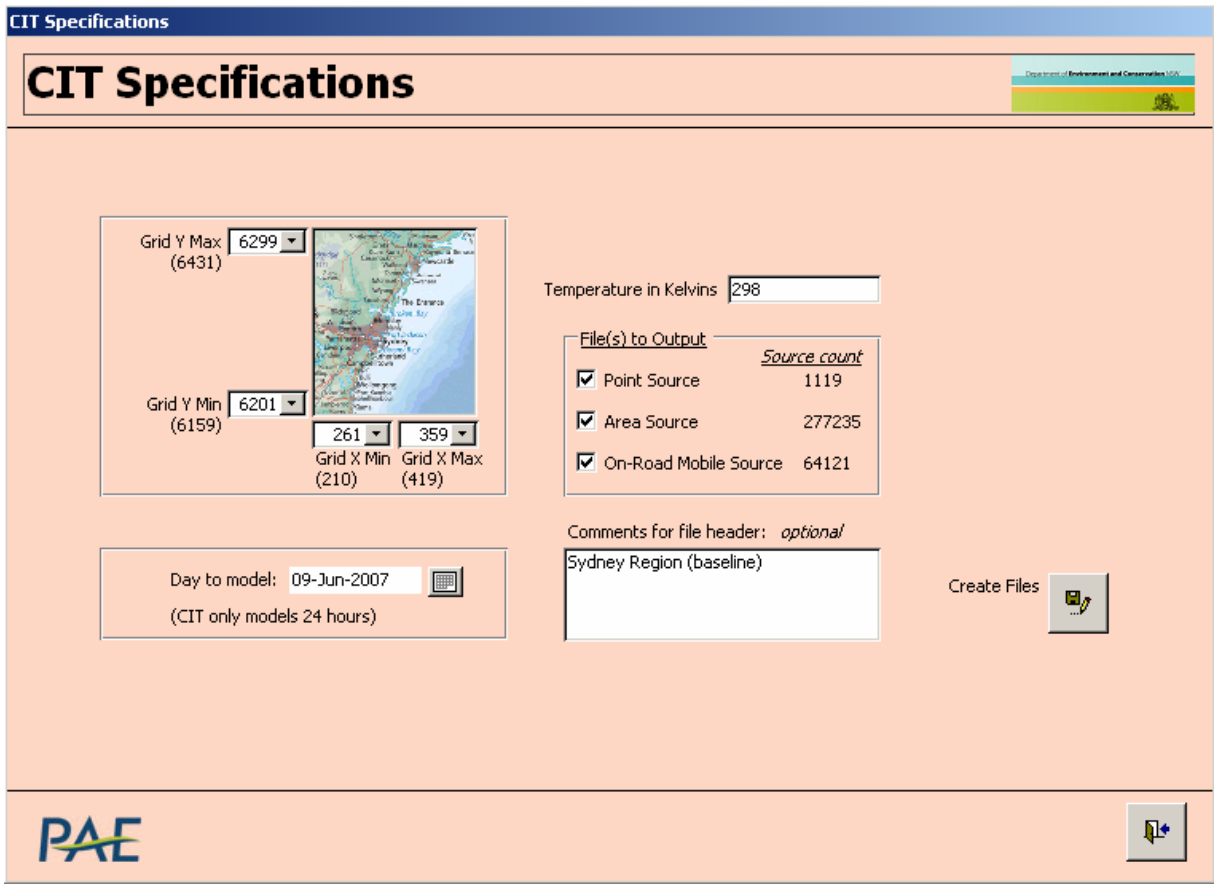

Figure 2.22: "CIT Specifications" – "Create Files"

To generate CIT modelling files users must perform the following steps:

- Select the grid dimensions that are to be modelled:
  - Select a maximum Northing (Y) coordinate
  - Select a minimum Northing (Y) coordinate
  - Select a minimum Easting (X) coordinate
  - Select a maximum Easting (X) coordinate
- Select a day to model by clicking on the "Calender" button and choosing a day. CIT model files are generated for a single day only

- Select the emission files that are to be generated
    - Check the point source check box to generate a point source emissions file (i.e. pems_<chemistry>_dx_<scenario>.in)
    - Check the area source check box to generate an area (i.e. gridded) source emissions file (i.e. aems_<chemistry>_dx_<scenario>.in)
    - Check the motor vehicles source check box to generate a motor vehicle emissions file (i.e. mvems_<chemistry>_dx_<scenario>.in)
- Enter comments if the users wishes, that are added to the header of the emissions input file
- Select the "Create Files" button and choose a location to save the generated CIT files

Files generated for CIT modelling are not "Ready to Go".

- Only varying emissions files are generated
- Users are required to provide meteorological and other data before CIT can be executed

Please refer to the CIT (McRae et. al., 1992a, 1992b and 1992c) and TAPM-CTM (Cope et. al., 2007) user manuals for specific details.

Users should be aware that CIT uses the Lurmann, Carter and Coyner (LCC) and GRS photochemical grouping schemes. To calculate reactive organic compounds (ROC) for the GRS photochemical model, the LCC photochemical groupings have been used and the procedure is detailed in the EDMS design documentation (Bawden et. al., 2004). Emissions for LCC and GRS photochemical groupings are calculated by the EDMS during the importation of data into the EDMS, using the procedure detailed in the EDMS design documentation (Bawden et. al., 2004). Users should refer to Section 2.5.5 for further details.

2.5.4 CTM Modelling Files

Users must click on the "CTM" button from the "Export Emissions Data to Modelling Software" form to navigate to the "CTM Specifications" form shown in Figure 2.23.

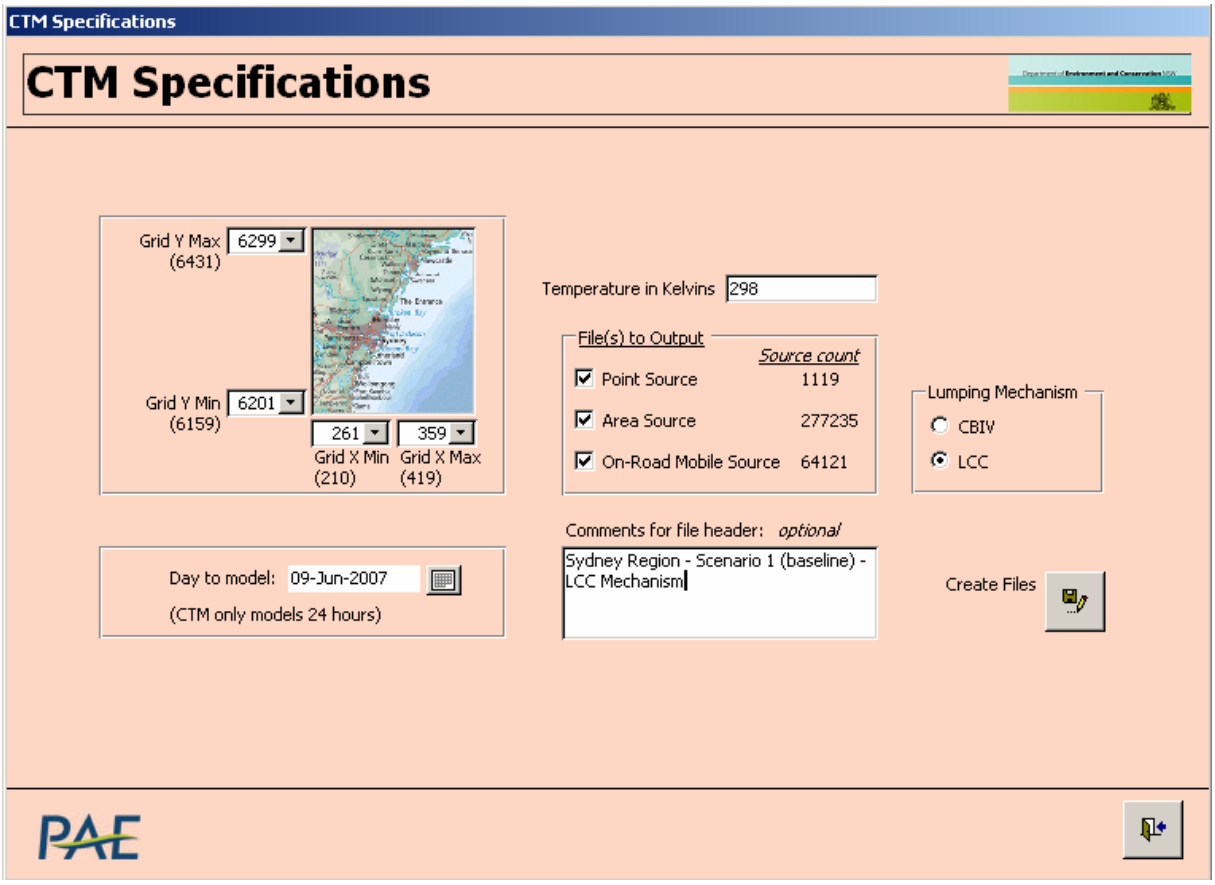

Figure 2.23: "CTM Specifications" – "Create Files" LCC Lumping Mechanism

To generate CTM modelling files users must perform the following steps:

- Select the grid dimensions that are to be modelled:
  - Select a maximum Northing (Y) coordinate
  - Select a minimum Northing (Y) coordinate
  - Select a minimum Easting (X) coordinate
  - Select a maximum Easting (X) coordinate
- Select a day to model by clicking on the "Calender" button and choosing a day. CTM model files are generated for a single day only
- Select the emission files that are to be generated
  - Check the point source check box to generate a point source emissions file (i.e. pems_<chemistry>_dx_<scenario>.in)
  - Check the area source check box to generate an area (i.e. gridded) source emissions file (i.e. aems_<chemistry>_dx_<scenario>.in)
  - Check the motor vehicles source check box to generate a motor vehicle emissions file (i.e. mvems_<chemistry>_dx_<scenario>.in)

- Enter comments if the users wishes, that are added to the header of the emissions input file
- Select the photochemical scheme to be used for the emissions output files by selecting either the LCC or CBIV lumping mechanism
- Select the "Create Files" button and choose a location to save the generated CTM files

Files generated for CTM modelling are not "Ready to Go".

- Only varying emissions files are generated
- Users are required to provide meteorological and other data before CTM can be executed

Please refer to the CIT (McRae et. al., 1992a, 1992b and 1992c), TAPM (Hurley, 2005a) and TAPM-CTM (Cope et. al., 2007) user manuals for specific details.

Users should be aware that CTM uses the CBIV, LCC and GRS photochemical grouping schemes. To calculate reactive organic compounds (ROC) for the GRS photochemical model, either the CBIV or LCC photochemical groupings have been used and the procedure is detailed in the EDMS design documentation (Bawden et. al., 2004). Emissions for CBIV, LCC and GRS photochemical groupings are calculated by the EDMS during the importation of data into the EDMS, using the procedure detailed in the EDMS design documentation (Bawden et. al., 2004). Users should refer to Section 2.5.5 for further details.

2.5.5 Photochemical Schemes

The photochemical schemes that the EDMS is designed to use are:

- The Generalised Reaction Scheme (GRS)
- Carbon Bond IV scheme (CBIV)
- Lurmann, Carter and Coyner scheme (LCC)

Emissions of photochemical groupings (e.g. ALKENES) are calculated during the importation of emissions data from each of the emissions modules (i.e. biogenic, commercial, domestic-commercial, industrial, off-road mobile and on-road mobile sources), using the procedure detailed in the EDMS design documentation (Bawden et. al., 2004). Emissions are calculated for CBIV grouped substances and LCC grouped substances. Examples of the CBIV and LCC calculation are provided in Section 2.5.5.1 and Section 2.5.5.2.

2.5.5.1 CBIV Example Calculation

Emission rates of CBIV substance groupings are calculated using the following formula (Adelman et. al., 2005; Carter, 2007 & Lubertino, 2002):

$$E_j = \sum_i \left(ModW_i \times CBIV_{i,j} \times \frac{nC_j}{nC_i} \times E_i \right)$$

where:

E_j	=	Emission rate of CBIV grouping j (calculated from an emission rate of substance i)	(kg/annum)
$ModW_i$	=	Weight modifier for substance i	(-)
$CBIV_{i,j}$	=	CBIV factor for substance i for CBIV group j	(-)
nC_j	=	Number of carbon atoms in CBIV group j	(-)
nC_i	=	Number of carbon atoms in substance i	(-)
E_i	=	Emission rate of substance i	(kg/annum)

Example data:

- An emission source has emission rates of 2-ethylfuran of 14.5742 kg/year and trans-2-hexenal of 30.065 kg/year
- The number of carbon atoms in 2-ethylfuran is 6
- The weight modifier for 2-ethylfuran is 1.0
- The number of carbon atoms in trans-2-hexenal is 6
- The weight modifier for trans-2-hexenal is 1.0

Other parameters required for the equation and the calculated CBIV grouping emission rates are shown in Table 2.3.

Table 2.3: Example Calculation of CBIV Grouped Substance Emission Rates

Parameter	CBIV Grouping - Emission (kg/year)										
	ALD2	ETH	ETOH	FORM	ISOP	MEOH	OLE	PAR	TOL	UNR	XYL
nC_j	2	2	2	1	5	1	2	1	7	1	8
$CBIV_{2\text{-ethylfuran},j}$	0	0	0	0	0	0	2	2	0	0	0
$CBIV_{trans\text{-}2\text{-}hexenal,j}$	1	0	0	0	0	0	1	2	0	0	0
$E_{2\text{-ethylfuran},j}$	0	0	0	0	0	0	9.72	4.86	0	0	0
$E_{trans\text{-}2\text{-}hexenal,j}$	10.02	0	0	0	0	0	10.02	10.02	0	0	0
E_j	**10.02**	**0**	**0**	**0**	**0**	**0**	**19.74**	**14.88**	**0**	**0**	**0**

Where: ALD2 = HIGHER ALDEHYDES (C2H40) (CBIV)
ETH = ETHENE (C2H4) (CBIV)
ETOH = ETHANOL (CBIV)
FORM = FORMALDEHYDE (CH20) (CBIV)
ISOP = ISOPRENE (C5H8) (CBIV)
MEOH = METHANOL (CBIV)
OLE = ALKENES (OLEFINS) (C2H4) (CBIV)
PAR = ALKANES (PARAFFINS) (CH2) (CBIV)
TOL = TOLUENE (C7H8) (CBIV)
UNR = UNREACTIVE (CBIV)
XYL = XYLENE (C8H10) (CBIV)

2.5.5.2 LCC Example Calculation

Emissions of LCC substance groupings are calculated by summing the emissions within each LCC Grouping (Adelman et. al., 2005; Carter, 2007 & Lubertino, 2002).

Example data:

An emission source is imported into the EDMS that has emission rates as described in Table 2.4.

Table 2.4: Example Emission Source Imported into the EDMS

Substance Name	Emission (kg/year)	LCC Grouping
2-ETHYL FURAN	14.6	AROM
2,4-HEXADIENAL	54.1	MEK
CYCLOHEXANONE	44.0	MEK
2,2-DIMETHYL CYCLOBUTANONE	6.2	MEK
TRANS-2-HEXENAL	30.1	ALD2
MESITYL OXIDE (2-METHYL-2-PENTEN-4-ONE)	92.5	MEK
CYCLOHEXAMINE	67.9	ALKA
HEXAMETHYLENEIMINE	82.4	ALKA

The calculated LCC grouping emission rates are shown in Table 2.5.

Table 2.5: Example Calculation of LCC Grouped Substance Emission Rates

LCC Grouping	Calculation	Emission (kg/year)
ALD2	= 30.1	30.1
ALKA	= 67.9 + 82.4	150.3
ALKE	= 0.0	0.0
AROM	= 14.6	14.6
CIN	= 0.0	0.0
ETHE	= 0.0	0.0
ETOH	= 0.0	0.0
HCHO	= 0.0	0.0
ISOP	= 0.0	0.0
MEK	= 54.1 + 44.0 + 6.2 + 92.5	196.8
MEOH	= 0.0	0.0
PINE	= 0.0	0.0
TOLU	= 0.0	0.0

Where: ALD2 = Higher Aldehydes (LCC)
ALKA = Alkanes (LCC)
ALKE = Alkenes (LCC)
AROM = Di- and Tri-Alkylbenzenes (LCC)
CIN = Cineole (LCC)
ETHE = Ethene (LCC)
ETOH = Ethanol (LCC)
HCHO = Formaldehyde (LCC)
ISOP = Isoprene (LCC)
MEK = Methyl Ethyl Ketone (LCC)
MEOH = Methanol (LCC)
PINE = Alpha-pinene (LCC)
TOLU = Mono-Alkylbenzenes (LCC)

2.5.5.3 ROC Example Calculation - CBIV

TAPM uses the GRS following CBIV lumping of speciated VOC emissions to model gas-phase photochemistry. The GRS uses emissions of smog reactivity (R_{smog} or ROC) instead of emissions of lumped speciated VOC emissions in photochemical reaction equations.

To derive the R_{smog} or ROC emission rate, emission rates of CBIV lumped categories (displayed in Table 2.6) are calculated using the following equation (applied to emission rates of the CBIV lumped categories) (Hurley, 2005b):

$$E_{ROC} = \sum_i \frac{14 \times CN_i}{MW_i} \times a_i \times E_i$$

where:

E_{ROC}	=	Emission rate of ROC	(g/s)
CN_i	=	Carbon number of CBIV lumped species i	(-)
MW_i	=	Molecular weight of CBIV lumped species i	(g/g.mole)
a_i	=	Reactivity of CBIV lumped species i	(ppbV/ppbC)
E_i	=	Emission rate of CBIV lumped species i	(g/s)

Data required to calculate emissions of ROC or R_{Smog} using the CBIV lumping of speciated VOC emissions are provided in Table 2.6 (Hurley, 2005b).

Table 2.6: CBIV reactivity constants required for calculating ROC

CBIV lumped species (i)	Compound Class	Carbon Number (CN_i)	Molecular Weight (MW_t)	Reactivity (ppbV/ppbC)
ALD2	Higher Aldehydes (C_2H_40)	2	44	0.01
ETH	Ethene (C_2H_4)	2	28	0.007
ETOH	Ethanol	2	32	0.0
FORM	Formaldehyde (CH_20)	1	30	0.035
ISOP	Isoprene(C_5H_8)	5	68	0.009
MEOH	Methanol	1	16	0.0
OLE	Alkenes (Olefins) (C_2H_4)	2	28	0.008
PAR	Alkanes (Paraffins) (CH_2)	1	14	0.0
TOL	Toluene (C_7H_8)	7	92	0.0008
UNR	Unreactive	1	16	0.0
XYL	Xylene (C_8H_{10})	8	106	0.008

2.5.5.4 ROC Example Calculation – LCC

CIT and CTM use the GRS following LCC lumping of speciated VOC emissions to model gas-phase photochemistry. The GRS uses emissions of smog reactivity (R_{smog} or ROC) instead of emissions of lumped speciated VOC emissions in photochemical reaction equations.

To derive the R_{smog} or ROC emission rate, emission rates of LCC lumped categories (displayed in Table 2.7) are calculated using the following equation (applied to emission rates of the LCC lumped categories) (Azzi, 2004):

$$E_{ROC} = \sum_{i} 0.0067 \times k_i \times E_i$$

where:

E_{ROC}	=	Emission rate of ROC	(ppmV/min)
k_i	=	Reactivity constants of LCC lumped species i	(ppmC/ppmV)
E_i	=	Emission rate of LCC lumped species i	(ppmV/min)

Data required to calculate emissions of ROC or R_{Smog} using the LCC lumping of speciated VOC emissions are provided in Table 2.7 (Azzi, 2004).

Table 2.7: LCC reactivity constants required for calculating ROC

LCC lumped species (i)	Compound Class	k_i (ppmC/ppmV)
ALD2	Higher Aldehydes	2.0
ALKA	Alkanes	5.9
ALKE	Higher Alkenes	3.4
AROM	Di- and Tri-Alkylbenzenes	8.4
CIN	Cineole	0.0
ETHE	Ethene	2.0
ETOH	Ethanol and Higher Alcohols	0.0
HCHO	Formaldehyde	1.0
ISOP	Isoprene	5.0
MEK	Ketones	0.0
MEOH	Methanol	0.0
PINE	Alpha-pinene	10.0
TOLU	Mono-Alkylbenzenes	7.0

2.6 Other Functions

The EDMS can produce files that can be used to conduct further analyses by other programs, namely applying the CAPCOA Air Toxics "Hot Spots" Program Facility Prioritisation Guidelines (CAPCOA, 1990), the University of California, Riverside (UCR) Maximum Incremental Reactivity (MIR) methodology (Carter, 2003) and GIS programs that can be used to visualise emission sources contained within the emissions inventory.

2.6.1 Facility Prioritisation Data Files

The EDMS allows users to export inventory data for Industrial and Commercial sources so that the CAPCOA Air Toxics "Hot Spots" Program Facility Prioritisation Guidelines (CAPCOA, 1990; DSE, 2005; MPCA, 2007; SCAQMD, 2005a; SCAQMD, 2005b; SCAQMD, 2005c; and SCAQMD, 2004) can be applied to all sources included in the emissions inventory by importing data into a customised Microsoft® Access 2003™ database for post-processing (See Figure 2.25). The export format is in comma separated variable (*.csv) format and the exported file includes the following data:

- Module_ID (i.e. 1 = Industrial, and 2 = Commercial)
- Module_Name (i.e. name of the Module where the emission source is categorised within)
- Year (i.e. 2003 to 2031)
- LGA (i.e. Local Government Area where the emission source is located)
- Region (i.e. Region where the emission source is located. This may include Sydney, Newcastle, Wollongong or Non-Urban)
- NSW_Activity_Code (i.e. the Code to specify the Schedule of EPA licensed activities specified in the *Protection of the Environment Operations Act 1997*. A NSW_Activity_Code of 0 is assigned to emission sources that are not from EPA licensed premises).
- Activity (i.e. name of the Activity where the emission source is categorised within)
- ANZSIC_Class_Code (i.e. the Class Code from the Australian and New Zealand Standard Industrial Classification (ANZSIC) system where the emission source is categorised within. An ANSZIC_Class_Code of 0 is assigned to emission sources that are not categorised
- ANZSIC_Class (i.e. the name of the ANZSIC Class where the emission source is categorised within)
- Facility_ID (i.e. Facility identifier for the emission source. Note that the Facility_ID is only unique to each module (i.e. there could be 2 facilities with an ID of 1, one for each module))
- Facility (i.e. Facility name for industrial and commercial facilities)
- Source_ID (i.e. Source identifier for the emission source)
- Source (i.e. the emission Source name)
- Source_Type (i.e. either Point, Fugitive or Area)
- Easting (i.e. the Map Grid of Australia easting reference point (km))
- Northing (i.e. the Map Grid of Australia northing reference point (km))
- Distance_To_Receptor (i.e. Note that this field is blank as this information was not collected during the inventory survey process)

- Height (i.e. the height of the point source emission release. Note that this field is blank for fugitive and area sources)
- Diameter (i.e. the diameter of the point source emission release. Note that this field is blank for fugitive and area sources)
- Temperature (i.e. the temperature of the point source emission release. Note that this field is blank for fugitive and area sources)
- Velocity (i.e. the velocity of the point source emission release. Note that this field is blank for fugitive and area sources)
- Substance_ID (i.e. the Substance identifier)
- Substance_Name (i.e. the Substance name)
- kg/year (i.e. the emission rate for each source in units of kg/year)

The EDMS exports data for all industrial and commercial sources and all pollutants at the one time. To generate the file, users must navigate to the "Facility Prioritisation" form via the "EDMS - Export Emissions Data to Modelling Software" form. The "Facility Prioritisation" form is shown in Figure 2.24. Users must simply select a year and choose a location to save the output files.

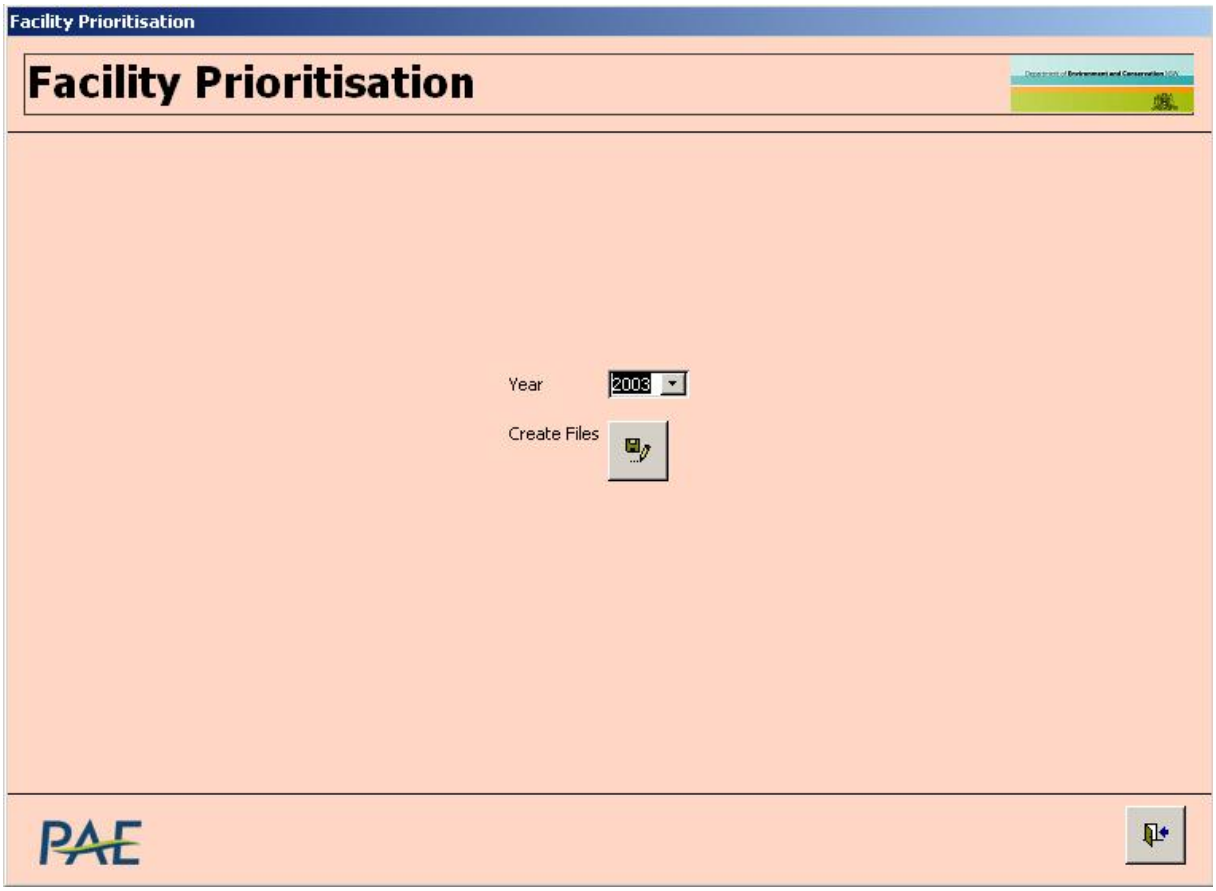

Figure 2.24: "Facility Prioritisation" Form

2.6.2 Maximum Incremental Reactivity Data Files

The EDMS allows users to export inventory data so that the University of California, Riverside (UCR) Maximum Incremental Reactivity (MIR) methodology (Carter, 2003) can be applied to all sources included in the emissions inventory by importing data into a customised Microsoft® Access 2003™ database for post-processing (See Figure 2.25).

From the "EDMS - Emissions Reporting" form shown in Figure 2.4, users should complete the following tasks:

- Generate a "Source Emissions Report" (Section 2.2.2); or
- Generate an "Emissions to Area Report" (Section 2.2.3); and
- Select "VOC" in "Substances for Report" (Section 2.2.4); and
- Generate a "Substance Details Report" (Section 2.2.5).

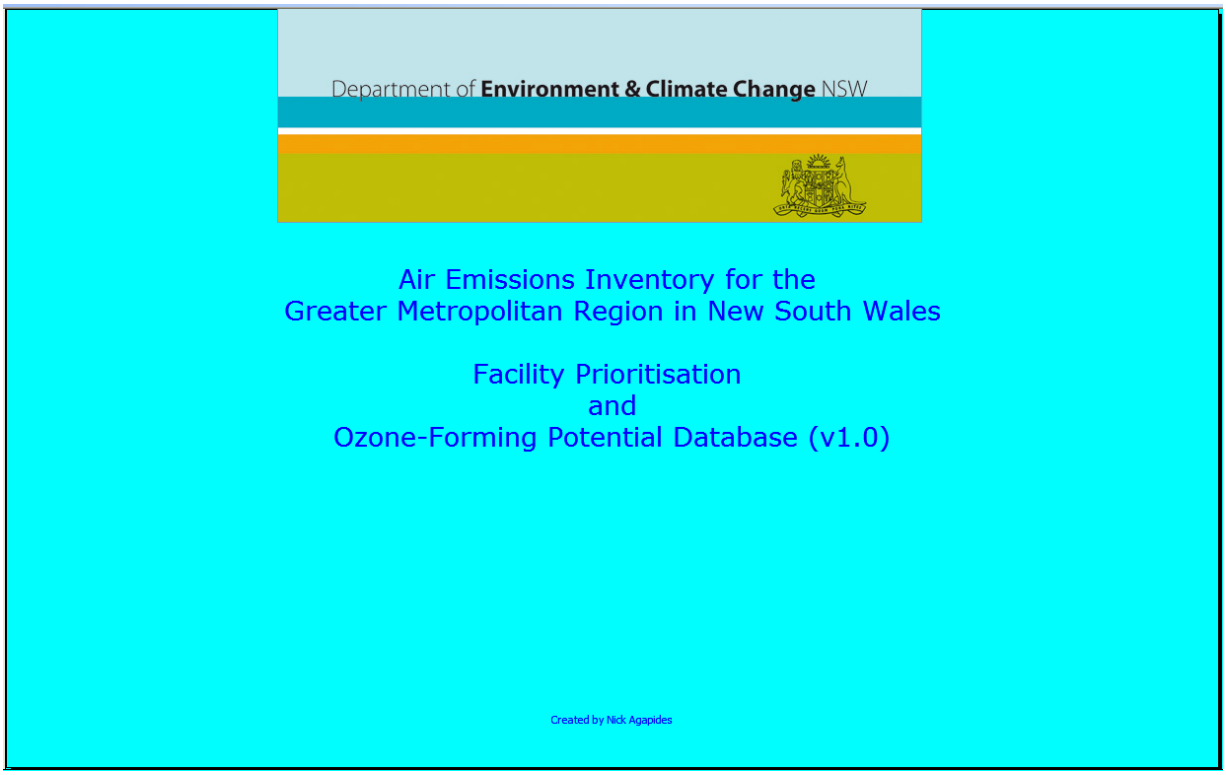

Figure 2.25: "Facility Prioritisation and Ozone-Forming Potential Database - Splash Screen"

2.6.3 GIS Data Files

The EDMS allows users to export inventory data that can be viewed in GIS programs. The user is required to specify which inventory parameters are required to be exported and which filter(s) to be applied. Examples of filters are:

- Module (i.e. the Module is a grouping of sources. Users can export emissions for all modules or only emissions from one module type at a time)
- Activity (i.e. an Activity is a grouping of sources based on the activity that leads to the emissions. Users can export emissions data for all activities or only export emissions data for a selected activity)
- Region (i.e. users can choose to export emissions data for a selected Region only. Users can choose to export emissions data for the entire GMR, or Sydney, Newcastle or Wollongong regions alone)
- LGA (i.e. Local Government Area where the emission sources are located)
- Facility (i.e. a Facility is a grouping of sources. Users can choose to export data for all facilities within a given activity or just sources from a selected facility)
- Source Type (i.e. stack sources or fugitive sources)
- Substance (i.e. users can only export emissions data for one substance at a time)
- Year (i.e. 2003 to 2031)

Users can select each of filters from the GIS Specifications form which is shown in Figure 2.26.

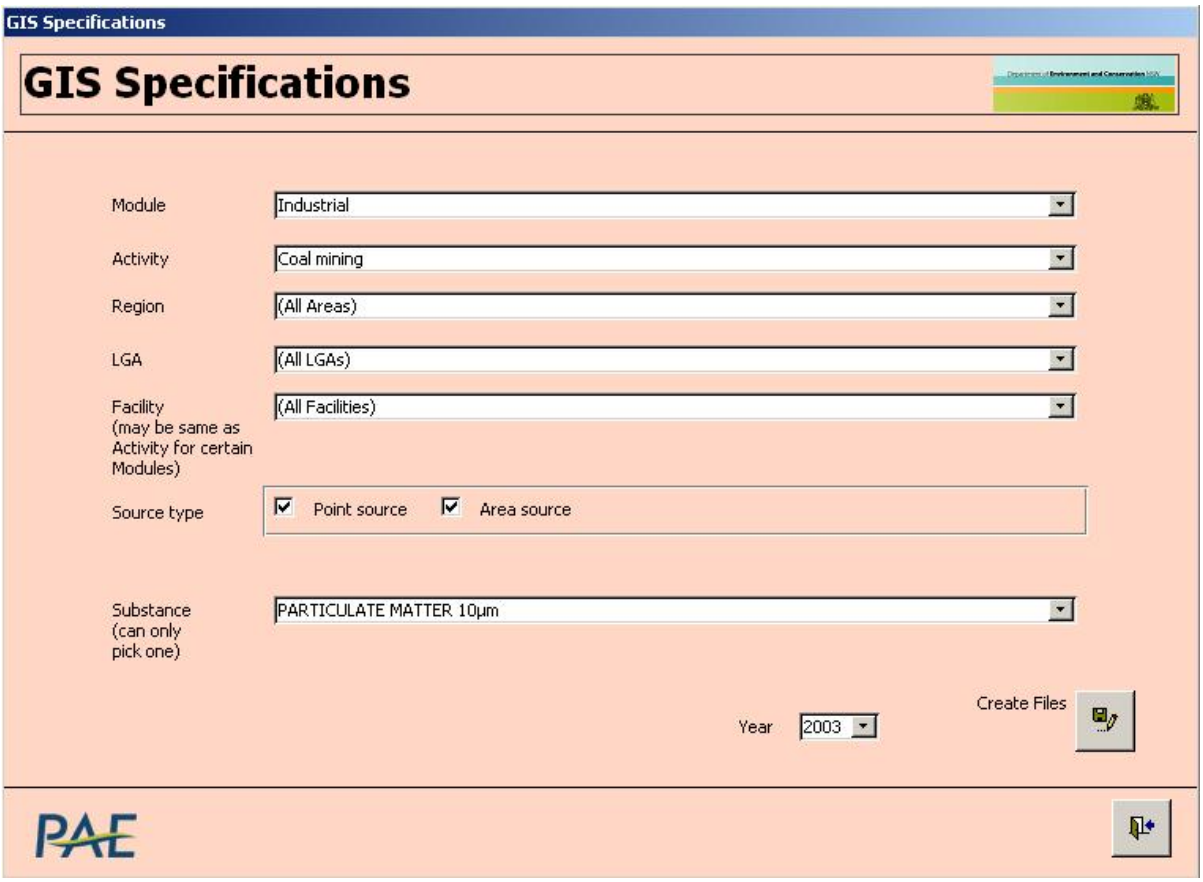

Figure 2.26: "GIS Specifications"

To generate the GIS files, the user must select the "Create Files" button and select a location to save each of the produced files. The GIS export function produces up to four export files as follows:

- Point source emissions file
- Point source locations file
- Area source emissions file
- Area source locations file

The user must choose a location and provide a file name for each of the files before the EDMS produces the files. The screenshots for each file save are shown in Figure 2.27, Figure 2.28, Figure 2.29 and Figure 2.30.

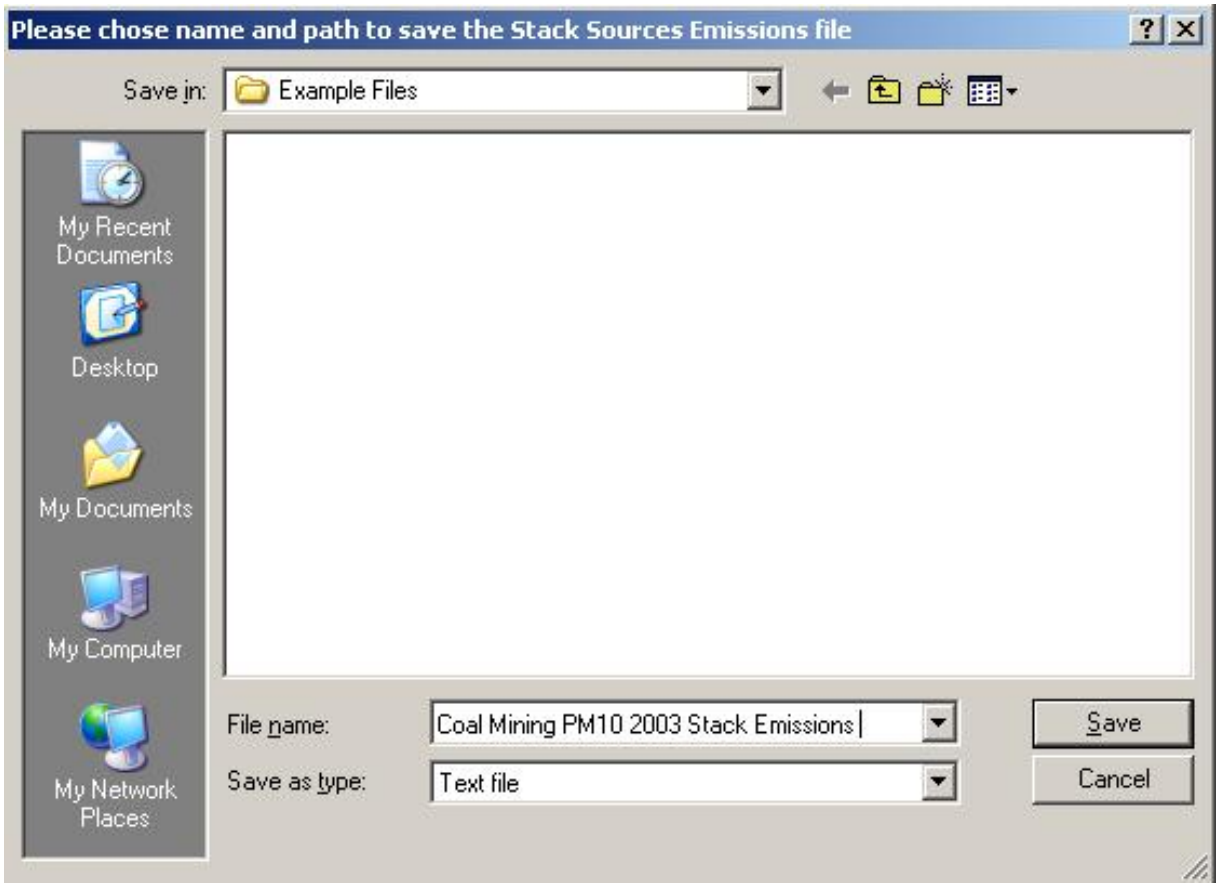

Figure 2.27: Saving the Point Source Emissions File

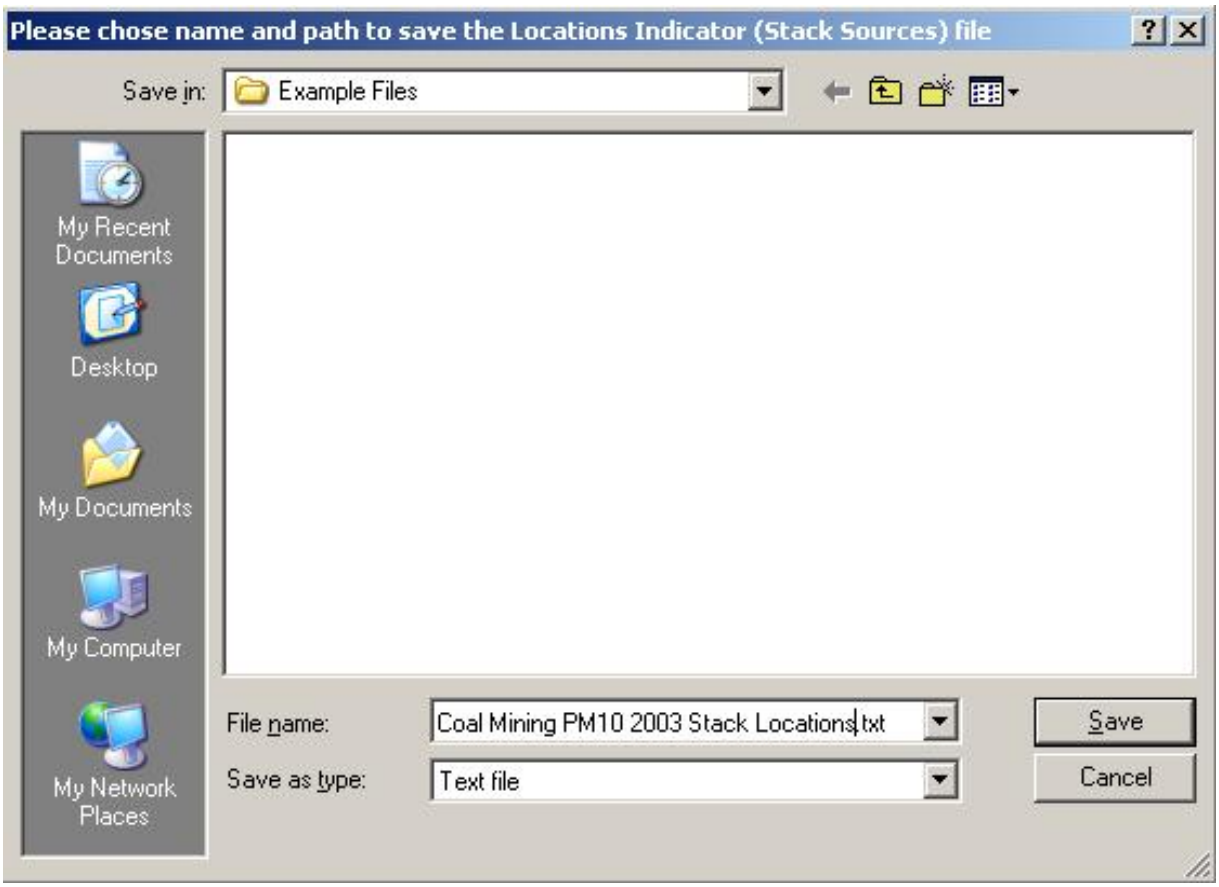

Figure 2.28: Saving the Point Source Locations File

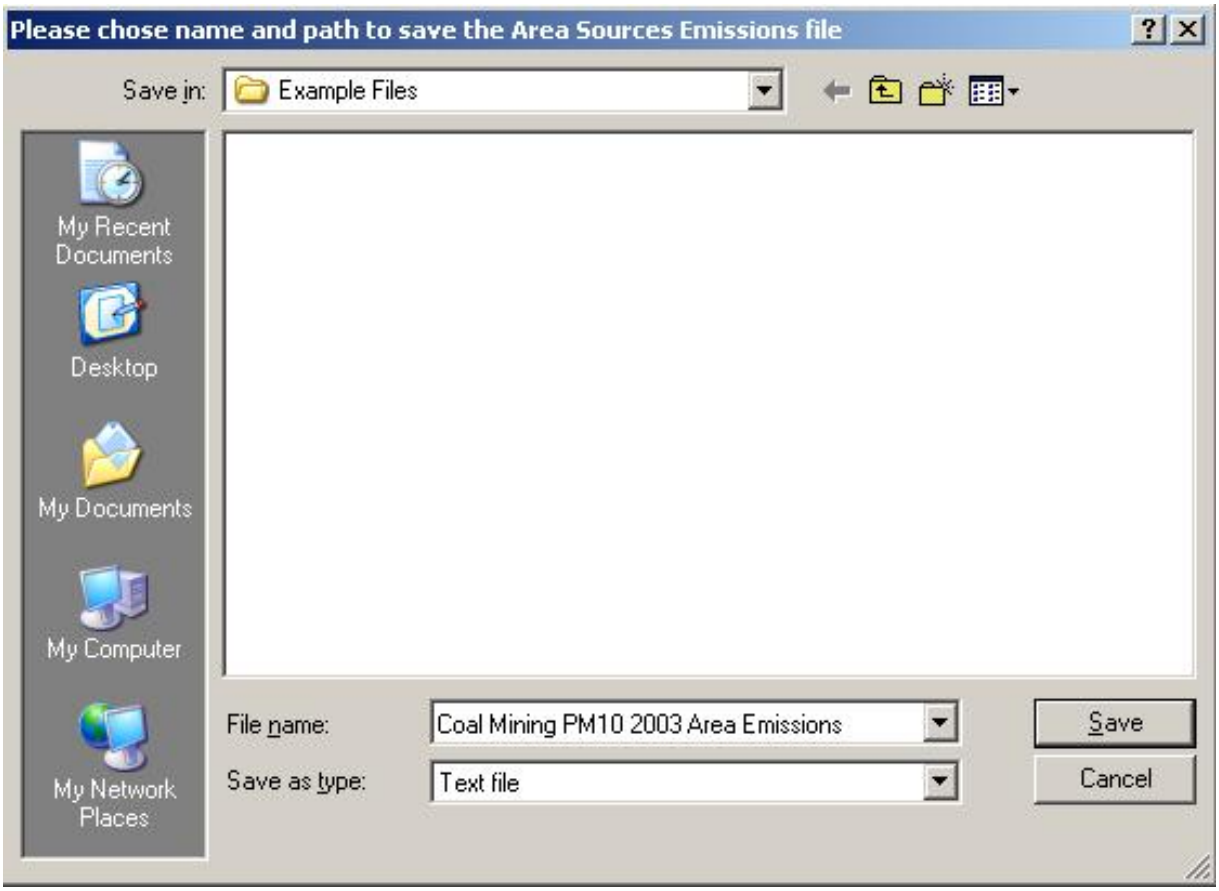

Figure 2.29: Saving the Area Source Emissions File

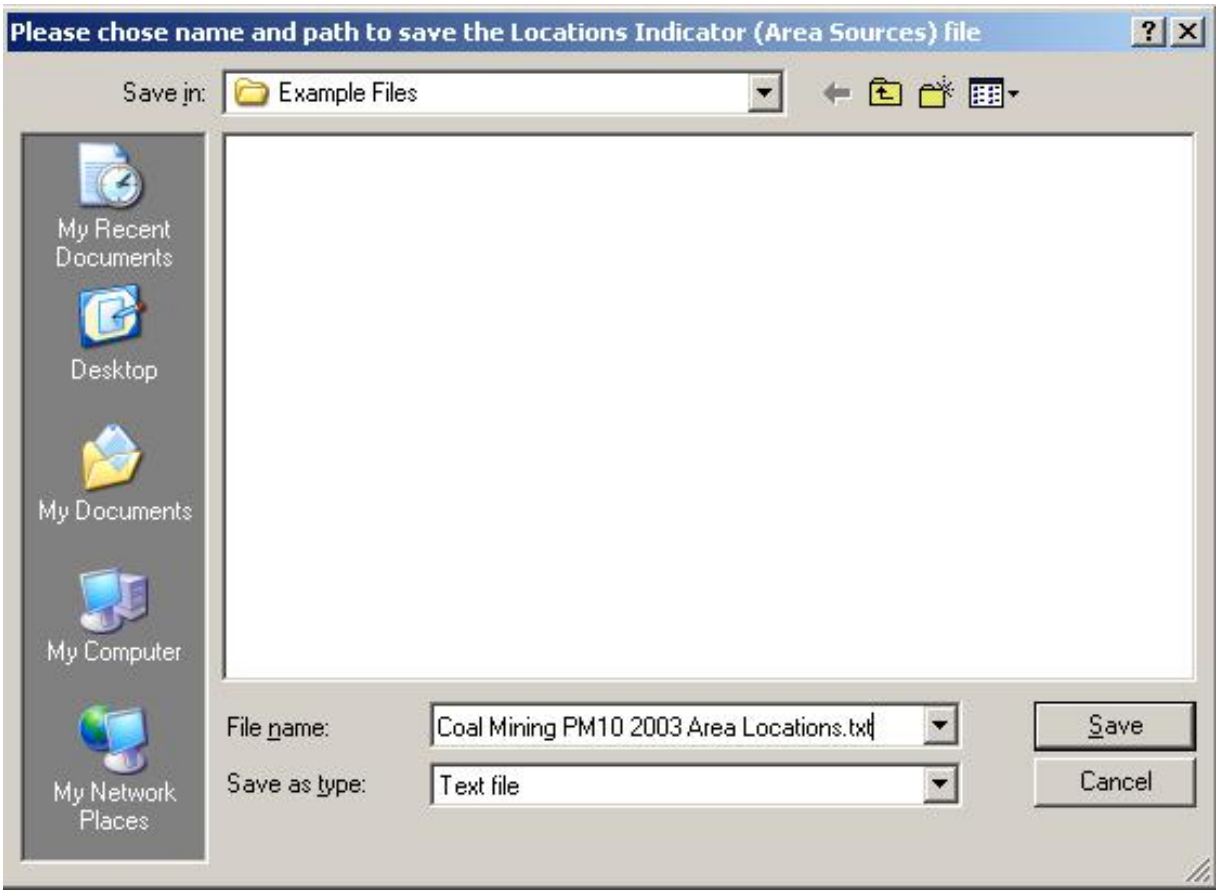

Figure 2.30: Saving the Area Source Locations File

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APPENDIX A EDMS DATA TRANSFER SPECIFICATIONS

A.1 Introduction

A complete description of the EDMS data transfer specifications is detailed in the EDMS design documentation (Bawden et. al., 2004).

The files required and file formats are listed in Sections A.2 to A.6. Example Data Transfer Files are provided in Microsoft® Excel™ 2003 format in the accompanying file "**Data Transfer Specification Example.xls**". The EDMS imports these files into staging tables, where the import data is validated, then transferred into working tables, where the data is used for the EDMS functionality.

Data transferred from the modules to the EDMS should be in comma separated values text format, text delimited by quotation marks, rows delimited by carriage return/line feeds (i.e. standard Windows CSV, in other words). The files should be named using the standard naming convention, so the EDMS can identify the module from which the data has come, and add this to the incoming data during import.

The datatypes specified are based on SQL Server datatypes, so none have been specified that do not have an equivalent MS Access datatype. The datatypes and definitions are listed in Section A.7. **Note!: Ensure that the correct datatype is used for every data field.**

Specific issues encountered are discussed in Section A.8 in a Questions and Answers format.

A.2 Module Codes

Modules should be identified as shown in Table A.1.

Table A.1: Module Codes

Module	Code
Industrial	1
Commercial	2
Off-Road Mobile	3
Biogenic	4
Commercial/Domestic	5
On-Road Mobile	6

In the following files specifications, the file name uses the placeholder '<n>' to indicate where the module code should be inserted. This ensures that the import process to the EDMS can identify the origin of the import data.

A.3 List of Files

A list of files required for each module is shown in Table A.2.

Table A.2: List of Files for each Module

Module	Files required
Industrial	Activity1.csv ActivitiesANZSICCodes1.csv Facility1.csv Source1.csv SourceType1.csv SourcesSubstance1.csv TFDaily1.csv, TFWeekly1.csv TFMonthly1.csv PFActivity1.csv PFSource1.csv PFFacility1.csv
Commercial	Activity2.csv ActivitiesANZSICCodes2.csv Facility2.csv Source2.csv SourceType2.csv SourcesSubstance2.csv TFDaily2.csv TFWeekly2.csv TFMonthly2.csv PFActivity2.csv PFSource2.csv PFFacility2.csv
Off-Road Mobile	Activity3.csv ActivitiesANZSICCodes3.csv Facility3.csv Source3.csv SourceType3.csv SourcesSubstance3.csv TFDaily3.csv TFWeekly3.csv TFMonthly3.csv PFActivity3.csv PFSource3.csv PFFacility3.csv
Biogenic	Activity4.csv ActivitiesANZSICCodes4.csv Facility4.csv Source4.csv SourceType4.csv SourcesSubstance4.csv TFDaily4.csv TFWeekly4.csv TFMonthly4.csv

Module	Files required
Domestic-Commercial	Activity5.csv ActivitiesANZSICCodes5.csv Facility5.csv Source5.csv SourceType5.csv SourcesSubstance5.csv TFDaily5.csv TFWeekly5.csv TFMonthly5.csv PFActivity5.csv PFSource5.csv PFFacility5.csv
On-Road Mobile	Activity6.csv ActivitiesANZSICCodes6.csv Facility6.csv Source6.csv SourceType6.csv SourcesSubstance6.csv TFDaily6.csv TFWeekly6.csv TFMonthly6.csv

A.4 Major Files

The file structure, field names and record data types for the major files required for each module are shown in Table A.3, Table A.4, Table A.5, Table A.6, Table A.7 and Table A.8.

Table A.3: Activity<n>.csv File Structure

Name		Use	
Activity<n>.csv		'Activity' is classification level above 'Facility'	
Column	**Datatype**	**Constraint**	**Notes**
Activity_ID	smallint		(Primary key)
Activity	nvarchar(50)		Name of Activity

Table A.4: ActivitiesANZSICCodes<n>.csv File Structure

Name		Use	
ActivitiesANZSICCodes<n>.csv		Lists which ANZSIC codes relate to which Activities The ANZSIC codes list is defined in the EDMS database and will have been supplied for inclusion in the module	
Column	**Datatype**	**Constraint**	**Notes**
Activity_ID	Smallint	Related to Activity list	
ANZSICCode_ID	Smallint	Related to ANZSIC Code list	If the Activity does not have an ANZSIC code, use the ANZSIC code 0. (Please see example Data Transfer Files for details). For example the Activity vegetation from the biogenic module does not have an ANZSIC code, therefore the corresponding ANZSIC code = 0

Table A.5: Facility<n>.csv File Structure

Name		Use	
Facility<n>.csv		A Facility groups Sources (that emit substances). In some modules, a Facility will be a factory, while in others it may simply be a logical grouping of sources (e.g. vegetation). All sources will have a 'Facility' and all 'Facilities' have an Activity. For many modules the Facility will have the same name as the Activity. A Facility<n>.csv file is required for all modules	
Column	**Datatype**	**Constraint**	**Notes**
Facility_ID	Int		(Primary key)
Facility	nvarchar(50)		
Activity_ID	smallint	Must relate to Activity<n>.csv file	Primary Activity of this Facility

Table A.6: Source<n>.csv File Structure

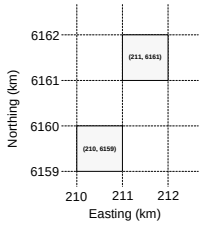
Name		Use	
Source<n>.csv		A Facility will have one or more Sources that emit substances	
Column	**Datatype**	**Constraint**	**Notes**
Source_ID	int		
SourceType_ID	int		
Source	nvarchar(50)		
Facility_ID	int		
GridCell_ID	nchar (6)	The grid coordinate system used for the air emissions inventory uses 1 km by 1 km grid cells. The grid coordinates start from the bottom left corner having index number with Easting (km) in the horizontal and Northing (km) in the vertical direction. Gridcell 210 km Easting and 6159 km Northing has a Gridcell_ID 001001	
Easting	Numeric (Precision: 7, scale: 3)		
Northing	Numeric (Precision: 7, scale: 3)		
PointType_ID	Tiny int	1 = Point, 2 = Fugitive, 3 = Area	

Table A.7: SourceType<n>.csv File Structure

Name		Use	
SourceType<n>.csv		Classifies Sources e.g. for the Industrial module, Source Types will include "Stack', 'Boiler – gas fired'"	
Column	**Datatype**	**Constraint**	**Notes**
SourceType_ID	Smallint		
SourceType	Nvarchar(50)		

Table A.8: SourcesSubstance<n>.csv File Structure

Name		Use	
SourcesSubstance<n>.csv		This contains the core data, i.e. the amount of each substance emitted by a specific source (The Substances table will have been defined in the EDMS and supplied for use in the module. It should not be modifiable within the module, so will not need to be exported to the EDMS)	
Column	**Datatype**	**Constraint**	**Notes**
Source_ID	Int		
Substance_ID	Smallint		
Amount	Numeric (Precision 38, scale 27)		If Multiplier is 1, then Amount is in kg/annum
Multiplier	Numeric (Precision 9, scale 5, default = 1)		Used to multiply Amount to reach a figure in kg/annum. (Should default to 1, and only be used for very large or very small amounts that exceed the capacity of the Amount column)
ControlFactor	Numeric (Precision 4, scale 3, default = 1)		If a control is applied to this source, then this will be less than 1, otherwise it will default to 1)

A.5 Temporal Factor Files

Although the term used to describe the values in these files is 'factor', the values in them are used in calculation as proportions (i.e. the values are taken as being relative to each other, rather than absolute).

The file structure, field names and record data types for the temporal factor files required for each module are shown in Table A.9, Table A.10 and Table A.11.

Table A.9: TFDaily<n>.csv File Structure

Name		Use	
TFDaily<n>.csv		Daily Temporal Factors for Sources: the profile of emissions variation over a twenty-four hour period by hour. The Weekday/Weekendday Factor columns are used in conjunction with the TFWeekly file to profile emissions over a week. The combination of Hour and Source_ID must be unique	
Column	**Datatype**	**Constraints**	**Notes**
Hour	Tiny int	Must be 24 records, numbered 1-24 for each Source_ID	
Source_ID	Int	Must relate to the imported Source list	
Substance_ID	smallint		
WeekDayProportion	Numeric (Precision:9 Scale:8)	Represents the ratio of emission per hour during a Weekday. e.g. to find the amount emitted for any one hour, the factor for this hour is divided by the total factors for the source and multiplied by the emission for the day	The precision and scale is that which will be stored in the EDMS. The actual precision and scale can be less. E.g. although it could store 0.00000001 to 9.99999999 numbers such as 1.25 or even 3 are fine
WeekEndProportion	Numeric (Precision:9 Scale:8)	Represents the ratio of emission per hour during a Weekday	As for Weekday Factor

Table A.10: TFWeekly<n>.csv File Structure

Name		Use	
TFWeekly<n>.csv		Weekly Temporal Factors for sources: the relative emissions for a Weekday or a Weekend day.	
Column	**Datatype**	**Constraint**	**Notes**
IsWeekday	Bit	For each Source there must be two records, one where IsWeekday = True (1), one where IsWeekday = False (0). Please use: 0 = Weekend day 1 = Weekday	
Source_ID	Int	Must correspond to the supplied Source list.	
Proportion	Numeric (Precision:9 Scale:8)	Represents the ratio of types of day during a week. e.g. If 5 Weekdays (working days) and 2 Weekend days then one record would contain 5 and the other 2. If the emission source emits only on Weekdays then the Weekday record would be 5 and the Weekend record would be 0	(as above)

Table A.11: TFMonthly<n>.csv File Structure

Name		Use	
TFMonthly<n>.csv		Monthly Temporal Factors for a source. Profiles emission rates over a year by month The combination of Month_ID and Source_ID must be unique	
Column	**Datatype**	**Constraint**	**Notes**
Month_ID	Tiny int	Each source will have 12 records, where Month_ID will be 1 through 12	The EDMS will have a look-up table of Months containing the Name of the Month (Month_ID = 1, Name = 'January') and the standard number of days for each month. Leap-years will be ignored
Source_ID	Int	Must relate to the imported Source list	
Proportion	Numeric (Precision:9 Scale:8)	The ratio of emission rates from month to month	

A.6 Projection Factor Files

The file structure, field names and record data types for the projection factor files required for each module are shown in Table A.12, Table A.13 and Table A.14.

Table A.12: PFActivity<n>.csv File Structure

Name		Use	
PFActivity<n>.csv		Year on year projection factors as applied to Activities. The combination of Activity_ID and Year must be unique.	
Column	**Datatype**	**Constraint**	**Notes**
Activity_ID	Small Int	Must relate to imported Activity file	
Year	Text(4)	A year entered as text e.g. '2005'	
Factor	Numeric (Precision : 4, Scale: 3)	The multiplier to apply to the data from the base year	

Table A.13: PFSource<n>.csv File Structure

Name		Use	
PFSource<n>.csv		Year on year projection factors as applied to Sources The combination of Source_ID and Year must be unique	
Column	**Datatype**	**Constraint**	**Notes**
Source_ID	Int	Must related to the imported Source file	
Year	Text(4)	A year entered as text e.g. '2005'	
Factor	Numeric (Precision : 4, Scale: 3)	The multiplier to apply to the data from the base year	

Table A.14: PFFacility<n>.csv File Structure

Name		Use	
PFFacility<n>.csv		Year on year projection factors as applied to Facilities	
Column	**Datatype**	**Constraint**	**Notes**
Facility_ID	Int	Must related to the imported Facilities file	
Year	Text(4)	A year entered as text e.g. '2005'	
Factor	Numeric Precision : 4, Scale: 3)	The multiplier to apply to the data from the base year	

A.7 Data Type Definitions

The datatype definitions are listed below.

- char, nchar, varchar and nvarchar

    i. char[(n)] - Fixed-length non-Unicode character data with length of n characters. n must be a value from 1 through 8,000. Storage size is n bytes.

    ii. nchar[(n)] - Fixed-length Unicode character data with length of n characters. n must be a value from 1 through 4,000. Storage size is two times n bytes.

    iii. varchar[(n)] - Variable-length non-Unicode character data with length of n characters. n must be a value from 1 through 8,000. Storage size is the actual length of the data entered, not n bytes. The data entered can be 0 characters in length.

    iv. nvarchar[(n)] - Variable-length Unicode character data with length of n characters. n must be a value from 1 through 4,000. Storage size, in bytes, is two times the number of characters entered. The data entered can be 0 characters in length.

    v. Remarks - When n is not specified in a data definition, the default length is 1.

- bigint, int, smallint and tinyint

    i. bigint - Integer (whole number) data from -2^63 (-9223372036854775808) through 2^63-1 (9223372036854775807). Storage size is 8 bytes. The bigint data type is available in SQL Server 2000 or later.

    ii. int - Integer (whole number) data from -2^31 (-2,147,483,648) through 2^31 - 1 (2,147,483,647). Storage size is 4 bytes.

    iii. smallint - Integer data from -2^15 (-32,768) through 2^15 - 1 (32,767). Storage size is 2 bytes.

    iv. tinyint - Integer data from 0 through 255. Storage size is 1 byte.

- decimal and numeric - Numeric data types with fixed precision and scale.

    i. decimal[(p[,s])] - Fixed precision and scale numbers. When maximum precision is used, valid values are from - 10^38 +1 through 10^38 - 1.

        - p (precision) specifies the maximum total number of decimal digits that can be stored, both to the left and to the right of the decimal point. The precision must be a value from 1 through the maximum precision. The maximum precision is 38.

- s (scale) specifies the maximum number of decimal digits that can be stored to the right of the decimal point. Scale must be a value from 0 through p. The default scale is 0; therefore, 0 <= s <= p. Maximum storage sizes vary, based on the precision.

ii. numeric[(p[,s])] - A synonym for decimal.

- float and real - Approximate number data types for use with floating point numeric data. Floating point data is approximate; not all values in the data type range can be precisely represented.

  i. float[(n)] - Floating point number data from - 1.79E + 308 through 1.79E + 308. n is the number of bits used to store the mantissa of the float number in scientific notation and thus dictates the precision and storage size. n must be a value from 1 through 53.

  ii. real - Floating point number data from -3.40E + 38 through 3.40E + 38. Storage size is 4 bytes. In SQL Server, the synonym for real is float(24).

- text and ntext - Variable-length character strings.

  i. text - Variable-length non-Unicode data in the code page of the server and with a maximum length of 2^31 - 1 (2,147,483,647) characters. Storage size is the actual length in bytes of the data entered.

  ii. ntext - Variable-length Unicode data with a maximum length of 2^30 - 1 (1,073,741,823) characters. Storage size, in bytes, is two times the number of characters entered.

- bit, uniqueidentifier and timestamp

  i. bit - Integer data type that can be 1, 0, or NULL.

  ii. uniqueidentifier - A globally unique identifier (GUID). A column of uniqueidentifier data type can be initialized using the NEWID function or converting from a string constant in the following form: xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx, in which each x is a hexadecimal digit in the range 0-9 or A-F.

  iii. timestamp - A database-wide unique number that gets updated every time a row gets updated. The value of a timestamp column is unique within a database. The storage size is 8 bytes.

A.8 Questions and Answers

Some common questions and answers regarding file structure are shown below.

- Q1. Does a particular module require a "facility" grouping? For example, the biogenic vegetation activity has sources but not facilities.

- A1. All inventory modules will have a "facility" grouping. In the case of "vegetation", the facility name relating to "vegetation" will be "vegetation". In the case of the activity "Light duty vehicles – petrol" the facility name is "Light duty vehicles – petrol". The term "facility" represents a logical grouping of sources and does not necessarily refer to an actual facility.

- Q2. There are no control factors in a particular air emissions inventory module, so are they required?

- A2. If an inventory module does not use control factors, all control factors must be set to 1 in the exported SourcesSubstances.csv file. Null values will not be accepted. Control factors must be supplied for all modules.

- Q3. A particular inventory module uses GridCell_IDs and not Eastings and Northings. Are both fields required?

- A3. When exporting the data, populate the Easting and Northing data field with the corresponding Easting and Northing to the south west corner of the GridCell_ID. Vice versa, a particular inventory module uses Eastings and Northings and not GridCell_IDs, so populate the GridCell_ID by using the Easting and Northing value for ALL sources. Null values will not be accepted.

- Q4. Is it necessary to strictly adhere to the datatypes for all fields?

- A4. Yes, they must be followed exactly! If the Datatype is "Numeric (Precision:9 Scale 8)" numbers from 0.00000001 to 9.99999999 will only be accepted. Numbers with more than 8 numbers to the right of the decimal place but within the data range will not be accepted.

- Q5. A particular inventory module has no activities that are related to ANZSIC codes. Must ANZSIC codes be provided?

- A5. All activities within an inventory module must be related to an ANZSIC code. The ANZSIC code of "0" has been added to indicate that the activity is not related to an ANZSIC code.

- Q6. Substances from the same source have different monthly temporal profiles. How should this be dealt with?

- A6. If substances from the same source have different monthly temporal profiles, the source name needs to be changed so that only one substance is emitted per source. For example if the source vegetation emits Total VOCs, Isoprene and Monoterpenes and all substances have different monthly temporal profiles then the source needs to be modified so that the source name from the "Facility" = Vegetation are "Vegetation – VOCs", "Vegetation – Isoprene", and "Vegetation – Monoterpenes". Monthly temporal profiles are associated with the source. Therefore substances emitted from the "facility" vegetation can have different monthly temporal profiles using the designed structure. This example is shown in Figure A.1.

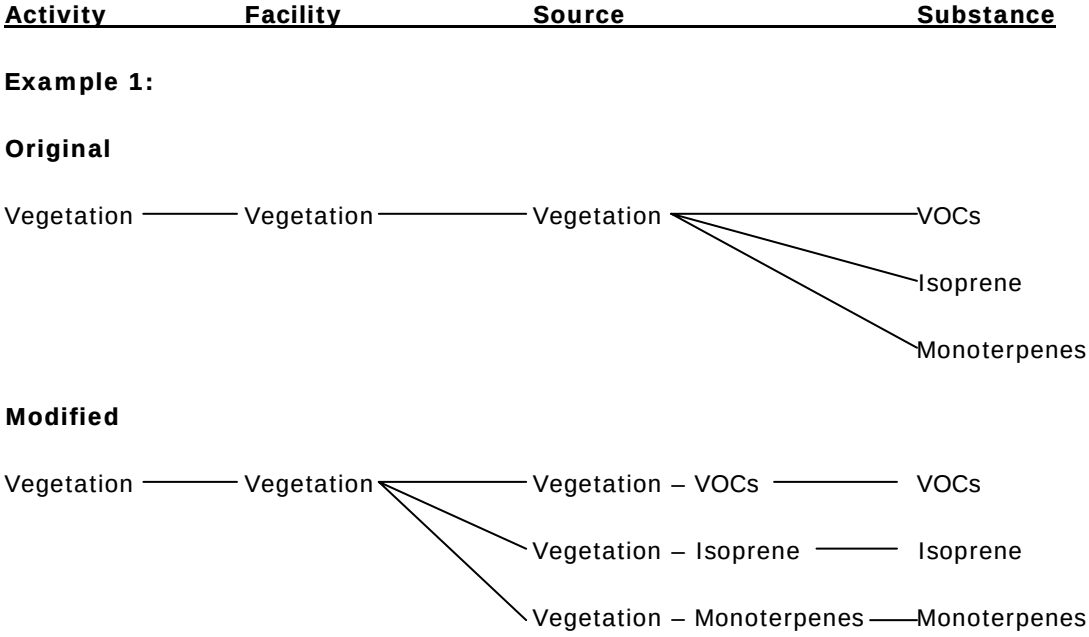


Figure A.1: Monthly Temporal Profiles that Vary for each Substance

- Q7. Are all modules required to provide all data transfer files?

- A7. No. The biogenic and on-road mobile emissions modules are not required to provide Projection Factor files. All other files are required.