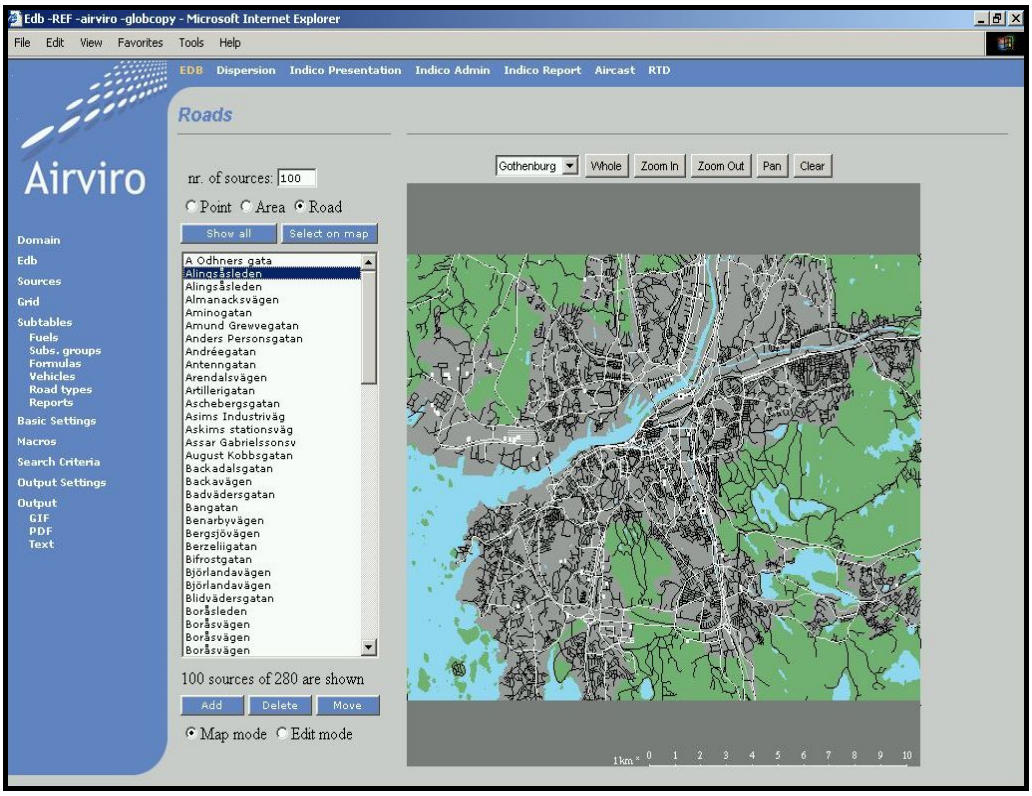


Working with the Emission DataBase (EDB) Client

How to construct a dynamic emission database and simulate emission scenarios

Working with the Emission DataBase Client

How to construct a dynamic emission database and simulate emission scenarios

Amendments

Version	Date changed	Cause of change	Signature
3.11	061024	Update to last Airviro version	GS/PI

Contents

3.1 Introduction: What it is All About

A Database Which Also Includes a Sophisticated Simulation Tool

The Airviro emission database (EDB) is not only a database. In fact the main emphasis has been placed on the user interface, the simulation models and the output facilities. A diagram explaining the structure of the EDB can be found in *Appendix 3C: Structure of an EDB.*

How does EDB client work?

EDB is a JAVA-based user interface to the database and shell programs at the Airviro server. EDB client can be executed from a PC or other device running Internet Explorer 6 or Netscape Navigator 7 (or higher).
After logging in, an EDB user can process data from a database at the server, according to settings in EDB. All processing of data is done at the Airviro server. Results are transferred over a TCP/IP connection for presentation in EDB.
Output is generated to an SVGA-capable display as an HTML-picture - including some interactive elements, as a pdf-file or as plain ASCII text. Printing is generated by the web browser or with third-party software, e.g. Adobe® Reader 6.
A searchable help system is provided in the form of a pdf-file.
Please be aware that the EDB client requires no installation at the PC side.
Anybody who knows the Airviro web URL may reach the database. It is therefore important to change passwords regularly and to set privilege levels for the users with great concern to limit not authorized access. Using an Intranet solution behind a firewall instead of Internet prevents access for the world - wide web, if properly set up.

The database includes structures designed to maximise the ease with which your knowledge of emission sources can be included in the system.

A Structured Way of Storing Emission Data

The tables provided enable you to describe:

- emission from
  - point source: all the emission is concentrated in a very small area, such as a chimney or stack. Information describing the stack conditions must be given for use in the Dispersion models.
  - area source: emission is evenly distributed over a rectangular area and is assumed to leak out.
  - road source : the emission is assumed to be evenly distributed over a line. This is normally used as an approximation for road traffic.
  - grid layers - background emission levels can be defined in the form of grids.

- time and temperature variation of emission

- different road types describing traffic patterns
- vehicle characteristics and speed-dependent emission factors

as well as other features that help you to convert obtainable information into emission figures.

Simulating "What Happens If..." Scenarios

Once you have started filling your Edb you will appreciate the ability to search for emission. The search facility allows you to specify exactly what sources you are interested in finding out the emission from, especially if you have created your Edb in a structured way. You can search using combinations of the following restrictions:

- source name and information strings
- point, area, road or grid sources, or a combination
- one or several fuel types, substance groups and formulae
- one or several road types and vehicle types
- any combination of search keys
- a restricted area of the map
- restrictions on time an temperature

Using the search keys you will be able to find out emission figures such as:

- The total emission of SO_2 from heating plants at 6 o'clock in the morning
- The contribution to the total NO_x emission of heavy vehicles in the city centre at rush hour
- The emission of toluene from paint spraying industries in the northern part of the town when the outside temperature is over 20 degrees

In this chapter a number of examples and recommendations on how to use the EDB software will be presented. If you follow the recommendations you can easily simulate the consequences of hypothetical situations such as:

- what would happen if heavy vehicles were removed from the city centre?
- what would be the effect of changing the speed limit on the main roads?
- what reduction of emission could be expected if low sulphur oil was introduced?
- which is the noise (dB) generated in the main roads?

Integration with Dispersion Models

Within the Airviro environment, the dynamic EDB is directly linked to the dispersion models, allowing you to combine different emission scenarios with various dispersion conditions. Given the weather and the parts of the day or year that you are interested in, relevant emissions will be used as input data to the dispersion calculation.

In the *Airviro User's Reference, Volume 4: Working with the Dispersion Module*, you will find examples on how to utilise the EDB for dispersion simulations.

The Report Generator

The report generator can be used to extract information from the EDB for presentation on the screen, storage in a file or as a printout. You can obtain selected static data such as source locations and emission factors, as well as time dependent information concerning emission loads for a given period and area.

Interface to Other Systems/Computers

Using the report generator, you can produce output in different formats that can be used for presentation using other software applications such as Microsoft Excel™. The ASCII output format can be used as a means to transfer Edb data to other computers. The Airviro dynamic EDB also provides an ASCII interface for importing data, such as traffic information from a traffic simulation system.

How to Collect the Relevant Information to be Stored in the EDB

Normally when you work with the EDB we recommend that you initially collect information directly from industry, local authorities, etc. and store the information in the EDB. If you work through the examples in this chapter you will be able to design suitable questionnaires.

Later on, you should be able to carry out dispersion calculations based on the EDB for historical periods and compare the results with measured ambient data. By simulating different wind directions and weather conditions you have a good chance of identifying sources that are not properly described in the EDB. Try to correct the emission data by collecting new information. If this method does not improve the results, we recommend that you use the Receptor Model to estimate emissions.

When you are satisfied with the historical simulation results based on the EDB, you are ready to work with real time dispersion applications (now casting) or forecasts for the next 24 hours.

3.2 Getting started

When Airviro has been installed at the Airviro Server, it is possible to jump to your Airviro URL with a browser over Internet/Intranet.
After logging in with user-ID and password, the user is presented with a list of available **Web Modules** and Domains. See Figure 3.2.1and 3.2.2.
When they have been selected, the user selecting an **Domain**.

Figure 3.2.1 Logging in Airviro

Figure 3.2.2 Select a Domain

In this section you will learn how to set up the EDB module so that it is ready to use. This includes:

- Selecting an Edb to work with - either the global Edb or a personal Edb
- Creating a new personal Edb by either copying another Edb or by copying the empty Edb
- Customising some of the menu texts
- Adding new substances to the substance list
- Creating substance groups
- Working with the map

Some of the examples shown here are based on real sources from the Airviro (Göteborg) Reference System, included in all delivered Airviro systems.

3.2.1 Selecting the Edb to Work with

When you start working with the Edb you have the option of creating a new emission database or editing an existing one. If you choose to build a new one then it may be convenient to copy and rename an existing one and then make the necessary changes.

A sub-window will appear on the screen as in Figure 3.2.1.1. Start your session by selecting a **Edb** under the sub-windows **User & Edb**.

There are two list boxes with the headings User (i.e. airviro,demo, global and ref) and Edb. If you click on global in the left list box and then **Apply** this means that you have chosen to work with the global Edb.

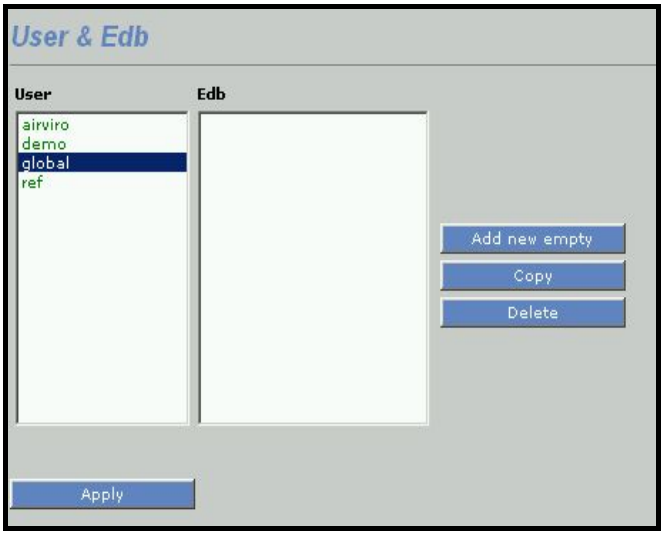


Figure 3.2.1.1 Select Global Edb

When Edb has been selected, the user gets a list of available frames or sub-menus on the left-hand side.

Note: A global Edb is the official, original emission database in the system consisting of formulae, emission factors and emission figures that should be approved and supported by the system manager. Usually, no one but the system manager should be able to edit the global Edb. However, any user can examine the contents of the global Edb or make a copy, rename it, and then edit and change the copy.

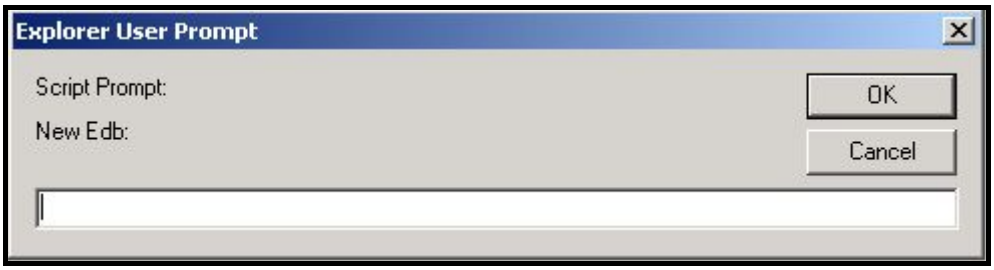
Note: It is possible to set up privilege levels in the Airviro system so that different users can have different privilege levels for different emission databases. It should be the task of the system administrator to make sure that the global Edb can only be edited by responsible persons and that other users can make their own personal copies of the global Edb if needed. It is not only the global Edb that can be protected in this way. Privilege levels can also be set up for a user's personal Edb's. If you have trouble accessing an existing Edb that you think you should be able to access then ask your system administrator about your privilege levels.

Creating a New Copy of the Global Edb

Normally, you are not allowed to edit the global Edb, so we suggest that you make your own copy. Select a **Edb** in the right list box on your user identity and click on **Copy**. Your user identity is the same name as you typed when you logged in to the computer. Your personal Edb will be shown in the list box on the right hand side.

You create your own copy of the global Edb by clicking on the push-button **Copy** to the right. A sub-window named **New Edb** appears. Type a suitable name in this sub-window**.** Confirm by clicking **OK**.

You now have a new copy of the global Edb. The new name appears in the right list box.



Creating a Copy of Someone Elses Personal Edb

Within the **Edb** sub-window:

- Click on the personal Edb that you want to copy and then click on **Copy**

- The **New Edb** sub-window will appear. Type the desired name for your copy in the text field.
- Click on **OK**.

Check that you have received a copy under your own user identity, with the name that you typed.

Note: It is even possible to set privileges on individual Edb's so that other users cannot even view them or copy them. This is done in the privilege level file which should be maintained by the system administrator.

Deleting a Personal Edb

You can easily delete any one of your own personal Edb.

Within the **User & Edb** sub-window:

- Click on the personal Edb that you want to delete and then click on **Delete**
- The Question sub-window will appear. Confirm or cancel your order.

Note: It is usually only possible to delete your own personal Edb. If you choose a personal Edb owned by any other user, or the global Edb, then the **Delete** button will be disabled. The ability to be able to delete other Edb's can however be configured in the privilege level file which should be maintained by the system administrator.

Creating a New Empty Edb

Within the **User & Edb** sub-window:

- Click on **Add new empty**
- The **New Edb** sub-window will appear. Type the desired name for your copy in the text field.
- Click on **OK**.

You have now created an empty Edb.

Exercise 3.2.2.1

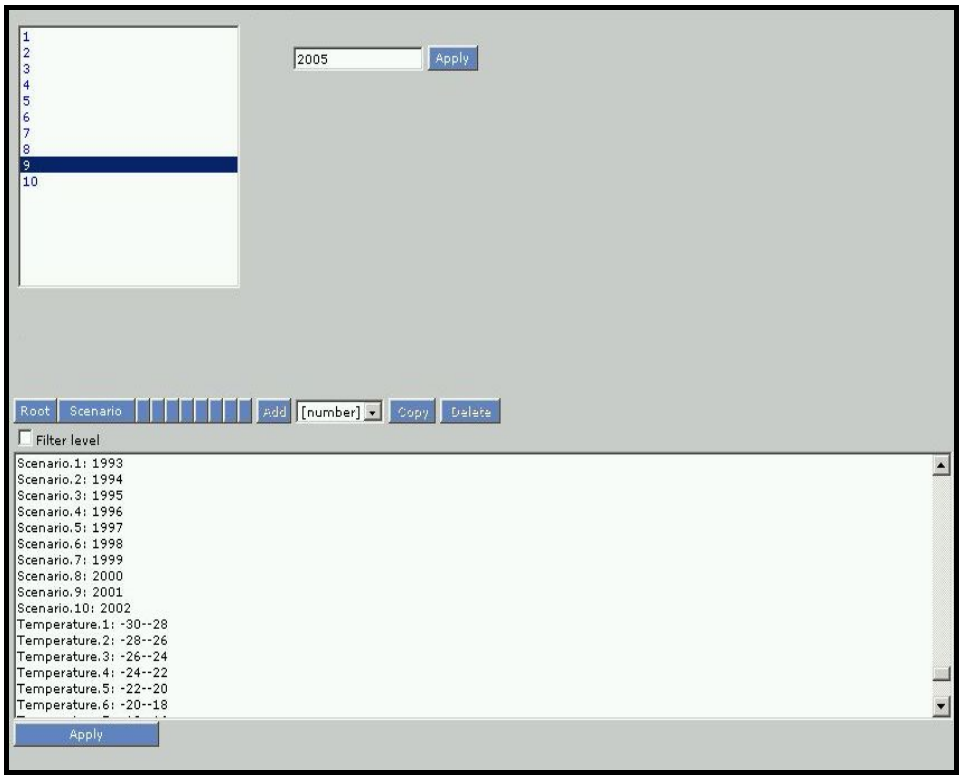
Create an empty personal Edb with the name: **My_first_EDB**.

3.2.2 Altering Sub-window Texts

Select your personal Edb: **My_first_EDB**, which should be empty. This Edb has been created with default texts but it is possible to alter some of them. You should only alter

texts in an empty Edb, that is before you start entering data, because these texts will apply to every single source in the Edb.

To look at the currently defined texts, choose the **Basic Setting** in the submenu on the left-hand side. Here you will see a list of the texts that can be user defined - the **Scenario** texts, **Speed** texts and **Temperature** texts. Choose one of them, for example **Scenario**. A sub-window appears showing the default scenario definitions - consecutive years starting from the year 1993. But what if you have emission estimations for the year 2005? To be able to incorporate these figures into your Edb, change one of the scenarios (e.g. change scenario 9) to 2005. Now, whenever you enter or edit a source, the year 2005 will appear in the scenario list in the 9th position.



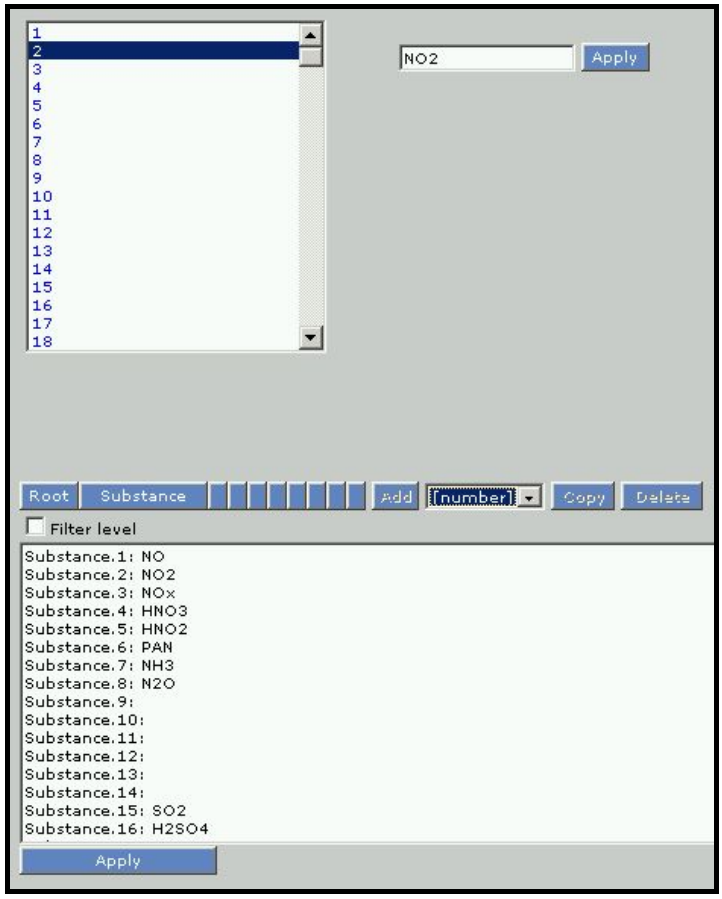
You can alter the speed and temperature texts too, as they have been set up to comply with Swedish traffic and weather conditions but might not be so relevant to other countries.

3.2.3 Adding Substances to the Substance List

Select the global Edb. This contains the default list of substances which is also used for all local Edb. To examine the substance list:

- In the **Basic Setting** on the frame, select **Substances.**

A list of substances will be presented as in the figure to the right, and is also included in the appendix. If you use the scroll bar to the right you will find out that there are 254 positions for different substances. These are grouped in categories depending on the type of chemical substance. This substance list has been adopted by several Airviro installations. We recommend that you do not change the positions of existing substances, but you may introduce any new substances at free positions in the substance list.



Note: There is only one substance list shared by the global Edb and all local Edb´s. The list can only be changed in the global Edb, so you must have edit privileges for the global Edb if you want to make changes to the substance list.

WARNING: The Edb does not recognise the substance name that you write in the substance list. It looks for the position, which means that there are 254 substances with internal names: 1 to 254. Later, when you define a source of emission you have to define what substances are emitted from that source by pointing in the substance list at the position where you have written the desired substance name. If you then change substance names between positions in the substance list, you have to redirect the pointer from all sources to the correct positions in the substance list. Consequently, you should set up the substance list as completely as possible before you start to fill the Edb with information.

3.2.4 Substance Groups in the EDB

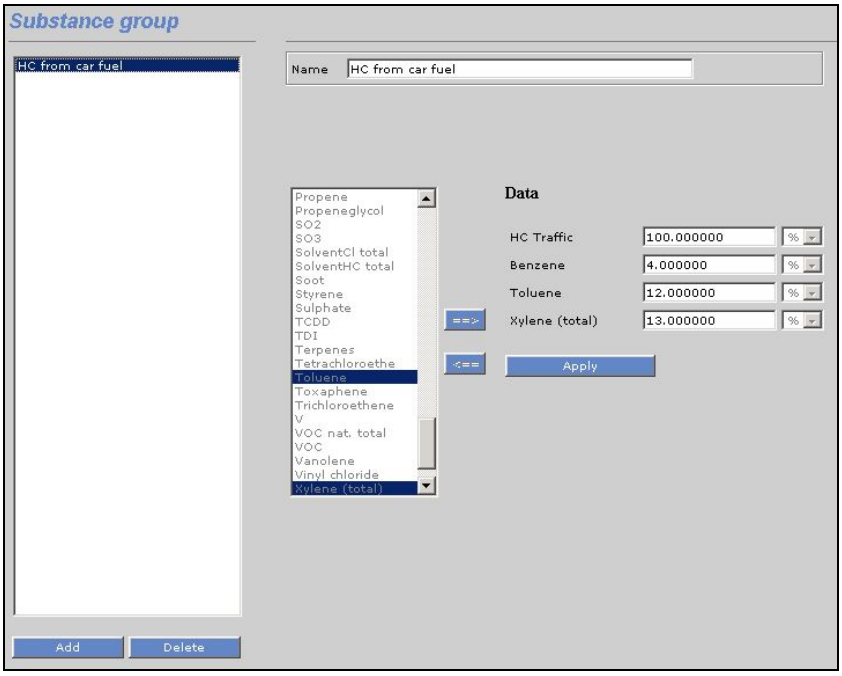
In several applications it would be convenient to define *substance groups* as a specific mixture of substances defined in the substance list. If you define a substance group called **standard petrol**, and define the percentage of different hydrocarbons, lead, etc. this would simplify and structure your work later on when you are to define all sources

emitting gases from **standard petrol** or if the composition of **standard petrol** needs to be changed.

To define a substance group:

- Select **Subs. Group** in the submenus **Subtables** on the left-hand side, in the EDB main window.
- The **Substance groups** sub-window appears and you should click on **Add.**
- Type the desired name of the substance group in the text field **Name.**
- Click on list the Substances and choose your individual substances by clicking on them in the substance list. To use <Shift> for one more selection**.** Confirm your choice by clicking on button of the arrow toward to the right.
- In **Data** fill in the weight percentage of the individual substances in the text area in the list box: **Emission (%)**
- Confirm your choice by clicking **Apply**. The choice is save when appears the legend "setting saved", and then the user can select other function the submenu on the left-hand side for Module EDB.

The example above shows a substance group that has been created to describe hydrocarbon emission from vehicles and is a particularly illustrative example of how substance groups can be used. Many different hydrocarbons are emitted from combustion of petrol, and we have details about a few of them. The substance group consists entirely of hydrocarbons from petrol, therefore we enter 100% for the substance HC Traffic. However contained in HC Traffic we know there is about 4% benzene, 12% toluene and 13% total xylenes. We can link the description of hydrocarbon emissions from cars to this substance group instead of just to the substance HC Traffic. In this way we have the option of searching for either total hydrocarbon emission or for one of the individual hydrocarbons.



Note: Once you have created a substance group you cannot add new substances. The only way around this is to use the ASCII interface (your system administrator should know about this).

Exercise 3.2.4.1

Define a substance group called **Standard Petrol** consisting of 5% Benzene, 12% Toluene and 3% P-Xylene.

3.2.5 Choosing a Geographical Area

Selecting a Map

Some systems have several maps within Airviro. You can choose between maps in the Source sub-window by using the option button of the Figure. You can choose between maps with the options of the text box. For example in this Figure is select Gothenburg.

Selecting a Geographical Sub-area Within a Map

When you have selected a map, it is possible to zoom in the map:

Click on the **Zoom In** button, in the map area. A black hair cross will appear when you move the mouse pointer onto the map.

Move the hair cross to a geographical point that you want to define as a corner in the zoomed area. Click on the left mouse button and drag the mouse to stretch a rectangle. Release the mouse button when you are satisfied with the marked area.

The chosen sub-area will be redrawn on the screen.

Note: As the map is vector based, you can zoom again in the zoomed area. However the resolution in the zoomed area will usually not be better than in the original map. There are two exceptions: the road network and the visual effects of having more picture elements on the screen per square metre of the geographical area. There is also a limit of how small an area can be zoomed into.

To Restore the Maximum Area Map

If you have zoomed in your map and would like to display the original (maximum) size of the map, then click on **Whole** in the map dialogue area (button up the map)

To restore the last Zoom Area Map

If you have zoomed in your map and would like to display the last size of the map, then click on **Zoom Out** in the map dialogue area.

Pan

I you have zoomed in your map and would like to display the other area map with the same scale, then click on **Pan** in the map dialogue area and move the map toward this area.

To Clear a Map

If you have displayed emission information on top of the map you can always clear the map area (displaying only the map) by clicking on the button **Clear** in the map dialogue area.

3.2.6 Notes on Filling in Tables in the Edb

When entering data into an EDB you will often come across large tables that have to be filled in with emission factors.

Within a table, the up, down, left or right move the mousse. Use <Tab> when you want move with column. It is very important that there are no extra spaces in the table.

By default, tables are created with the value 100 in each cell.

3.3 Point sources in the EDB

In this section you will learn the basic ideas behind entering point sources in the Edb. The emission from a point source can be defined in one of three ways:

1. By defining the total amount of each substance emitted in a year
2. By defining the total amount of a substance group emitted in a year
3. By linking the source to a fuel and defining its maximum effect

The following steps will be explained:

- Information required when entering a point source
- Time and temperature variation formulae
- Static information needed for dispersion modelling
- Using the search conditions to find out emission figures from your source
- Creating a fuel type
- Defining a point source based on fuel consumption

3.3.1 What is a Point Source?

If the air pollutants are emitted from

- a well defined position
- a small restricted volume

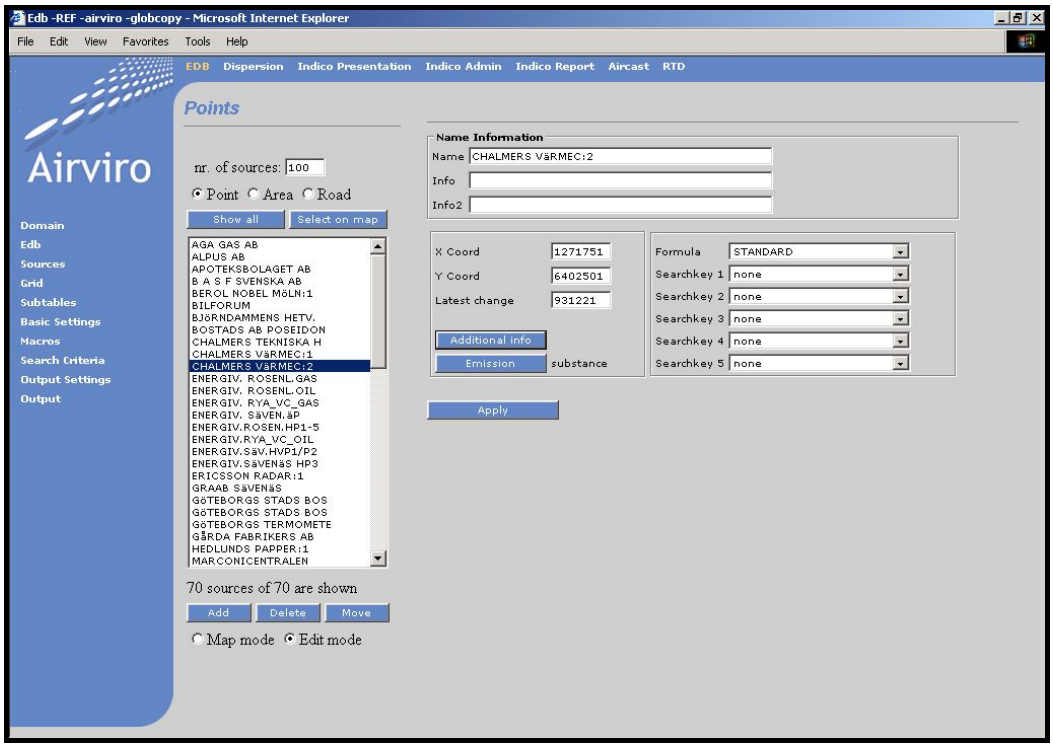
then we define the source as a point source. An emitting stack or chimney is a typical point source. In the Edb, you can describe the effect of heat and momentum fluxes on point source emissions, i.e. information that is necessary in order to make realistic dispersion simulations from a stack.

3.3.2 General Principles

When adding a point source to the Edb the following information must be given:

- **Name information** gives the name of the source plus two information strings. These strings can be used as search conditions when searching in the Edb.
- **General information:** such as the name of the company, address, contact person, etc. This information is needed to maintain the database.

- **Formula (or Dynamic information)** is the information that directly controls the emission, such as formulae that describe the emission as a function of outdoor temperature or as a function of day type and hour.
- **Static information** such as chimney height, exhaust gas temperature, coordinates, etc. These figures do not affect the emission strength, nor do they vary over the year, but they are required in order to describe the exact location of the initial pollutant plume. This type of information is vital for the dispersion simulations.
- **Emission** from the source either directly in terms of the substances emitted, or linked to a substance group or fuel type
- **Search keys** - it is possible to define five groups of search keys in order to structure the pollution sources into groups that can be used to separate the total emissions. The first two groups have space for 128 search keys each and the other three groups have space for 32 search keys.



3.3.3 Dynamic Emission: Formulae for Time Variation and Temperature Effects

Before giving any general or static information it is important to create a formula that describes the typical variation of the emission. In most cases of emission within a large city we know that the variation of emission is of the same order of magnitude as the long term average emission. If you start with an empty Edb there is one default formula in the

system, so called **STANDARD** formula which contains a time constant emission and no temperature dependency.

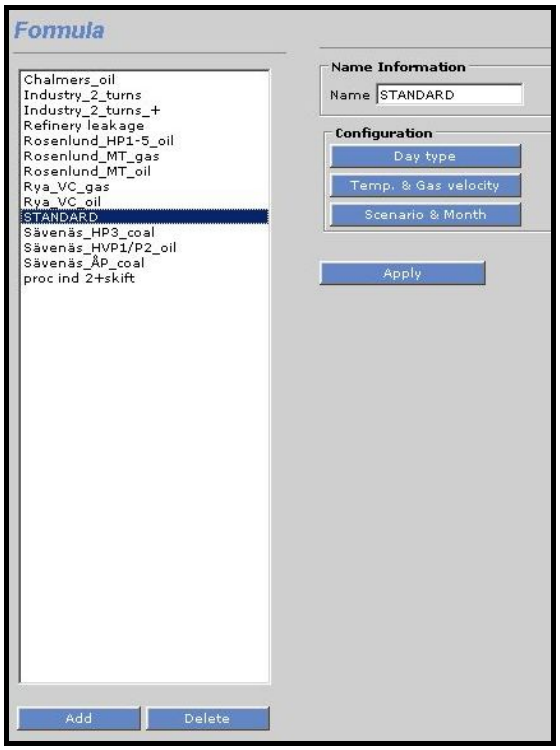
The emission variations defined in the formula tables are interpreted in two principal ways as a consequence of linking either a substance, a substance group of a fuel to a formula:

- substance, substance group: yearly variation is given as absolute values but all other variations are normalised
- fuel: all variations are given as absolute values

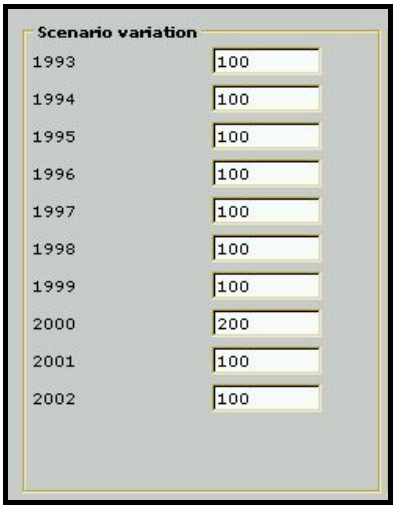
We will begin by considering the first group as this expresses a more general formulation of emission variations. In *3.3.7 Introducing a Point Source Based on Knowledge About the Emission Process* we will discuss the second alternative to be used for emission variations where we have information about the emission process.

To create a formula:

- Choose on **Formulas** in the submenus **Subtables** on the left-hand side, in the EDB main window. Then Formula sub-window will appear.
- Click on **Add** (or click on **STANDARD** if you want to edit the default formula)
- Define a source type name in the **Name information** text field
- Define the yearly variation by clicking on **Scenario & Month**



The Scenario & Month sub-window will appear and 10 text fields marked with yearly figures are displayed. In these text fields you can describe the absolute variation of emission in percent during the years.



Normally you should type 100 for the present year, meaning a factor equal to 1. If you estimate that the yearly emissions will double by the year 2000, then type 200 in that text field.

Confirm the table (OK) and select other option from the Configuration.

Note: The scenario names are texts that can be altered by the user, and these are stored under **Basic Setting** (on the frame in the menu EDB).

- Define the monthly variation by clicking on **Scenario & Month**

The **Scenario & Month** sub-window will appear containing 12 text fields marked with the names of the months. In these text fields you can describe the relative variation of emission during the months of the year. The figures you enter will be normalised at the same moment EDB uses them to estimate the emissions. This will be explained mathematically in Appendix 3B, and you can see the effects and understand the principles later on when you perform simulations.

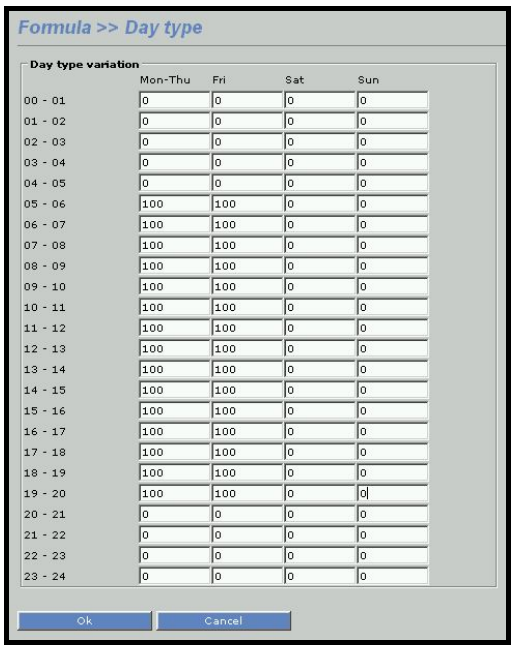
Example 1: If you write 100 for all months but put June and July = 0 then no pollutants will be emitted during these summer months, but the total yearly emission will be evenly distributed over the other ten months. If you had written 200 instead of 100 for all months except June and July the result would have been the same.

Example 2: If you write 75 for 6 months (October-March) and 25 for the other 6 months (April-September), then emission will be three times higher in the winter than in the summer. You will get the same result if you had given the figures 300 and 100 instead of 75 and 25.

When you are ready, click on **OK** and leave the sub-window.

Note: These figures are **not** normalised if linked to a source defined in terms of a fuel

- Define the daily and hourly variation by clicking on **Day type...**The **Day type** sub-window will appear and 4 columns with 24 text fields marked with the day types: Monday-Thursday, Friday, Saturday and Sunday are displayed. There are 24 text fields in each column defining the hours during the days. In these text fields you can describe the relative variation of emissions during the week. The figures you enter will be normalised at the same moment Edb uses them to estimate the emissions. This is explained mathematically in Appendix 3B, and you can see the effects and understand the principles later on when you perform simulations.



Example: If you write 100 for all hours during Monday-Thursday and Friday but 0 over the weekend then no pollutants will be emitted during Saturday and Sunday but 7/5 of the weekly average emissions will be emitted during workdays.

- When you are ready, click on **OK** and leave the sub-window.

Note: This table is **not** normalised if used with a source defined in terms of a fuel.

- Now define the emission dependency on outdoor temperature by clicking on **Temperature & Gas velocity**

The **Temperature & Gas velocity** sub-window will appear and a column with 30 text fields marked with the outdoor temperature intervals is displayed. In these text fields you can describe the relative variation of emission as a function of the outdoor temperature. This is explained mathematically in Appendix 3B: Mathematical Definitions of the Formulae Used in the EDB. In *3.3.5 Specifying a Point Source Based on Yearly Total Emission. in 3.3.7 Introducing a Point Source Based on Knowledge About the Emission Process* examples will be given showing how to use this table.

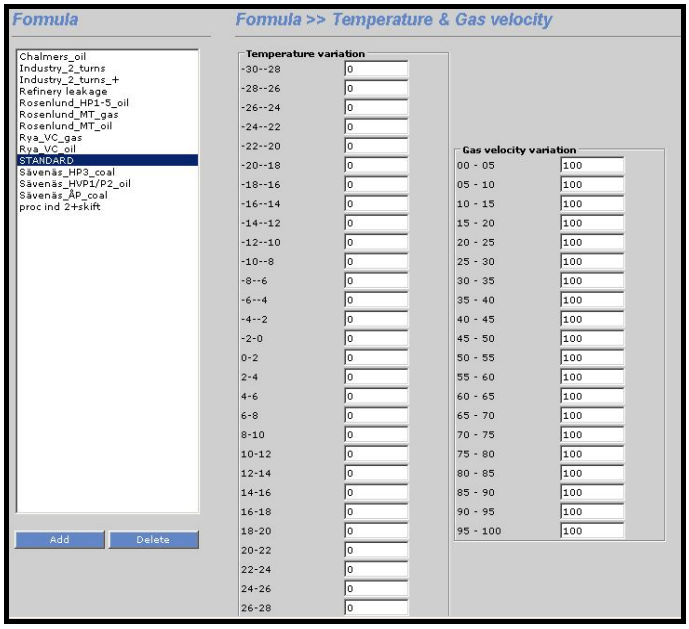
- Click on **OK** to save the temperature information

- Define the exhaust gas velocity by clicking on **Temperature & Gas velocity...**

The **Gas velocity** sub-window will appear and a column with 20 text fields is displayed. In these text fields you can describe the *relative variation* of exhaust gas velocity as a function of the production rate. Maximum gas velocity has to be given as static information when you define the point source (see *3.3.4 Static Emission Information* and *3.3.6 Emission Simulation from a Point Source*). The information on exhaust gas velocity is important in order to compute the so called plume lift. In large power plants the exhaust velocity from the stacks can vary substantially depending on the production rate. This is further explained in *3.3.7 Introducing a Point Source Based on Knowledge About the Emission Process.*

Note: This table is active **only** when the emission from the source is specified as a fuel.

- Click on **OK** to save the gas velocity information



Exercise 3.3.3.1

Create a formula named **industry_2shift** where there is a constant emission during working days between 6 a.m. and 10 p.m., and no emission at all during other times of the day (or during weekends). The industry is completely closed in July.

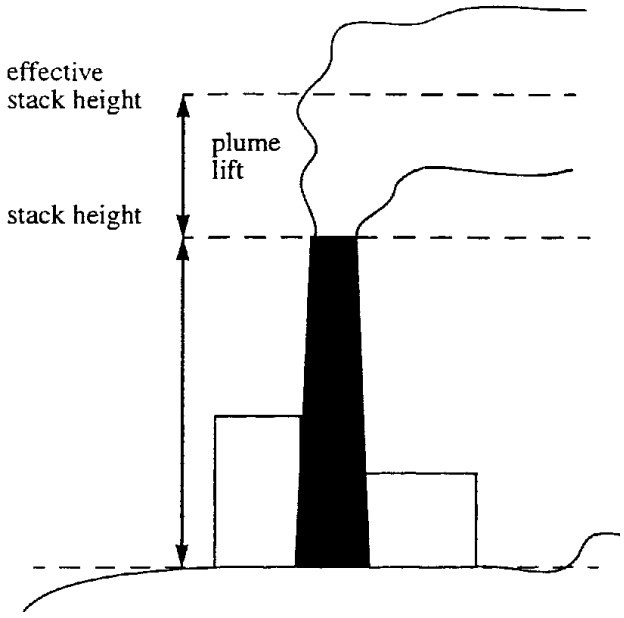
3.3.4 Static Emission Information

There are important emission characteristics that do not affect the emission strength, but must be known in order to utilise the emission information in a dispersion model so that the effect of emissions in the ambient air can be determined.

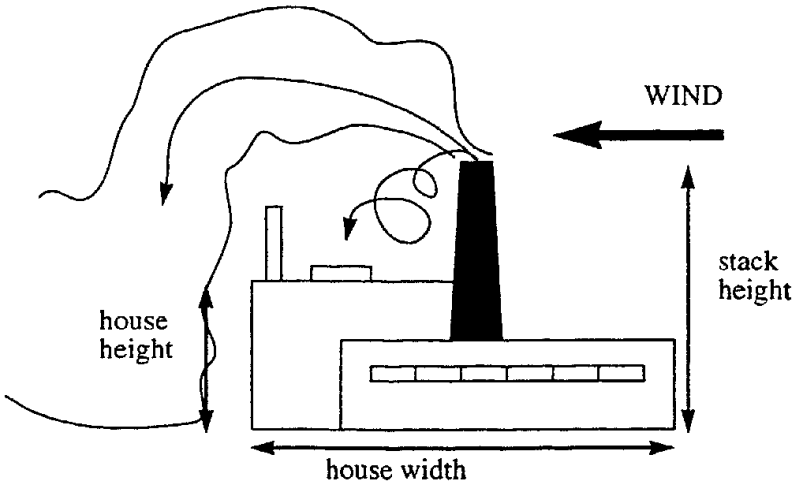
The static information is defined as:

- **Chimney height**. It is important to know the release height when we apply a dispersion model. Generally speaking: the higher the stack is, the lower pollutant concentration on the ground close to the stack.
- **Inner diameter** of chimney and **Exhaust gas velocity** are used to compute the vertical displacement of the pollutants before the horizontal wind and turbulence transports the pollutants and mixes them down to lower levels. We use these figures to compute the so called *effective stack height.*

It is also important to know the **Exhaust gas temperature** when we want to determine the *effective stack height*. If the gas is considerably warmer than the surrounding air, then the buoyancy effect will create a large plume lift.



The **Outer diameter** of the stack as well as large buildings in the vicinity affect the wind flow close to the stack and consequently the dispersion pattern. In some cases a considerable down draught can occur creating high concentrations of pollutants on the ground close to the source.



Buildings can create an effect if the stack is less than 2.5 times as high as the buildings. You should give the dimensions of the largest nearby building as this will have the greatest influence.

Note: The static information is not necessary in order to simulate emissions in the EDB but it is vital if you want to simulate the air quality effects using the Gauss or Grid model in the Dispersion module. Therefore we recommend that you always document the static information as soon as you add a point source to the EDB.

3.3.5 Specifying a Point Source Based on Yearly Total Emission

You are now ready to introduce the first point source in the EDB. The first example is based on a typical situation from real life. You have asked Mr. John Smith, the environmental manager of a medium size company (a cement factory) about the emissions of NO_x.

He has given you the total emission during the year and indicated the periods during which the factory is closed. Additional information about stack height, exhaust temperature, etc. has been given and the information can be summarised as follows:

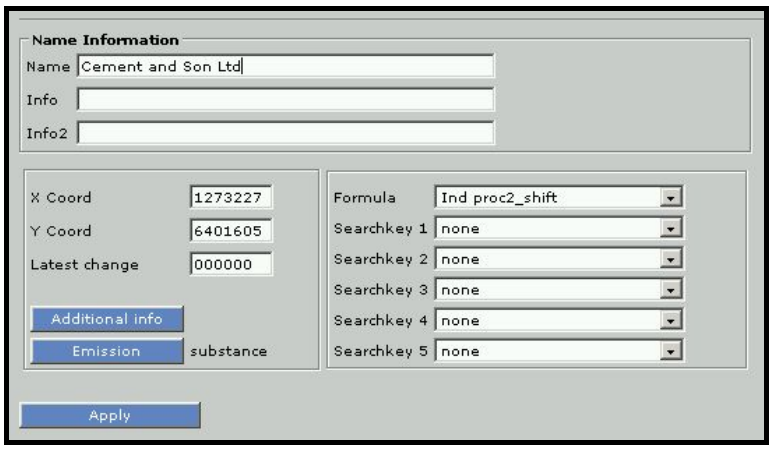
Company name: Cement and Son Ltd.
Total yearly emission of NO_x: 600 tons
Stack height: 45 m, outer diameter: 2 m, inner diameter: 1 m.
Stack mounted on a building of dimension 50*40 m[1] and height 32 m.
Exhaust gas temperature: 12°C, velocity: 8 m/s
Production on working days (Monday-Friday) between 6 a.m. and 10 p.m. Closed in July.

1. The house width should be calculated as $\sqrt{length \times width}$

Mr. John Smith estimates that the production will increase by about 10% per year until the year 2000.

How to Specify your First Point Source in the EDB

Click on **Source** on the left-hand side, in the EDB main window and then **Select on the map**. A hair cross will appear when you move the mouse pointer over the map area and the computer waits for you to select an area. Press the right mouse button to enter the **Point** sub-window without having to select a sub-area.



Note that it is only necessary to select a sub-area if you want to edit an existing point source or if you want to copy information from an existing source to a new source. To select an area, hold down the left mouse button and drag it over the area you want to choose, then release it.

The **Point** sub-window appears, and in the list box to the left all existing sources in the selected area are shown. In this case, working with the personal EDB: **My_first_EDB**, there should not be any existing sources.

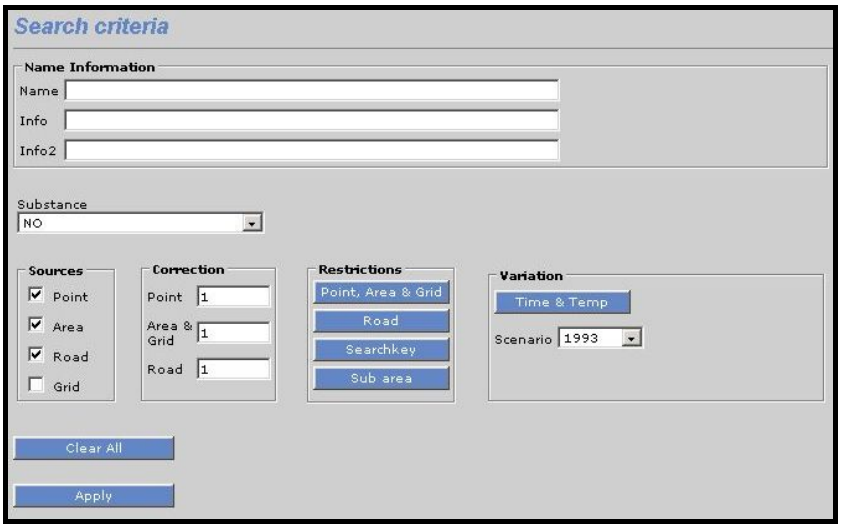
Click on **Add** and the hair cross appears in the map area. Select the desired location of the source by positioning the hair cross and clicking on the left mouse button. The **Point** sub-window appears again and you can start to fill in information.

- Start to fill in the name of the company in the upper text field **Name**
- Continue to fill in the **Additional Information** and
- If you want to change the location of the source on **X Coord and Y Coord**
- Select the proper **Formula** by clicking on **industry_2shift**
- Fill in the **Emission.** The **point emission** sub-window appears. Select NO_x from the list box and fill in the total yearly emission (tons/year) in the relevant text field. Confirm by clicking on **OK**.
- All information except **Search keys** and the **Info1** and **Info2** string (we will introduce them later on in *3.3.8 Using Search Keys and Pattern Matching Facilities as Search Conditions*) has been given, so save the information by clicking on **Apply**.

3.3.6 Emission Simulation from a Point Source

We can use the first point source to perform an emission simulation. Emission simulations are performed using the **Search criteria** sub-window. Searching is carried out over the map area that you see on the screen, so that if you have zoomed into a sub-area then only that sub-area will be searched.

Click on **Search Criteria** on the left-hand side, in the EDB main window. The **Search criteria** sub-window will appear on the screen.



In the **Search Criteria** sub-window the following panels exist:

- **Name Information:** In the three text fields **Name, Info** and **Info2** you have the possibility to write the characters you want to match when searching for sources in the Edb. If you write **Cement and Son Ltd**. in the **Name** text field then the sources with exactly that name will be found, and no other sources. There is the possibility to use so called ”wild cards” in connection with the strings. For example: If you write **Cem*** then all sources with a name starting with Cem will be selected. For further information see *3.3.8 Using Search Keys and Pattern Matching Facilities as Search Conditions.*
- **Sources**: You can select any combination of point, area and road sources. For example, check the box only **Point** and **Area** sources will be included in the search.
- **Substance**: You must select a substance from the substance list.
- **Correction:** this consists of three choices: **Correction** give you the possibility to multiply the emission from point, area and road sources with an arbitrary factor.
- **Variation**: **Scenario** allows you to change to a different scenario. If you select **Time & temp** the **Time and Temp** sub-window will appear. You can give selection constraints concerning time such as: Month, Day type, Hour and Temperature.

This gives you the possibility to compare emissions such as the emissions during rush hour on Mondays in September with daily emissions on Saturdays in June. The **Temperature** gives you the possibility to prescribe the outdoor temperature or the frequencies of outdoor temperature. Instead you can activate the **Dependent on time** option, in which case a temperature distribution based on the time restrictions that you have made will be automatically included (this option however must have been predefined in your system otherwise you cannot activate it).

- **Restrictions** consists of four sub-windows.
  1. **Point, Area & Grid** restrictions give you the possibility to select point/area/grid sources that are defined with a specific **Substance group, Fuel** and/or **Formula**. Defined restrictions are applied simultaneously (using Boolean AND criteria). A maximum of 10 selections can be made in each list.

  2. **Road** restrictions give you the possibility to select line sources (traffic roads) that are based on a specific **Road type**, **Vehicle** type and typical **Speed** on the road (see *3.6 Traffic Emissions in the EDB*). A maximum of 10 selections can be made in each list.

  3. **Search key** restrictions give you the possibility to estimate emissions from sources that have been given specific search key (see *3.3.8 Using Search Keys and Pattern Matching Facilities as Search Conditions*). An unlimited combination of search keys can be made.

  4. **Sub area** restrictions allow you to define a geographical area in which to perform the search for emission sources.

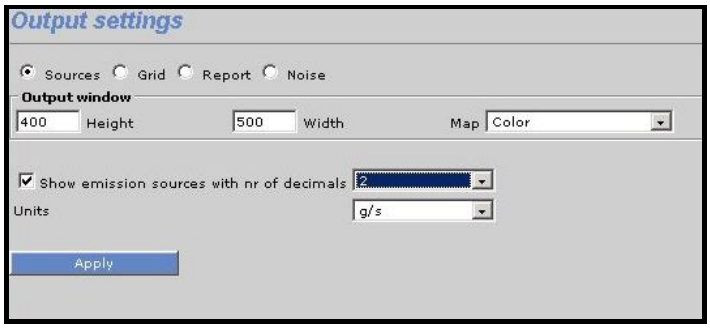
- **Output Setting** emission rates are usually expressed as grams per second (g/s) unless you are able to specify some other units. There are three different output functions:

  1. **Normal** output means that all sources that fulfil the search criteria will be displayed on the map (on the screen), both location and emission strength. You can use the option *Show emission sources with nr of decimals*. A maximum of 8 decimals can be select in each list.

  2. **Grid** output means that you can define a grid with a user-defined resolution over the map or a sub-area within the map. The total emission in each grid cell will be displayed using graded colours. You define the grid resolution, colours, etc.

  3. **Report** is the EDB Report Generator. Here you can define several types of reports to display information from the EDB. The Report Generator is described in *3.9 Creating EDB Reports.*

4. **Noise** is a characteristic of the road sources. It will be visible only in the personal Edb that has the noise linked to a road source. Communicate with the Administration to enter the parameters that describe the noise in the EDB.



Along the bottom of the window is one push buttons:

- **Apply:** save all settings and select option on Output on the main menu

Along the option of the windows:

- **Map:** the list box where select the map between colour map and black and white map.
- **Output windows**: select the size – height and width- the Output sub-windows.

Example

Make the following selection in the **Search Criteria** sub-window:

Search strings:	Name: Cem*				
Substance:	NOx				
Sources:	Point				
Restrictions:	-				
Variation: Time & temp:	Scenario: 1993	Month: all	Day type: all	Hours : all	Temperature: not used
Variation: Corr. Factors	Point: 1	Area: 1	Road: 1		
Output:	Normal	No of decimals: 0			

Click on **Apply** for settings saved, and then select GIF Output. The position of the source Cement and Son Ltd. will be displayed and the emission estimation is 19 g/s. That is exactly what will be emitted as an average during the period you have selected. If you instead ask for the figure expressed as tons/year, you will be given the answer 600 tons, i.e. the yearly emission figure that you gave when the source was defined.

Click on **Search Criteria** and change the time constraint to:

Variation:Time & temp:	Scenario: 1993	Month:all but July	Day type: Mon-Fri	Hours: 6-22	Temperature: not used

i.e. the production period at the factory. Then the estimated emissions will be 43.6g/s. This is the mean emission rate coming from the stack during production time. The yearly emission equivalent would represent what the total emission would be during a year if the factory were running all hours and days during the year with that emission rate.

Note: is recommend setting the output before select the type output (gif, pdf or text) the your search.

Exercise 3.3.6.1

Simulate the mean emission for Fridays during the period May-September. The answer should be 23.3 g/s.

Simulate the yearly mean emission at the year 2000 (Hint: use the correction factors). The answer should be 20.9 g/s, which is 660 tons per year - exactly a 10% increase on the present mean emission.

Note: When converting between g/s and tons/year it is assumed that there are 365.25 days in a year.

3.3.7 Introducing a Point Source Based on Knowledge About the Emission Process

In many cases you will not gain information about the total emission during a year, but information about the process that causes the emission.

To incorporate all the information we know about such a source we have to work through the following steps:

1. Create a formula describing the time and temperature variation of the source

2. Create a fuel type specifying the energy value and the emission either as grams per mega-joule or as a percentage of the fuel weight.

3. Create a point source linked to the formula and fuel type and specifying the maximum effect of the process.

The following example shows typical information given from a fossil-fuelled power station used for district heating.

Heat production for hot water consumption at night time (10 p.m. - 6 a.m.): 10 MW

Heat production for hot water consumption at day time (6 a.m. - 10 p.m.): 20 MW

Heat consumption as a function of the outdoor temperature:

Outdoor temperature	20°	15°	10°	5°	0°	-5°	-10°
Heat consumption	0 MW	20 MW	40 MW	60 MW	80 MW	100 MW	120 MW

Maximum effect of the boiler: 100 MW

Type of fuel: Oil (43 MJ/kg)

SO_2 content: 0.2%

NO_x production in the process: 0.1 g/MJ

Stack height: 85 m, outer diameter: 2 m, inner diameter: 1 m.

Stack mounted on a building of dimensions 50*40 m and height 32 m.

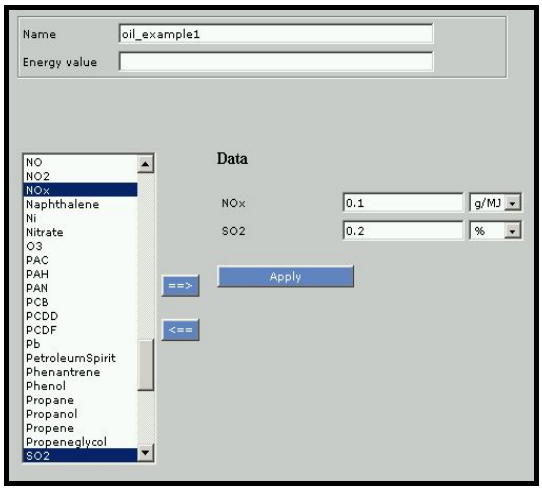
Exhaust gas temperature: 120 °C, velocity: 15 m/s

If we analyse this information we find that the heat consumption including the hot water will exceed the capacity of the boiler at lower temperatures than 0° during daytime and roughly -2° in the night time. Obviously the energy company must supply energy from an additional production unit when the consumption exceeds the maximum capacity of the boiler above. If we had been given information about the additional capacity of production (and emission), we would have been able to include this information. However, in this case we are explicitly interested in describing the emission from one specific boiler as we want to focus on the possibility of simulating the emissions in a realistic way, i.e. so that differences between day and night time, temperature dependency and maximum emission are properly described.

In order to introduce the information in the EDB we start to define a **Formula** named **oil_boiler** in the same way as in *Exercise 3.3.3.1.* The relative figures in the monthly, daily, and temperature tables have to be defined as *relative to the maximum production rate*. Consequently, in the **Day type** table you should write 10 (%) during nights and 20 (%) during daytime for all day types. In the **Temperature** table, you should convert the heat consumption figures to percentage figures (actual heat consumption/maximum heat production). No specific information has been given regarding monthly or yearly variation. Consequently, we write 100% in the **Month** and **Scenario** tables.

After you have saved the formula you have to define a **Fuel**. Within this database you can define the emission as a function of a burning process and a fuel involved in that process.

- Click on **Fuels (**on the **Subtables -** on the left hand side in the EDB main menu**).** The **Fuel** sub-window will appear.



- Click on **Add** and type the name oil_example1 in the Name text field
- Write the name, select substances and write the emission.
  - **...** and fill in the NO_x value 0.1 g/MJ
  - **...** and fill in the SO_2 value 0.2%
- Save the settings with **Apply**.

The next step is to define the source:

- Click on **Sources** The **Point** sub-window will appear. Select on the map the location. Click on **Add.** Type the Name of the source (oil boiler) and fill in the **Additional info**. Select the **Formula** oil_boiler.
- Click on the **Emission** and choose **Fuel**. The **Fuel** sub-window will appear. Select the fuel: oil_example1 and type the maximum production effect (100 MW) in the text field. Click **OK**.
- Save the point source information.

The emission from this source can now be calculated in the following way:

1.For NO_x (which is emitted in g/MJ) the emission formula is

Total Emission [g/s] = f_a x MaxEffect[MJ/s] x 1000 x RelativeEmission[g/MJ]

2.For SO_2 (which is emitted in % weight) the emission formula is

$$TotalEmission[g/s] = f_b \times \frac{MaxEffect[MJ/s]}{EnergyValue[MJ/kg]} \times 1000 \times \mathrm{Re}lativeEmission[\%]$$

where f_a and f_b are factors created from the scenario, month, day type, temperature and gas velocity tables. The factor of 1000 in the second equation is to convert the result from kg/s to g/s.

To check the emission figures we return to the **Search Criteria** sub-window and make the following settings:

Search strings:	Name: oil*				
Substance:	Nox				
Sources:	Point				
Restrictions:	-				
Variation: Time & temp:	Scenario:1993	Month: all	Day type: all	Hours: all	Temperature: Yearly mean
Correction	Point: 1	Area&Grid: 1	Road: 1		

And select Normal and No. of decimals1 on the **Output Setting** sub-windows

For NO_x the mean annual emission is 216.8 tons/year.

For SO_2 the mean annual emission is 100.8 tons/year.

Exercise 3.3.7.1

Manually change the temperature settings, specify the hour of the day, and simulate the emissions for the following cases (you can search for a certain temperature interval by specifying 100% for that interval and 0% for all other values):

Outdoor Temperature	20°	15°	11°	5°	1°	-1°	-3°	-5°	-10°
Emission NO_x at 12 o'clock	1.02	1.86							
Emission SO_2 at 12 o'clock									

Fill in the table.

3.3.8 Using Search Keys and Pattern Matching Facilities as Search Conditions

The Search Keys

All emission sources in the Edb can be classified using five groups of search keys. In the first two groups there are 128 individual search keys and in the last three there are 32 in each group. The benefits of the search keys are obvious by looking at some examples:

Assume that you have a large number of districts (municipalities) included in your territory. Utilise the first group of search keys by defining all districts by name in the first search key list (choose **Basic Setting** on the frame and **Search key 1**). In the second search key list you may group different activities that contribute to pollution, such as **Petrochemical industry, Automotive industry, Traffic, Lawn mowers**, etc. In the third search key list you can categorise your emitters into classes such as: **Private industry, State owned industry, Public sector, Private consumption**, etc. In the forth you may categorise the area in which the emitter is located, such as: **rural, sub-urban, residential, inner city**, etc.

Later on when you want to estimate the total emission from lawn mowers in a certain district in the residential areas you can have your answers very quickly. If, before filling the emission database with figures and formulas, you analyse your future needs concerning emission estimation, you will find that the search keys can play an important role, giving you a convenient emission database handler.

You will benefit from constructing and utilising good search key lists. They provide a very efficient way of searching in the database for certain groups of pollution sources. You can search using unlimited combinations of search keys from the different search key lists.

The Search Strings

The **Search strings** (**Name, Info1** and **Info2**) that can be given for all sources can be extremely valuable as a complement to search keys. The first string (**Name**) consist of 47 characters. It is the intention that you should include the name of the source in this string (such as **Oxford street** or **Shell**, etc.). In addition you are free to fill the whole string with characters and numbers that can be valuable to classify the source in a convenient way. As an example you can provide a national identification code, property code, etc. If you provide unique characters as separator between the information, it will be easy (as

demonstrated in next paragraph) to use matching facilities when searching for emissions in subsets of the database.

The two extra strings **Info1** and **Info2** consist of 47 characters and can be used in the same way as **Name**.

Matching Search Keys

When simulating emissions in the **Search Criteria** sub-window you can apply restrictions to your search in the database by clicking on **Search key**. In this sub-window you are free to choose search key definitions in all five search key groups. You can select several search keys in each group.

If you have chosen more than one search key in a group, all sources belonging to any key in the selected subset will be extracted from the database (*or-criteria*). If you have chosen combinations in two search key groups, then sources belonging to any key in the selected subset in the first group and any key in the selected subset in the second group will be extracted from the database. Between groups we have an *and-criteria*.

For example: Suppose you have selected **district1, district2** and **district3** in the first search key group, and **Lawn mowers** and **traffic** in the second, but no selection in the next three groups. The following sources will then be extracted from the database:

Sources with 5 search key definitions such as:

a) District1,Lawn mowers, Private consumption, Resident, Green

b) District2,Lawn mowers,-,-,-

c) District3,Traffic,-,-,Yellow

The following sources will **not** be extracted from the database:

d) District1,Petrochemical industry, Private industry, Sub-urban, Black

e) -,-,-,-,Brown

f) District3,-,-,-,-

The - indicates that no search key definition has been made.

Matching Search Strings

In the **Search** sub-window, you are free to select a specific source by defining the **Search** strings so they match a specific source. But if you want to match all the sources that have some characters or numbers in common in the search string definition you can apply the following pattern matching possibilities:

A*	All strings beginning with an A (capital letter)

*street	All strings ending with street
street	All strings that contain the word street
street|*avenue*	All strings containing the word street or avenue
?A*	All strings in which the second letter is an A
[Aa]*	All strings that begin with an A or an a
[A-F]*	All strings that begin with capital letters between A and F
^K*	All strings that do not begin with an K
*[^h-k]	All strings that do not end with small letters between h and k

Examining the matching capabilities, you will realise that a carefully prepared strategy concerning search string definitions will allow the user to have unlimited possibilities of selection criteria.

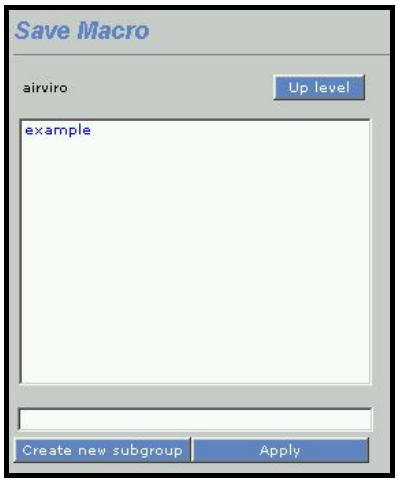
Note: When filling in the name and information strings for a source, you should not use the reserved characters |, *, ^, $, ., [,], {, }, ?.

3.3.9 Saving your search criteria

When you have defined all search criteria for your project database, you may save the query as an Edb search macro. The Edb search macro saves all settings in the **Macros** frames so they can be used at a later stage either in the Edb. You can Load, Save and Delete Macros.

It is very simple to save your search settings:

- On the left-hand menu, choose **Macro**
- Choose **Save**
- Select your username from the list
- Enter a unique and meaningful name for your settings
- Click **Apply.**



It is recommended that you save your search criteria with a meaningful filename so that you can easily recognise the content.
Macros are stored in groups, where there is a group for each user in a domain, a common group and some other groups. Users can always save macros in their own group, but usually not in other groups, although it is
possible to load macros from other groups.
If your username doesn't exist in the macro group list, you can create it, or some other subgroup by clicking **Create new subgroup**.
If the default macro exists under your username group, it will be used, otherwise the default macro stored under **[Common]** will be used.

You can have your settings back at any later time:

- On the left-hand menu, choose **Macro**
- Choose **Load**
- Select a group and select a macro name from the list
- Click **Apply.**

3.4 Area Sources in the EDB

3.4.1 What is an Area Source?

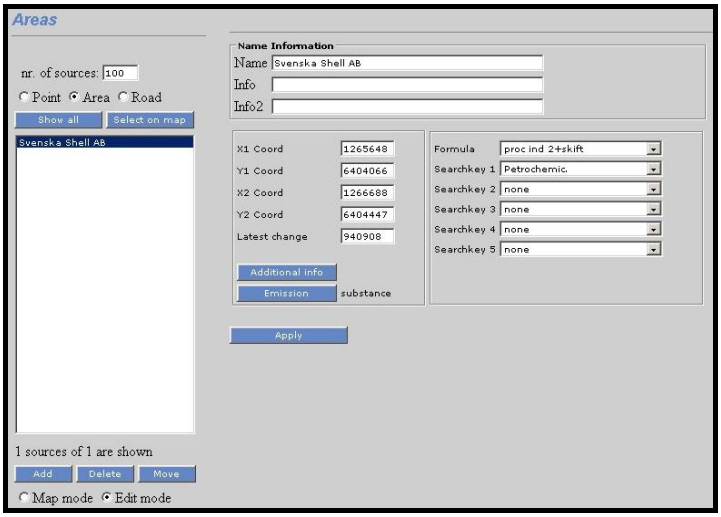
An area source is a pollutant source that is widely spread over an area. The leakage from pipes, valves and tanks at a refinery is a typical example of an area source. Usually we don't know exactly the locations of emission, so we treat the whole area as a source and assume that the emission is evenly distributed.

The static information that is used for point sources is not included in the area sources. In the representation of the area source, the map is divided up into grid squares, and the emission in each square is calculated. This reduces simulation time so that it can happen that an area source simulation runs quicker than a point source simulation, if there are many small point sources. In a simulation, the area source emission will take place 2 m above the ground and there is no emission velocity.

3.4.2 General Principles

In the Edb you can mark the source area as a rectangle. To include an area source in the Edb is very similar to the inclusion of a point source, but instead of clicking on a point you mark an area by dragging the mouse.

The general principles are the same as for point sources. You can use **Formulae, Fuel**, etc. in the same way as for point sources.



3.5 Grid Layers in the EDB

3.5.1 What is a Grid Layer?

A grid layer in the Edb is a collection area sources spread over a large area. These sources are grouped into a grid layer. A typical example is household heating: is it often possible to estimate the amount of fuel that is consumed in each area of a city. From this information is it possible to create a grid of emission sources.

For each grid layer the information that is common for all grid cells is stored only once. Only the information that might be different is stored for each grid cell. The emission from each grid cell is always stored.

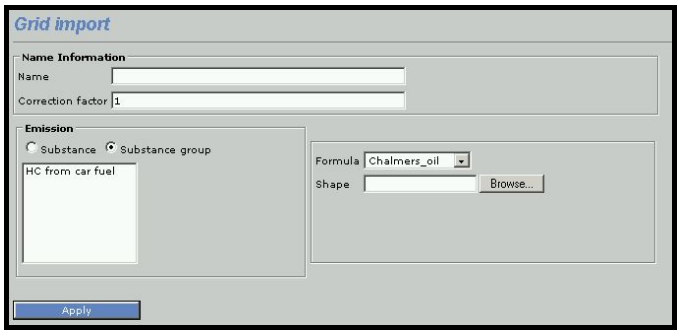
It is of course possible to store the emission sources in the grid as area sources instead but the grid layer solution has some advantages compared to the area sources:

- Increased computation speed.
- The need of disc space will decrease, often quite dramatically.
- The import format for grid sources is simpler than the format for area sources.

3.5.2 General Principles

A grid layer can only be created with the grid ASCII interface. The geographical information about the grid, the data that is specific for each grid cell and the common information is used as input at creation time.

The menus for the grid layers are exactly the same as for area sources but only the common information of the grid layer can be altered. The interfaces for the grid cell specific data will be dimmed. Another difference is that the emission from a grid layer must be specified as substances or substance groups.



3.6 Traffic Emissions in the EDB

3.6.1 What is a Road source?

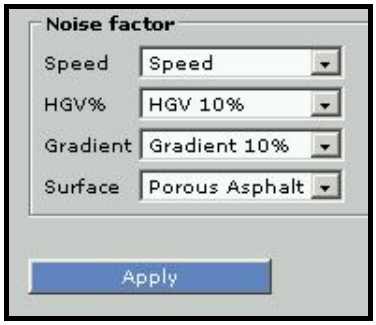
A road source is a mathematical idealisation that does not exist in reality. When we talk about road sources we generally mean emission from road traffic. Every car moving on the road is more or less a point source, although we can never locate or follow any individual car. For the Edb user it is quite convenient to define the road traffic (or maybe shipping route traffic, etc.) by drawing a line on the map.

In urban areas, the dominant part of the air pollution can be derived from road traffic emissions. Consequently, the quality of the work concerning traffic emission data is the most crucial part in the construction of an Edb. However, the number of roads and cars in a large city are so numerous that we need to simplify the handling of the data. Below you will find a description of the principles of the Airviro traffic emission data processing. The method described can be refined but is still very efficient in terms of manpower needed to set up a traffic emission database for a large urban region.

3.6.2 General Principles

You can, in an interactive way, define the positions of a road graphically on the map/screen. When the position of the road is fixed, you have to give information on noise, traffic speed, traffic intensity and variation as well as information on the types and proportions of vehicles operating on that road.

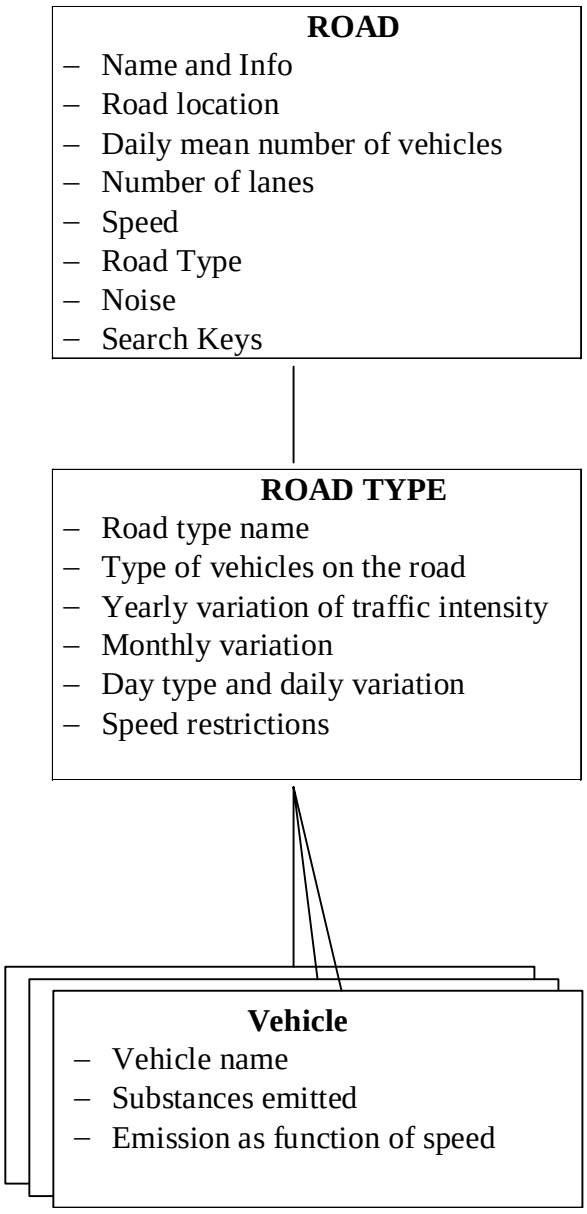
The noise is a characteristic of the each road. The example of the figure is a configuration type for the noise. The noise can be described himself with the following parameters:



- Speed: circulation speed average
- HGV%: heavy vehicle percentage that circulates for the road
- Gradiente: slope of the road
- Surface: surface type, i.e. asphalt

Note: the parameters that describe the noise are a characteristic of each Personal Edb. Communicate with the system administrator to enter them in the EDB.

The traffic behaviour is likely to be similar on several roads. Consequently, the traffic variation as well as proportions of different vehicles on a road can be defined in groups of Road types.



The typical number of Road types that you will have to define is likely to be 10-25 depending on the complexity of the area. Instead of defining all traffic variation characteristics on each road, you simplify the work by addressing the information to be found in the **Road type** database.

The emission factors from different vehicles are found in the **Vehicle** database. The emission factors in the **Vehicle** database are referred in the **Road type** definitions in the **Road type** database. To be able to simulate traffic emissions it is likely that you have to define 5-25 different emission tables in the **Vehicle** database.

The typical amount of traffic information that you have to supply in order to describe the traffic emissions in a large city is:

Roads: 500-1000 roads or road links

Road types: 10-25 different road types

Vehicles: 5-25 tables with emission factors from different vehicles.

3.6.3 Introducing Emission Factors for Vehicles

Emission from vehicles is mainly dependant on:

- The type of vehicle, classified depending on the engine type, fuel used, weight class, etc.
- The driving behaviour and the general traffic environment.
- The speed the vehicle is travelling at.

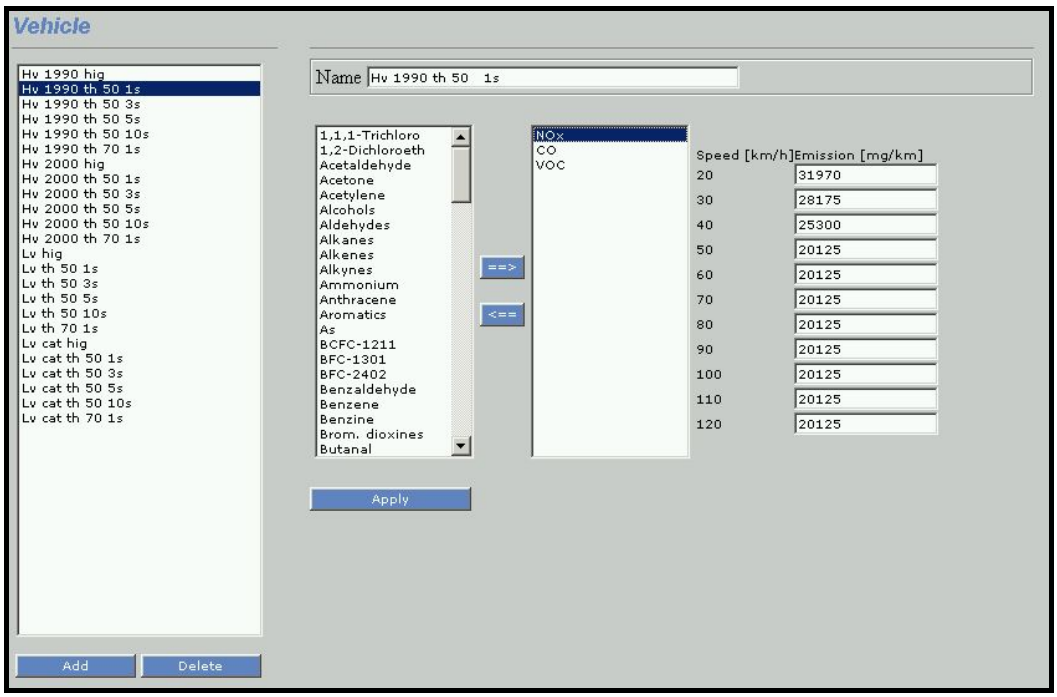
In many countries, emission factors have been derived based on the factors above. You are able to include these in the Edb. A set of emission factors are included in the **Vehicle** database in the Airviro Reference database. The emission factors are basically derived as functions of:

- **Substance** NO_x, CO and total HC
- **Speed** 0-120 km/hour
- **Type of vehicle** Light vehicles and Heavy vehicles (>3.5 ton)

To include the driving pattern, separate emission factors are given in various traffic situations. Consequently, vehicles that are driving in the centre of a city tend to accelerate and slow down more than vehicles on a highway. The name: **Lv cat tho 50 10s** represents the emission factors for light vehicles (**lv**) equipped with catalytic converters (**cat**), driving on a through-road (**tho**), signed maximum speed: 50 km/hour (**50**), and the vehicles have to make 10 stops or turns/km (**10s**).

The way in which it has been chosen to structure the road types and vehicle types is based on a Swedish model, the VETO model, and this model is used here as a typical example. Other models exist that are not quite the same but you should be able to adapt the Edb to these other traffic models when you define road types and vehicle types. You may also want to refine your traffic Edb by introducing other important processes, e.g. defining vehicles with higher emission due to low temperatures in the combustion process (cold start), etc.

If you choose **Vehicle** in the **Subtables** frames (on the left-hand side, in the EDB main window) the **Vehicle** sub-window will appear.



In the left list box you can see all the different emission factors that are given in the Reference database. If you would like to define a new vehicle type and the corresponding emission factors, you simply click on **Add** in the lower left corner. To edit an existing vehicle, click on the proper vehicle in the left list box. If it is a new vehicle, you have to name it by typing it in the upper right text field. You can define or add a substance by clicking in the list.

To edit or add the emission factors as a function of the vehicle speed, click on contaminants and the speed/emission sub-window will appear. This sub-window consists of a list box on the left hand side, in which you can see the substances which are defined to be emitted from the vehicle type. The **Speed table** to the right, is disabled until you have clicked on a specific substance. As soon as you have chosen a substance the **Speed table** will be enabled and you can add or edit the emission factors as a function of the vehicle speed.

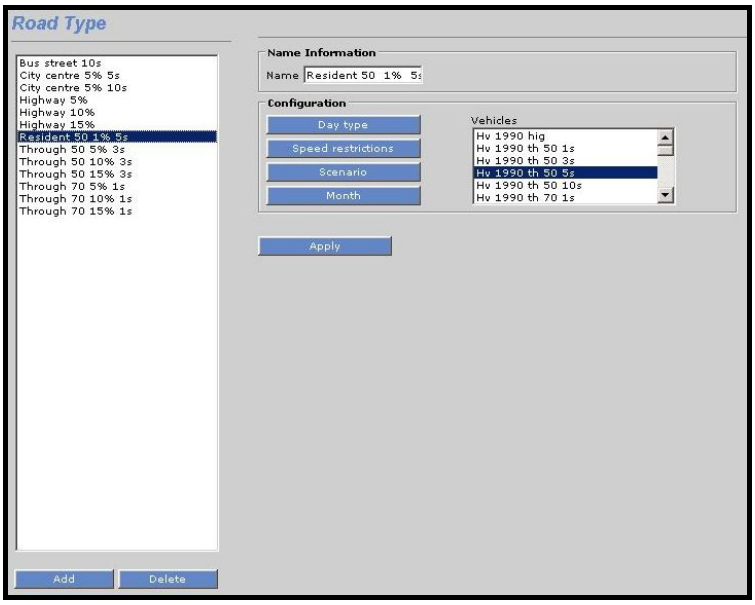
In the example shown the vehicle **Hv 1990 tho 50 1s** and substance nitrogen oxides (NO_x) have been chosen. A table of emissions as a function of speed will appear as illustrated in the figure. You can edit the table and save your modified emissions by clicking on **Apply**.

3.6.4 Naming Standard for Emission Factors

There are several reasons why you should name your different emission factors in a structured way. As soon as you start to work with the **Road types**, you will recognise an obvious reason to have a corresponding name convention in order to link different emission factors to the corresponding **Road types**. In the model used in the Airviro Reference database, the name of the emission factors is defined by the characteristics: vehicle type and traffic environment, i.e. the emission factors are constructed in the following way:

Example	Type of Vehicle	Vehicle subset	Type of Road	Signed maximum speed	Number of stops/turns per km
Lv cat hig	Light vehicle	Catalytic converter	Highway	90	0
Hv 1990 tho 70 1s	Heavy vehicle	Old type	Through road	70	1
Lv tho 50 10s	Light vehicle	No catalytic converter	Through road (city street)	50	10

3.6.5 Introducing Road Types



To be able to simulate the emissions at a specific hour caused by the traffic, we need to know the typical traffic variation on the streets and roads. However, from a practical point of view, it is not possible to define the traffic time variation separately for every road and street in an urban region. In the EDB it is assumed that typical traffic behaviour can be categorised in classes. These classes are called Road types and consist of:

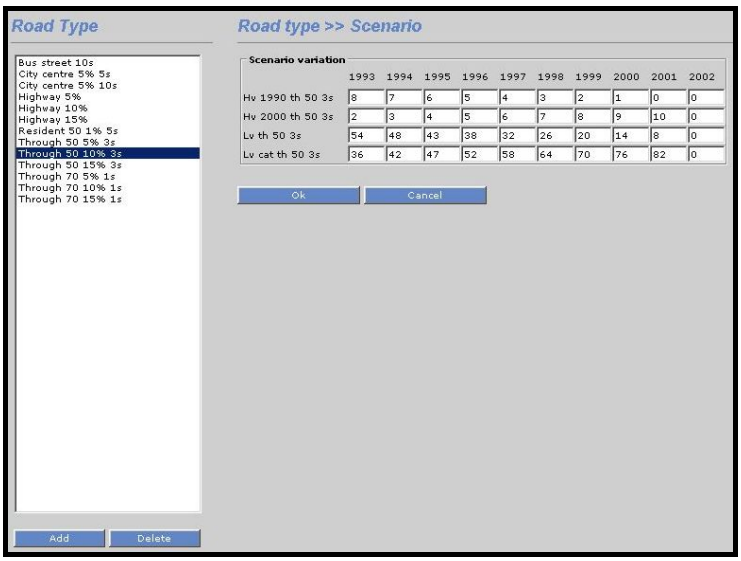
- Proportions of different vehicle types on the road
- Yearly index (expected increase or decrease of traffic in the future)
- Monthly variation
- Daily variation (within 4 different day types)
- Hourly variation
- Speed restrictions

In order to define a specific road type, you have to choose **Subtables and Road type** on the left-hand side in the EDB main window. The **Road type** sub-window will appear, and to edit an existing road type you have to click on the one you want in the **Road type** list box to the left. To create a new one, you click on **Add** in the lower left of the sub-window. Name your new road type in the **Name** text field in the upper right corner of the sub-window. The next step is to define the type of vehicles that operates on this road type. Select the proper vehicles in the **Vehicles** list box in the right part of the sub-window. To define the proportions of the vehicles you have to click on **Scenario.**

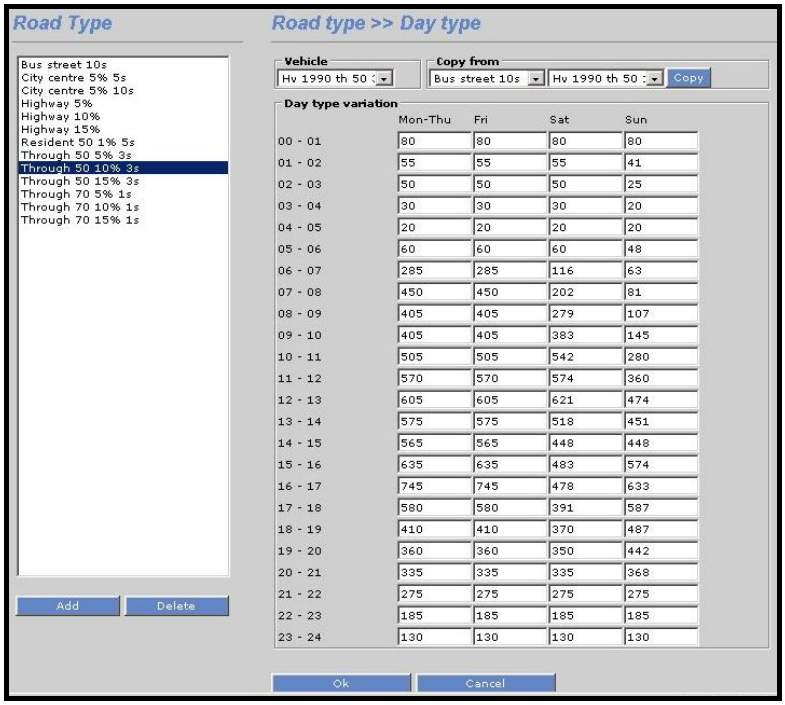
The **Scenario** sub-window appears and you are able to fill in the percentage of the different vehicle types. You can define the expected proportions for up to 10 different years or scenarios. This table is basically the same as the **Scenario** table in the **Formula** database, i.e. the figures will be treated as absolute values (as percentage) *and will later on be multiplied by a daily total number of vehicles on a street*. The scenario figures in the **Road type** definition can be used to forecast future changes in the traffic intensity, vehicle proportions and accordingly the future emissions caused by traffic. Save your figures and leave the sub-window by clicking on **OK**.

Note: If the percentage for a specific scenario sums up to 100, the number 1.00 will be multiplied by the daily total number of vehicles. If the sum had been 120 for a different scenario, then the factor 1.20 will be multiplied by the daily total number of cars on a specific street.

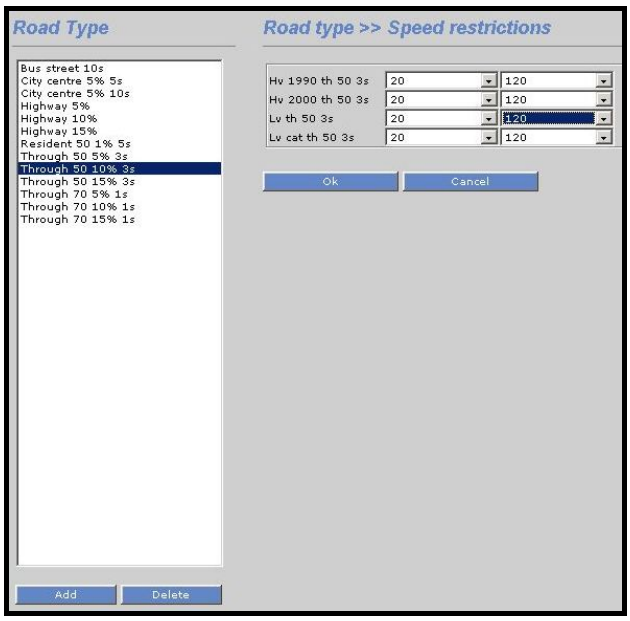
As for the yearly variation, you can define the monthly variations by clicking on **Month**. Notice that this table is similar to the **Scenario&Month** table in the **Formula** database, i.e. all figures are relative and will be normalised before used. Save your monthly variation figures and leave the sub-window by clicking on **OK**.



You can define the hourly traffic variation by clicking on **Day type**. The **Day type** sub-window will appear, and the principles here are similar to the **Day type** table in the **Formula** database. By clicking on one of the existing vehicles on the **Vehicles** list box to the left, you can fill in the hourly traffic variations in the text area. Please note that the figures are relative, i.e. they will be normalised as described in *3.3.3 Dynamic Emission: Formulae for Time Variation and Temperature Effects*. Use the **Copy** button if you want to copy a daily variation from an existing vehicle to the vehicle that you are currently editing. The variation you want to copy can be stored under any of the existing road types. Save your daily figures and leave the sub-window by clicking on **OK**.

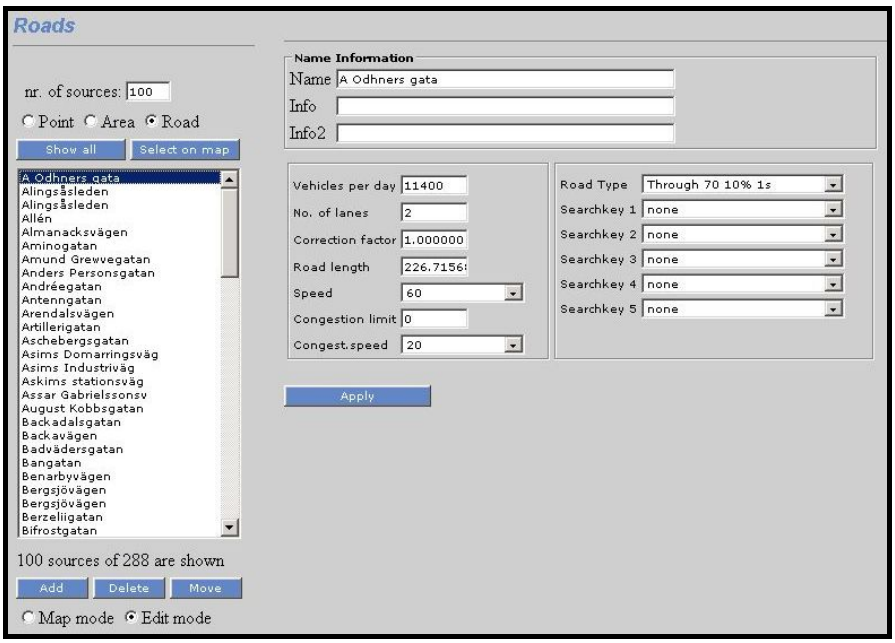


Finally, you can prescribe speed restrictions for the different types of vehicles operating on the Road type. Click on **Speed restrictions** and the **Speed restrictions** sub-window will appear. Click on the desired vehicle in the left list box (Road type). Now you can prescribe a minimum and a maximum speed for that type of vehicle. This feature is very useful if you for instance would like to define differences in speed between heavy and light vehicles. Save your speed restrictions and leave the sub-window by clicking on **OK**.



3.6.6 Introducing Traffic Information in the EDB

After you have created emission factors for different types of vehicles as well as a number of typical road types you are ready to introduce road emissions into the Edb. In the main window, click on **Source** and then **Road**. A hair cross will appear in the map area and the computer waits for you to select an area. To select an area, hold down the left mouse button and drag it over the area that you want to choose, then release it. The sub-window **Road** appears and in the list box to the left all existing roads within the chosen area are displayed. If you click on any of the existing roads the location of it will be displayed on the map. To introduce a new road, click on **Add** in the lower left corner. The sub-window disappears and a hair cross appears on the map. Position the hair cross on the map at the start of your new road. Click on the left mouse button. Move the hair cross to the next position of your road. Double click on the left mouse button for a line, to conclude with the left. A rubber band will be stretched between the last position and the hair cross. Find your new position and click on the left mouse button. Continue in this way until you have defined the whole road extension.



Now you have to fill in the characteristics of the road. Start with the road name in the **Name** text field, and a code definition in the **Info** text field. The next step is to fill in the traffic information. Fill in the total number of **Vehicles per day** (this should be the yearly mean traffic for a day). Also enter **Number of lanes** (in total), although this field is currently not used. You may also give a **Correction factor**, by which the **Vehicles per day** is always multiplied. This should be 1 if you do not want any correction effects.

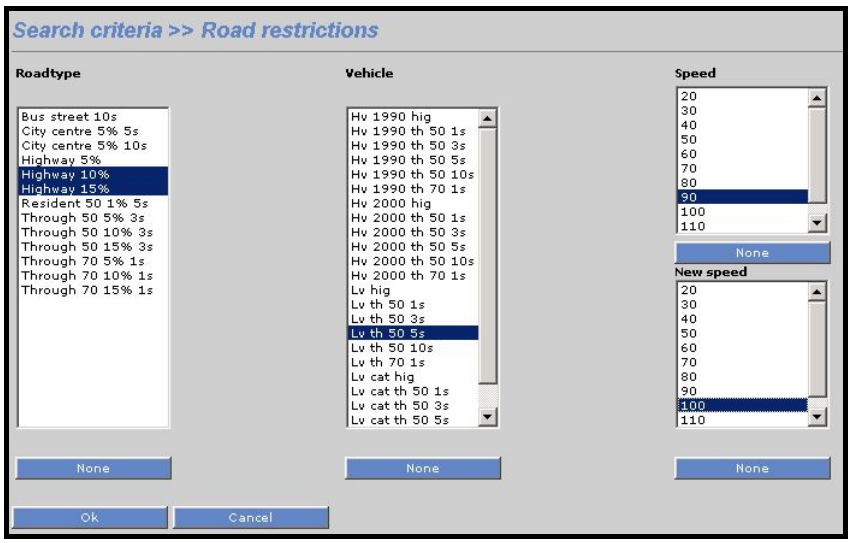
Two parameters characterize the congestion of the traffic, limits and congestion speed .

Select a proper road type from the **Road type** list box in the lower right corner. Finally, define the typical speed on the road and select suitable search keys. For this model you should give the average speed of the traffic on the road. Save your road definition by clicking on **Apply**.

3.6.7 Emission Simulation with Road Sources and Restrictions

Simulation of emissions based on road sources is identical to point sources as described in *3.3.6 Emission Simulation from a Point Source*. However, there are certain features unique for the road emission as can be seen in the **Search Criteria** sub-window.

If you want to simulate road emissions exclusively, you have to check only the box **Road**. Restrictions that are specific for road emissions can be seen by clicking on **Road.**



You are free to select up to 10 **Road type** restrictions as well as up to 10 **Vehicle** types and any number of **Speed**s in the same way and with the same results as selecting amongst the **Search keys** (see *3.3.8 Using Search Keys and Pattern Matching Facilities as Search Conditions*).

In addition you can alter the speed by prescribing a **New Speed**. For example: If you have selected all roads having a signed speed 90 and then select a new speed of 70, then all roads defined as 90-roads will be selected and the emission will be calculated after reducing the speed on the roads to 70.

3.7 Grid Presentation of Emissions

In previous examples, the emissions have been estimated and presented as figures located at each individual source and summed for the entire displayed map area. In several applications, you might be interested to see the spatial distribution of the emissions indicating hot spots. The EDB provides you with the possibility of defining a grid in which all sources located in each grid square are summed and represented with a colour code.

To present emission as a coloured grid you enter the **Search Criteria** sub-window. We recommend that you first of all toggle your map so the background map will be represented in a grey scale.

Choose **Output Setting** on the left-hand side in the EDB main menu and select Map **B/M**. Then, you have to choose **Grid** as **Output**.

Your next step is to define your grid resolution, you are free to decide the resolution of the grid. You can do it in two different ways. If you have toggled for **Grid size**, then you just have to define the grid length in the east-west direction (**dx**) and in the north-south direction (**dy**). The figures are given in the unit metres. Your second choice is to toggle for **Grid size/ Number of cells**. In this case you have to define the numbers of grid squares in the east-west direction (**nX**) and in the north-south direction. The grid size will now be determined depending on the size of the map area that you have chosen. When you have decided what to enter, you save by clicking on **Apply**.

Now define the colour table and the intervals of emissions corresponding to the emissions per area unit. You do that by choosing the **Colour and levels** in the **Output Setting** main menu. You are free to define floating numbers corresponding to the colour intervals and by clicking on the coloured square you will be able to choose the desired colour from a palette. Make your selection as described in *3.3.6 Emission Simulation from a Point Source* or *3.3.7 Introducing a Point Source Based on Knowledge About the Emission Process*. When ready, you click on **Apply**.

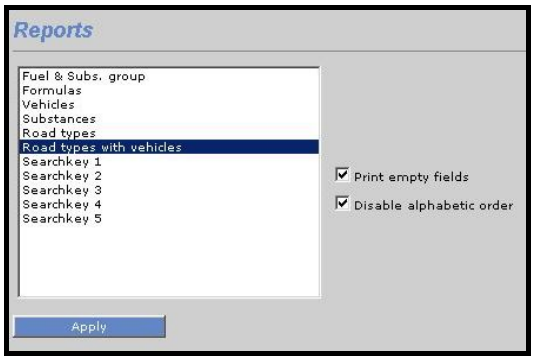
You should now have returned to the **Output** sub-window and execute your choice by clicking on GIF.

The result will be presented as a coloured map, and you can experiment how to get a proper resolution for the purpose you are looking for.

It is worthwhile mentioning that if you define your resolution as 50*50 m and search for road emissions, then you will see a nice road map, presenting the roads in different colours classifying them depending on the traffic emissions.

3.8 Displaying the Database Structures

The EDB is not one single database but a combination of many different databases. For example, in the EDB main window you will have **Subtables**, under which are buttons to access the Fuel, Substance group, Formula, Road type, Vehicle and Reports. It is possible to print out summaries of these sub tables, along with the substance and search key lists.



Choose **Reports** under **Subtables** on the left-hand side in the EDB main menu. The **Reports** sub-window will appear, which is simple to use. First select either **Printer** or **Viewer** under Destination. It is always best to print to a screen viewer first (if you have one) to check that this is really the data that you want. Output can then be sent from the viewer to a printer or file.

Next you have to decide if you want to print empty fields, such as gaps in the substance list, etc. Usually you don't want this. You can also disable the alphabetic sort and print the database in the order that the Edb stores them. Every member of a database is given a number by the Edb.

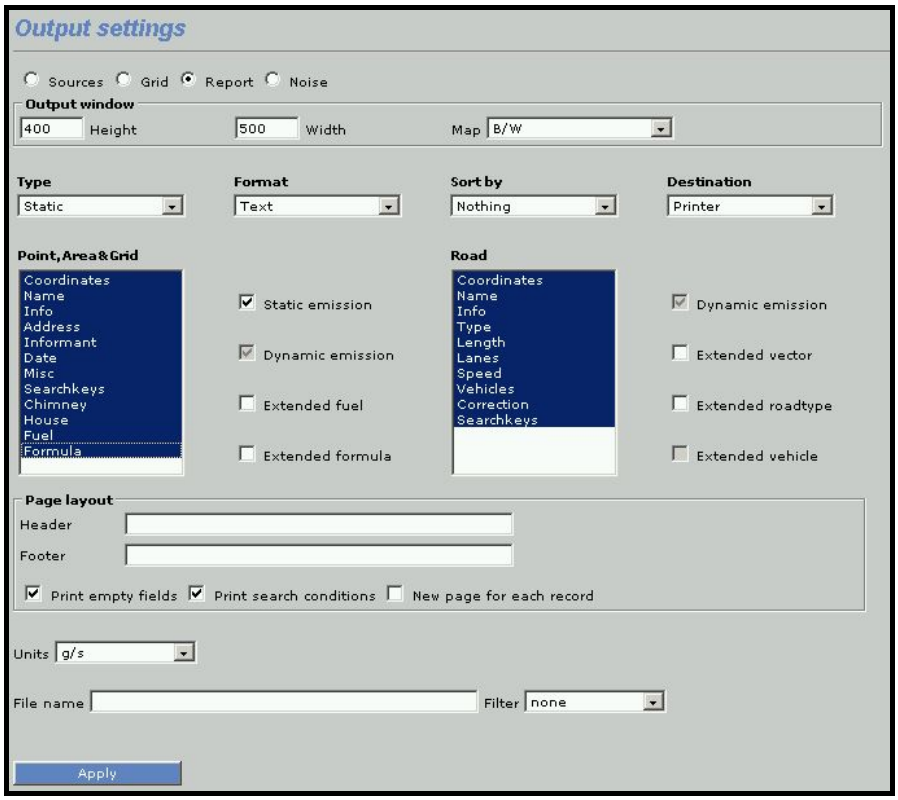
Now choose which Subtable you want to see by clicking on it, and then click on the **Print empty fields** . The output is concise but easy to read and is a convenient way of viewing a whole database. This example is taken from the vehicle database:

```
Name:  Hv 1990 hig   (30)
Substances:  NOx (3), CO  (25), VOC (70).
Emission:
Spd (km/h):20    30    40    50    60    70    80    90   100   110   120
Subst.
(3): 13800 13800 13800 13800 14375 14375 14375 14950 15525 16100 16100
(25):  3600  3600  3600  3600  3600  3700  3800  4000  4200  4300  4300
(70):  1500  1500  1500  1500  1200  1100  1000  1000  1000  1000  1000
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Name:  Hv 1990 th 50   1s (36)
Substances:  NOx (3), CO  (25), VOC (70).
```

```
Emission:
Spd (km/h):20    30    40    50    60    70    80    90   100   110   120
Subst.
(3): 31970 28175 25300 20125 20125 20125 20125 20125 20125 20125 20125
(25): 10500  9900  8200  5350  5350  5350  5350  5350  5350  5350  5350
(70):  1730  1570  1580  1630  1630  1630  1630  1630  1630  1630  1630
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Name:  Hv 1990 th 50   3s (32)
Substances:  NOx (3), CO  (25), VOC (70).
...
```

3.9 Creating EDB Reports

It is possible to create reports about sources stored in the Edb. The **Search Criteria** sub-window is used to pick out the sources that you are interested in. Choose **Report** under **Output Setting** on the left-hand in the EDB main menu. Here you specify the information that you want to include in your Edb report.



There are two different types of report: **static** and **dynamic**. The **static** reports can only be in **Text** format. The **dynamic** reports also include the emission figures. This can be in a **text** format, **SKV** format (more compact, and useful for exporting the data), **Grid** format or **GIS** format (these two just contain emission data - they provide two different formats that can be used for exporting the emission data to an external dispersion model or to a GIS system).

Under **Destination** you have three choices of where to send the output. If you choose **File** then you must write the name on **File name** to specify the name of the file to save to.

On **Page layout** to specify a header and footer to print on each page and to choose whether to print each record on a new page. You can also choose whether or not to print empty fields or to print the specified search conditions.

If you have chosen **Grid** or **GIS** format then you can specify the grid on Grid specification sub-windows.

If you have chosen **Text** or **SKV** format then you can choose what point, area and road attributes that you would like to be included in the report. Each of these is selected by a click on them to select or unselect them again.

There is also a possibility of applying a **Filter** to the output that can for example alter the format of the output or send it somewhere else such as directly to a floppy disk, or to another computer. Filters must be specially ordered from SMHI.

A special filter is skv2shape, which formats the output as a shapefile. The use of this filter, which is included in Airviro 2.3 and higher is described in *10.3 Working with EDB source export* in *User's Reference Volume 10: Working with the Shapefile Translator Module.*

When you have chosen the format of your report and specified all your requirements, click on **Apply** and to return to the **Output** sub-window.

Selecting **Output – PDF** in the left-hand menu. Text font and special characters can be changed if you use Adobe_ Acrobat. You cannot save or use the PDF-file without an Adobe program, except if you can locate the temporary PDF-file, which is stored under Temporary Internet Files in your profile directory.

The Report can be exported to other programs by sending the output to an ASCII file. Select **Output – Text** in the left-hand menu.

The following is a typical data report output (text):

```
Plain datareport
Substance:    NOx
Source type:  Point
Region:       (12(61750,6394750)-(1281747,6410750)
Print empty text fields
Alpha sort
Output to stdout

Coordinates:                X1=1280000
                            Y1=6410300

Name:                       ANGEREDS VÄRMECENTRUM

Input date:                 920618
Latest change:              931221

Substance:
          NOx (3)           7.0000 ton/year
          SO2 (15)          10.0000 ton/year

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Coordinates:                X1=1273730
                            Y1=6400380

Name:                       BEROL NOBEL MÖLN:1
```

```
Input date:                 920616
Latest change:              931221

Substance:
            NOx (3)         3.1000 ton/year
            SO2 (15)        0.7000 ton/year

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Coordinates:                X1=1280250
                            Y1=6406300

Name:                       BJÖRNDAMMENS HETV.

Input date:                 920616
Latest change:              931221

Substance:
            NOx (3)         11.0000 ton/year
            SO2 (15)        10.0000 ton/year

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

The following is an example of the more compact SKV output, and is usually quite suitable to export to other database programs.

```
"X1";"Y1";"X2";"Y2";"Name";"Dynamic emission in gram per
sec";"Dynamic emission in ton per year";
1280000;6410300;0;0;"ANGEREDS VäRMECENTRUM";0.221816;6.99998;
1273730;6400380;0;0;"BEROL NOBEL MÖLN:1";0.0982328;3.09999;
1280250;6406300;0;0;"BJÖRNDAMMENS HETV.";0.348568;11;
1271761;6402605;0;0;"CHALMERS TEKNISKA H";0.389072;12.2782;
1271750;6402500;0;0;"CHALMERS VäRMEC:1";0.126752;3.99999;
1271751;6402501;0;0;"CHALMERS VäRMEC:2";0.31688;9.99997;
1270490;6404094;0;0;"ENERGIV. ROSENL.GAS";1.61119;50.8453;
1270499;6404090;0;0;"ENERGIV. ROSENL.OIL";0.204872;6.46527;
1266700;6403400;0;0;"ENERGIV. RYA_VC_GAS";0.871012;27.487;
```

Appendix 3A: Suggested Substance List

3A.1 Inorganic Gaseous Substances (1-39)

	Symbol	Position
Gaseous Nitrogen Compounds		
Nitrogen oxide	NO	1
Nitrogen dioxide	NO_2	2
(NO_2 003+ NO)	NO_x	3
Nitric acid	HNO_3	4
Nitrous acid	HNO_2	5
Peroxyacetylnitrate	PAN	6
Ammonia	NH_3	7
Nitrous oxide (laughing gas)	N_2O	8
Gaseous Sulphur Compounds		
Sulphur dioxide	SO_2	15
Sulphuric acid	H_2SO_4	16
Sulphur trioxide	SO_3	17
Hydrogen sulphide	H_2S	18
Carbon sulphide	CS_2	19
Gaseous Carbon Compounds		
Carbon monoxide	CO	25
Carbon dioxide	CO_2	26
Other Inorganic Gaseous Substances		
Ozone	O_3	30
Hydrochloric acid	HCl	31
Hydrogen peroxide	H_2O_2	32

3A.2 Particulate (Inorganic, Nonmetallic) Substances (40-49)

	Symbol	Position
Particulate Matter	Dust	40
	Soot	41
	Carbon dust	42
Particulate Inorganic Substances (Nonmetallic)		
	Ammonium	45
	Nitrate	46
	Sulphate	47

3A.3 Metals (50-69)

	Symbol	Position
Arsenic	As	50
Lead	Pb	51
Iron	Fe	52
Cadmium	Cd	53
Copper	Cu	54
Chromium	Cr	55
Mercury	Hg	56
Manganese	Mn	57
Nickel	Ni	58
Vanadium	V	59
Zinc	Zn	60

3A.4 Organic substances (not halogens) (70-179)

	Symbol	Position
Volatile organic substances	VOC	70
Total hydrocarbons	HC traffic	71
Alkanes		
	Alkanes	80
	Methane	81
	Ethane	82
	Propane	83
	Butane	84
Alkenes		
	Alkenes	90
	Ethene	91
	Propene	92
	Butene	93
Alkynes		
	Alkynes	100
	Acetylene	101
Aldehydes		
	Aldehydes	110
	Formaldehyde	111
	Acetaldehyde	112
	Butanal	113
	Benzaldehyde	114
Ketones		
	Ketones	120
	Acetone	121
Alcohols		

	Alcohols	125
	Methanol	126
	Ethanol	127
	Propanol	128
	Butanol	129
	Phenol	132
Glycols		
	Glycols	135
	Etheneglycol	136
	Propeneglycol	137
Aromatic Substances		
	Aromatics	140
	Benzene	141
(= methylbenzene)	Toluene	142
(= dimethylbenzene)	Xylene (total)	143
(= vinylbenzene)	Styrene	144
Toluenediisocyanater	TDI	145
Polycyclic Aromatic Compounds		
Polyaromatic compounds (PAH including substituted polyaromates)	PAC	150
Polyaromatic hydrocarbons (not substituted)	PAH	151
Nitric aromatic compounds	nitro-PAH	152
	Naphthalene	153
	Anthracene	154
	Phenantrene	155
Complex Solvents (Petroleum Based, not Chlorides)		
	Solvent HC total	160
	Benzine	161
	Petroleum spirit	162
	Vanolene	163
Naturally Emitted Hydrocarbons		
	VOC nat. total	170
	Isoprene	171
	Terpenes	172

3A.5 Halogenic Organic Substances (180-249)

	Symbol	**Position**
Chlorinated Solvents		
	Solvent Cl total	180
(= Dichloromethane)	Methylene Chloride	181
(= Trichloromethane)	Chloroform	182
(= CCl_4)	Carbon tetrachloride	183
	Vinyl chloride	184
	1,2-Dichloroethane	185
	1,1,1-Trichloroethane	186
(= trichloroethylene, Tri)	Trichloroethene	187

(= Perchloroethylene)	Tetrachloroethene	188
Chlorine-Fluorine-Bromine-Alkanes		
Completely halogenated freons:		
Chlorinefluorinecarbons (total)	CFC total	190
	CFC-11	191
(=R12)	CFC-12	192
	CFC-113	193
	CFC-114	194
Incompletely halogenated CFCs:		
(Replacement for CFC - soft freons)		
(R22)	HCFC-22	200
Incompletely fluoridated CFCs:		
($C_2H_2F_2$)	HFC-134a	203
Bromium-chlorine-fluorine carbons (Halons):		
Completely halogenated halons	Halons total	210
(= CF_2ClBr)	BCFC-1211	211
(= CF_3Br)	BFC-1301	212
(=$C_2F_2Br_2$)	BFC-2402	213
Incompletely halogenated halons (=CHF_2Br)	HBFC-22B1	215
Other halogenated organic substances		
(=1,1,1-trichloro-2-bis(4-chlorophenyl)ethane)	DDT	220
Chlordane	Chlordane	221
Polychlorinated biphenyls	PCB	222
Toxaphene	Toxaphene	223
Dioxines		
Polychlorinated dibenzo-p dioxines	PCDD	225
Polychlorinated dibenzo-furanes	PCDF	226
Brominated dioxines	Brom. dioxines	227
	TCDD	228
	Lindan	229

3A.6 Others (250-)

Number of vehicle kilometres	vekm	250

Appendix 3B: Mathematical Definitions of the Formulae Used in the EDB

3B.1 Point, Area and Grid Source Emissions

In the Airviro EDB, emissions can be calculated as a function of the hour, day, weekday, month and as a function of the outdoor temperature. In order to identify non-working days when they appear in the middle of the week (e.g. when New Years Day appears on a Wednesday) the concept of day types is introduced, i.e.

Day type (index)	Meaning	Relative occurrence during a year
Monday-Thursday type (0)	Ordinary working day	4/7
Friday type (5)	Day before non working day	1/7
Saturday type (6)	Non working day - Saturday	1/7
Sunday type (7)	Non working day - Sunday	1/7

The following variables and functions are defined:

Dty = day type index = {0,5,6,7}

w(dty) = relative occurrence of day type dty

M = index for month m= {1, 2, ..., 12}

W(m) = relative occurrence of month m (approximated as 1/12)

H = hour during the day = {1, 2, ..., 24}, e.g. h=12 corresponds to mean value between 11 and 12

S = scenario index

T = outdoor temperature = {T1-T2, T2-T3, ..., T29-T30}. By default -30°C<T<30°C with a class width of 2°C.

W(T) = relative occurrence of temperature interval T.

E_0 = mean emission during the year (g/s)

E_{max} = maximum emission at any hour during a year

E(h,dty,m,s) = estimated emission for any hour, day-type and month for the scenario s

TabS(s) is a table defining the variation with different scenarios and is not normalised.

TabM(m), TabD(dty,h) and TabT(T) are the tables defined in the EDB Time and Temperature formulae giving the variation for months, for all hours and all day types and outdoor temperatures. TabS(s) is the table defining the variation with scenario and is not normalised.

A normalisation constant k is calculated so that the following condition is fulfilled:

$$k \times \frac{1}{12}\sum_{m} TabM(m) \times \left\{ \frac{1}{24}\sum_{h}\sum_{dty} w(dty) \times TabD(dty,h) + \sum_{T} w(T) \times TabT(T) \right\} = 1 \quad \text{(eq B1.1)}$$

The emission can be calculated in two different ways, i.e.:

$$E(h,dty,m,s) = E_0 \times TabS(s) \times k \times TabM(m) \times \{TabD(dty,h) + TabT(T)\} \quad \text{(eq B1.2)}$$

$$E(h,dty,m,s) = TabS(s) \times E_{\max} \times Amp \quad \text{(eq B1.3)}$$

where $Amp = TabM(m) \times [TabD(dty,h) + TabT(T)]$ if Amp < 1 else Amp = 1 (eq B1.4)

The difference between equation B1.2 and B1.3 will become obvious when you work with the formulae. Equation B1.3 represents an upper limit restricted emission, i.e. the maximum emission is E_{max} for all hours during the year. If you describe the emission as originating from an oil-burning power plant, then the energy production rate and consequently the emissions would depend on the load. There is however an upper limit in the production rate, restricted by the maximum capacity of the boiler. *Equation B1.3 is used for the emission estimation in the EDB when you choose emission estimation based on* ***Fuel****.*

In equation B1.2 there is no such restriction. E_0 represents the total emission during a year if we convert the units from grams/second to tons/year. The factor **k** ensures that the mean emission from the source for the whole year is the figure E_0. The figures in **T**abM, TabD and TabT just give the variation within the year. *Equation B1.2 is used for the emission estimation in the EDB when you choose emission estimation based on* ***Substances (or Substance group****) and yearly emission figures.*

Consequently, equation B1.2 permits the user to prescribe a scenario in which all pollutants coming from a source are concentrated to a few hours.

3B.2 Road Source Emissions

The following variables and functions are defined:

Dty	= day type index = {0,5,6,7}
w(dty)	= relative occurrence of day type **dty**
M	= index for month m= {1, 2, ..., 12}
w(m)	= relative occurrence of month m (approximated as 1/12)
H	= hour during the day = {1, 2, ..., 24}, e.g. **h**=12 corresponds to mean value between 11 and 12
S	= scenario index
L	= length of the road
N	= average number of vehicles per day on the road
corr	= correction factor for the road
E(speed,h,dty,m,s)	= estimated emission for any speed, hour,day-type and month for the scenario **s**
TabS(s,v)	Is the table defining the variation with different scenarios and is not normalised
TabR(speed,v)	Is the table defining the absolute emission from the vehicle with index v for different speeds.

TabM(m,v) and **TabD(dty,h,v)** are the tables defined in the formulae giving the variation for months, during the hours for all existing day types for a vehicle with index **v**. For each vehicle in a road type the normalisation constant **k(v)** is calculated so that the following condition is fulfilled:

$$k(v) \times \frac{1}{12} \sum_{m} TabM(m,v) \times \frac{1}{24} \sum_{h} \sum_{dty} w(dty) \times TabD(dty,h,v) = 1 \qquad \text{(eq B2.1)}$$

The emission for a road is then calculated as:

$$E(speed,h,dty,m,s) = corr \times n \times 1 \times \sum_{v} (TabS(s,v)) TabR(speed,v) \times k(v) TabM(m,v) \times TabD(dty,h,v)$$

(eq B2.2)

3B.3 Normalisation of Formulae in an EDB

Normalisation is needed whenever emission data is given as a total yearly emission, that is for substance groups, substances emitted from point and area sources and for traffic exhaust emissions. The normalisation guarantees that the yearly emission will always be

exactly the one specified, in spite of emission variations in time and as a function of temperature.

In the EDB calculations the following approximations are made:

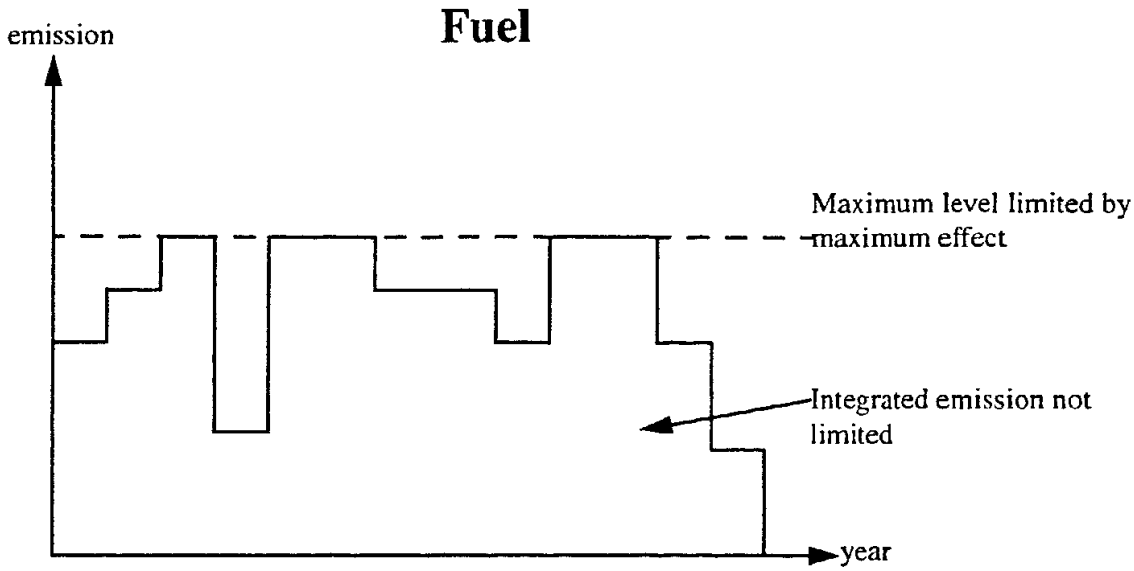
1 Year	= 360 days
1 Month	= 30 days
Mon-Thu	This day type is weighted with 4/7
Fri, Sat, Sun	These day types are each weighted with 1/7

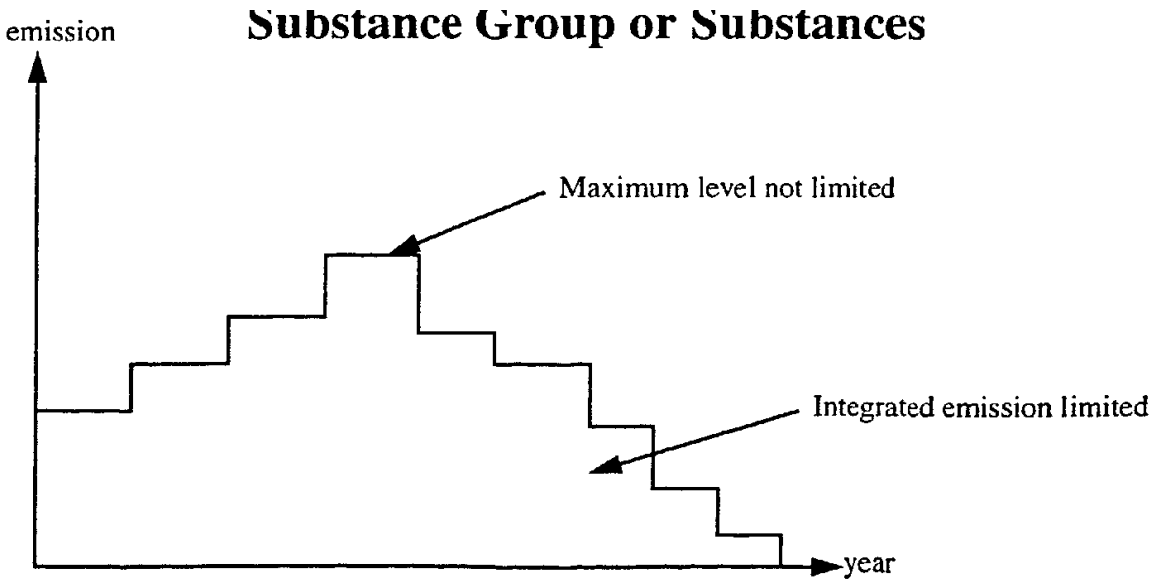
3B.3.1 Sources where the emission variation is not dependent on ambient air temperature variations

A total average emission E_0 is given for the whole year. If the emission is emitted evenly throughout the whole year then the emission per second will be E_0. However if the emission is emitted evenly for just 12 hours every day then the emission for those hours will be twice as much while the emission outside those hours will be zero.

3B.3.2 Sources where the emission variation depends only on ambient air temperature

In principle it is possible to combine both time and temperature dependence in the normalisation formula, but the output would be very difficult to interpret. So unless you have very good reasons use either the time or temperature variation to characterise this type of emission variation. Note the difference between the ways in which the yearly emission is specified if you choose fuels (based on maximum effect) and if you choose substance groups or substances (based on yearly average emission).





The most common emission specification is the second case where a yearly average emission is specified. In order to be able to normalise the temperature dependence we need to know the temperature distribution during a year. Within Airviro there is the possibility of configuring databases for statistical data such as climatological temperature distributions during a normal year, normal months and normal hours. The distributions are given as percentage values so that each distribution adds up to 100%. If the temperature database has not been configured then the default temperature database will be used which is based on temperature data from Göteborg. If you do not want to use a temperature distribution from Göteborg then it is possible to type in a distribution by hand in the **Search** sub-window.

3B.3.3 Emissions described by maximum effects (fuels)

In this case there will be no normalisation. All variations specified in the tables will be interpreted as absolute percentage values and the emission can never be higher than the limit given by the maximum effect.

Appendix 3C: Structure of an EDB