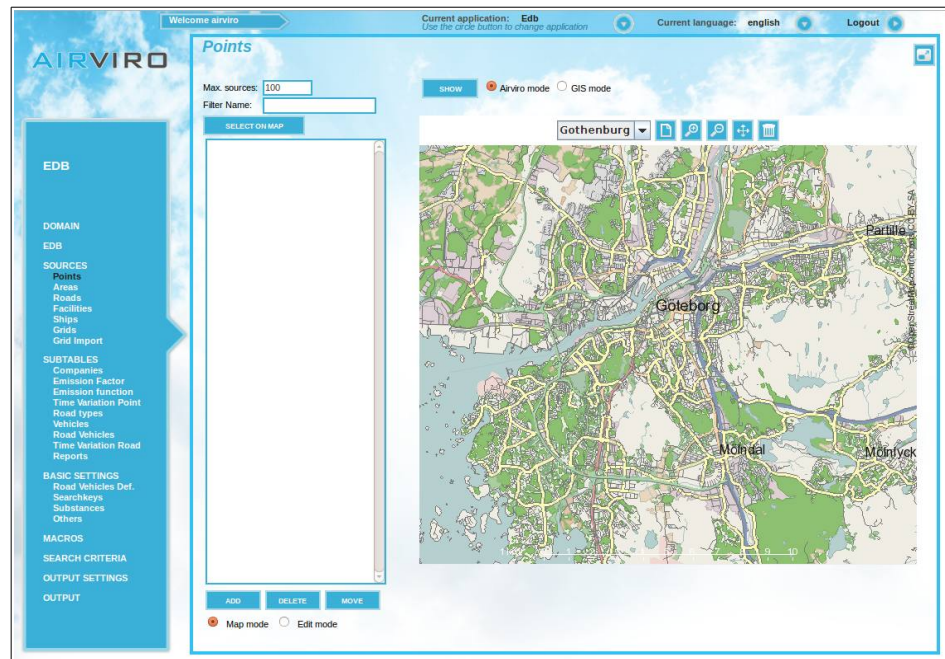


Airviro User's Reference



Working with the Emission DataBase (EDB)

**How to construct a dynamic emission database
and simulate emission scenarios**

Amendments

Version	Date changed	Cause of change	Signature
3.11	July 2007	Upgrade to Airviro version 3.11	GS
3.12	Jan 2009	Upgrade to Airviro version 3.12	GS
3.13	Jan 2009	Upgrade to Airviro version 3.13	GS
3.20	April 2010	Upgrade to Airviro version 3.20	GS
3.21	Dec 2010	Upgrade to Airviro version 3.21	GS
3.21	July 2012	Review	GS
3.22	Sept 2012	Upgrade	GS
3.22	March 2013	Review	GS
3.23	May 2013	Upgrade	GS
3.23	July 2015	Review	GS
4.00	Sep 2015	New Version	GS
4.00	Aug 2018	Review	GS
4.01	March2019	Review	GS
5.00	Oct2019	Upgrade	GS
5.00	Jan 2021	Review	DC

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1.1 Introduction

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. EDB includes tools for management and administration of emission sources. A diagram explaining the structure of the EDB can be found in *Appendix 1C: Structure of an EDB*.

How does EDB client work?

This Airviro module runs on any PC or other devices running Internet Explorer 6 or later, Firefox or any other mozilla based browsers

After logging in to Airviro with your user-ID and password, a domain must first be selected, and then EDB module should be chosen from the available modules. All data processing is made on the Airviro server and afterwards the results are sent to the web browser.

Airviro version v5.00 or higher don't need Java Runtime Environment to run.

A Structured Way of Storing Emission Data

The tables provided enable you to describe emissions from:

- Point sources - the emissions are 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 sources - emissions are evenly distributed over a rectangular area and are assumed to be leakings.
- Facilities- several point sources can be related to a Facility, i.e. Point and Area sources concentrated in the same geographic area, using the same administrative information (address, reporting, and other information).
- Road sources - emissions are assumed to be evenly distributed over a line. This is usually used as an approximation for road traffic.
- Grid layers - background emission levels can be defined in the form of grids.
- Ships - Information from ships is gathered using IAS radio messages from the ships. This includes coordinates, velocity and a unique ship identifier. With this information the emissions are calculated for each ship individually.
- Emissions time variation depending day type, month and scenario.
- Emission factors and emission functions for point and area sources.
- 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

The search functionality allows you to restrict the sources from which the emissions are coming. A search can be made using the following restrictions:

- Source name and information strings.

- Point, area, road or grid sources, or a combination of them.
- One or several road types and vehicle types.
- Congestion vehicle and speed.
- Emission factors, Time variations and Emission functions.
- Any combination of search keys.
- A restricted area of the map.
- Restrictions on time and temperature.

Using search keys you can find emission values such as :

- Total emission of SO₂ from heating plants at 6 o'clock in the morning.
- Contribution to the total NO_x emission of heavy vehicles in the city centre at rush hour.
- 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 module will be presented. Following these recommendations you will be able to 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?
- How much would emissions be reduced if low sulphur oil was introduced?

Integration with Dispersion Models

The dynamic EDB can be used with the Airviro 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.

See *Airviro User's Reference, Volume 2: Working with the Dispersion Module*, for examples on how to use EDB for dispersion simulations.

The Report Generator

The report generator or Output can produce information from the EDB for presentation on screen, storage in a file or as a printout. You can visualise source locations and emission factors, as well as time dependent information concerning emission loads for a given period and area, a standardised output for road noise emission levels (colour-coded range), etc.

This output can be configured for source, grid, noise and report (only ASCII Text). Reports can be produced in different formats (GIF, PDF and ASCII Text) to be used by other applications.

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

When working with EDB, it is recommended initially to collect all relevant information directly from the industry, local authorities, etc. and save the data in the EDB. Working 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 data for historical periods and compare the results with measured ambient data. By simulating different wind directions and weather conditions you will 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 you to use the Receptor Model to estimate emissions (Dispersion Module)

Once 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.

1.2 Getting started

After logging in to Airviro with your user name and password (*Figure 1.2.1*) a domain must first be selected and then EDB module should be chosen from the available modules. See *Figure 1.2.2*.

At the top of the window, in Current application the name of the module actually selected is shown. Clicking on the [down arrow] button beside the name other modules can be selected.

Clicking on the Current language [down arrow] button it is possible to select the language to work with. This functionality is not yet implemented.

By clicking on the [down arrow] **Logout** button, the current module is closed and the Airviro login page is displayed instead.. See *Figure 1.2.2*



Figure 1.2.1 Logging in to Airviro

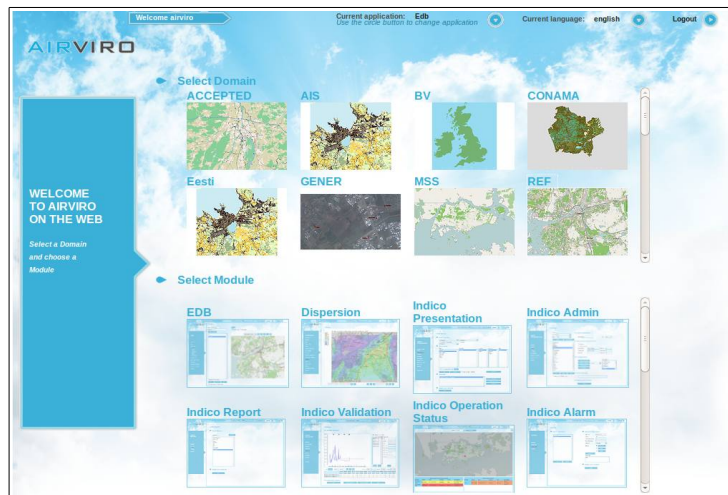


Figure 1.2.2 Available Domains and Modules.

This manual will show you how to set up the EDB module . 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 Emission Factors.
- Working with the map.

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

1.2.2 Selecting an EDB to Work with

Once EDB has been loaded into the web browser, you will see the main menu options on

the left side

Go to the **Edb menu** (see *Figure 1.2.2.1*).

There are two list boxes labelled **User** and **Edb**. If you decide to work with the global EDB, select the **global** user in the list box to the left, then the edb's list will be blank. Press the **[APPLY]** button. Alternatively you can select other user and edbs.

The following functionalities are available:

CHECK EDB: Checks the consistency of the EDB database and displays any errors found.

REPAIR EDB: Repairs a corrupted EDB.

MANAGE SHAPE: Imports and deletes shape files. Shapes generated using other GIS system can be easily imported into Airviro.

IMPORT GRID FROM SHAPE: To Import a grid you must assign it a name, select the file type (shape or CSV), assign it the grid fields to the corresponding fields in Airviro ,(for example, name, info, info2, address, date, searchkeys and activity code), define grid size and the position of the first point in it and select substances from the list.

IMPORT ROAD FROM SHAPE: To import roads, select a shape file from the list and then assign the shape headers to the corresponding fields in Airviro EDB .

ASSIGN GEO CODES: Import geo codes from shape files by selecting the code position in the edb code field to be assigned or replaced, the field name containing the code in the shape file and format in the shape file in which the code must be interpreted by Airviro.

IMPORT HYPE SUB BASINS: Not yet supported for this version.

IMPORT HYPE POINT SOURCE: Not yet supported for this version.

To be able to use the csv / shape files within Airviro you must first import them into the Airviro server. The shape files saved in the user's pc can be copied into the Airviro server through the **Manage Shape** menu.

These files are saved in the shp folder (/usr/airviro/data/name/shp).

The **Description** text box can be used to describe the contents of the selected database. You can add a description to the Edb selected by entering some text and pressing the button **[SAVE DESCRIPTION]**.

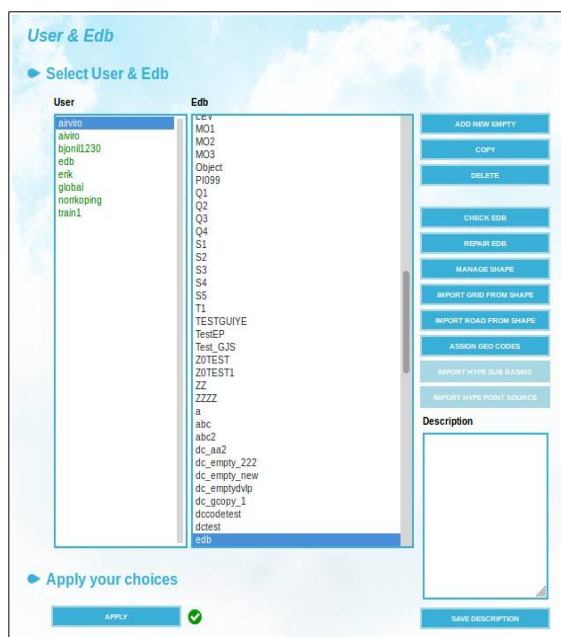


Figure 1.2.2.1 Select user and Edb

Note: A global EDB is the official, original emission database in the system consisting of a substance list 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 access the contents of the global EDB and make a copy of it with a different name, and then edit it.

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. This task should be done by the system administrator. The system administrator have 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 EDBs. 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

Usually, only the system administrator is allowed to edit the global EDB, but you can make your own copy. Select the user "global" and then press the button [**COPY**], write a new name for the edb and press the [OK] button (see *Figure 1.2.2.2*), The new copy of the global edb will appear in your personal edb folder, under your log in user name .

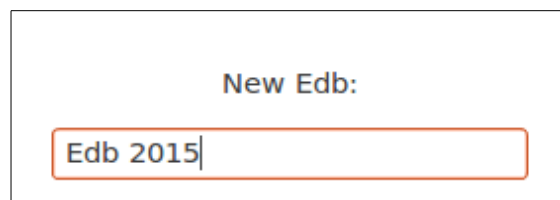


Figure 1.2.2.2 Adding a new EDB or a copy.

Creating a Copy of Someone else's Personal EDB

Same as copying the global edb, but instead of the "global" user, select an edb from your own personal folder or from someone else, and follow the same steps as before.

Note: It is even possible to set privileges on individual EDBs 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 an Edb

Select an edb from your own personal folder and then press the **[DELETE]** button. An alert will appear requesting you to confirm or cancel the removal.

Note: Usually, it is only possible to delete your own personal edbs. If you choose someone else's personal EDB , or the global EDB, then the **DELETE** button will be disabled. However, it could be possible to delete someone else's Edbby setting the corresponding privilege level by the system administrator.

Creating a New Empty EDB

Just press the **[Add new empty]** button and write a name for your new edb (See *Figure 1.2.2.2.*), The new empty edb will appear in your personal edb folder, under your log in user name.

Exercise 1.2.2.2

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

Check and repair EDB

Clicking on the **[CHECK EDB]** button the system will check the consistency of the personal EDB selected in the list.

Clicking on the **[REPAIR EDB]** button the system will try to repair the personal EDB selected in the list.

1.2.3 Modifying Basic Settings Texts

Select your personal Edb: **My_first_EDB**, which should be empty. This EDB has been created with default texts for certain tags and list options, but it is possible to modify some of them. You should only modify 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, go to the different sub-menus under the **BASIC SETTINGS** menu. You can define: **Scenario** texts, **Speed** texts, **Temperature** texts, Searchkeys, activity codes, geographical codes, noise and Units.. Choose one of them, for example **Others**, and then select **Scenario....** from the list. A new list appears displaying the default scenario definitions as consecutive years starting from the year 2003. But what if you have emission estimations for the year 2015? To be able to incorporate these figures into your EDB, change one of the scenarios (e.g. change scenario 10) to 2015. Now, whenever you enter or edit a source, the year 2015 will appear in the scenario list in the 6th position. See *Figure 1.2.3.1*.

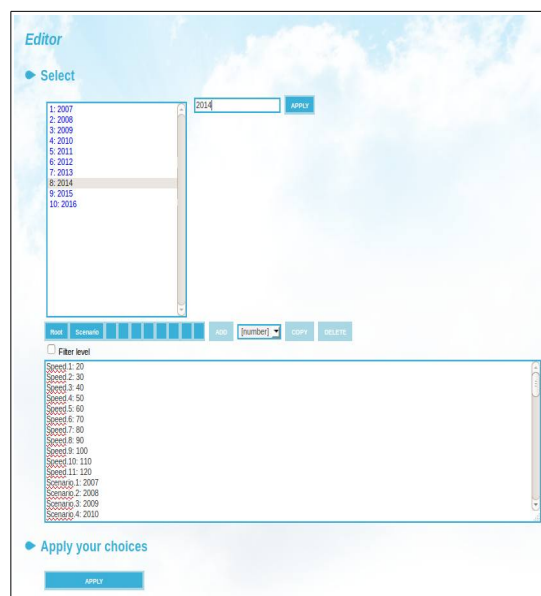


Figure 1.2.3.1. Basic Setting

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

1.2.4 Adding Substances to the Substance List

Select the "global" user in EDB. This edb contains the default substance list, which is also used for all local Edb. To view the substance list select **Substances** under the menu **Basic Settings**.

A list of substances will be presented as in the figure 1.2.4.1, also included in the appendix. There are 1023 positions for different substances. These can be grouped in categories depending on the type of chemical substance. It is recommended not to change the positions of existing substances, however, you may introduce any new substances at the empty positions in the substance list.

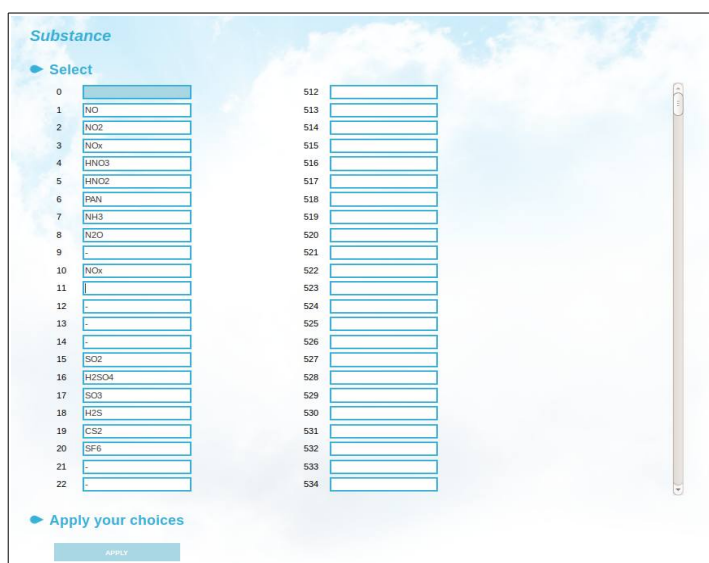


Figure 1.2.4.1 Substances

Note: There is only one substance list shared by the global EDB and all local Edb's. The substance list can only be modified in the global EDB, so you must have privileges for editing the global EDB.

WARNING: Internally, Edb does not use the substance names that you write in the substance list. It does, however, look for their positions in the list. This means that there are 1023 substances with internal keys: 1 to 1023. For instance, if you use position 11 for substance AA and position 12 for BB, and later, when you define an emission source you assign substance AA as emitted from that source, then edb will actually use key 11. If you then change substance names between positions in the substance list, for instance swap 11 to BB and 12 to AA, the emission source defined will still be pointing to position 11, independently of the name you have given to it, so you will have to redirect the pointer from all the emission sources already defined 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.

1.2.5 Emission factors in EDB

Sometimes it will be convenient to define emission factors as a specific mixture of the substances defined in the substance list. Thus, you can define an emission factor called **standard petrol**, assigning it the percentage of different hydrocarbons, lead, etc. This will simplify your work later on when you have to define all sources emitting gases from **standard petrol**, or if the composition of **standard petrol** needs to be changed.

To define an emission factor:

Select the **Emission Factor** submenu from the **SUBTABLES** main menu, and then press the button **[ADD]**

Type a name for the new emission factor in the text field **Name**.

- Select the required substances from the list and add them by pressing the **[ADD TO FACTOR]** button.
- The emission is calculated using a linear equation ($\text{Emission} = k * \text{activity} + m$). The values for k and m, must be specified for each substance. The activity is specified when a point or area source is defined.

- Save your emission factor by clicking [**Apply**].

The example below shows an emission factor that has been created to describe hydrocarbon emission from vehicles and it is a particularly illustrative example of how Emission Factor can be used. Many different hydrocarbons are emitted from combustion of petrol, and we have details about a few of them. The emission factor consists entirely of hydrocarbons from petrol, therefore we enter a value for k and 0 for m for each substance. However, contained in HC Traffic we know there are about 4% benzene, 12% toluene and 13% total xylenes. We can link the description of hydrocarbon emissions from cars to this emission factor instead of just to the substance HC Traffic. In this way we have the option of searching for either total hydrocarbon emission or for each one of the individual hydrocarbons.

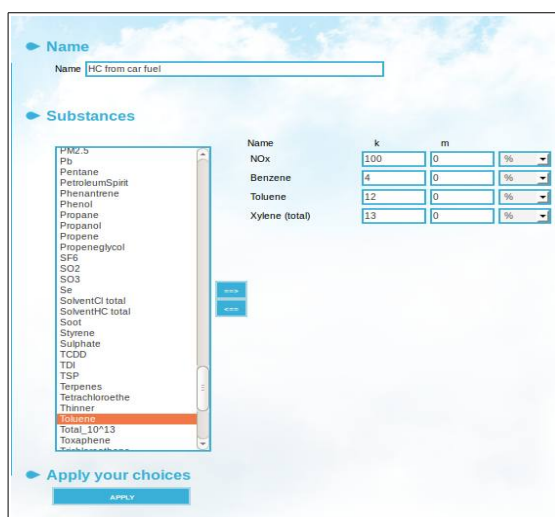


Figure 1.2.5.1 The emission factor sub window.

Exercise 1.2.5.2

Define an emission factor called **Standard Petrol** consisting of 5% Benzene, 12% Toluene and 3% P-Xylene.

1.2.6 Choosing a Geographical Area

Selecting a Map

Some Airviro installations have several maps . You can select which map to use from the dropdown list in the Map page for **Sources** (*Figure 1.2.6.1*). . For example in this figure Gothenburg OSM SWREF is selected.



Figure 1.2.6.1. Map

Selecting a Geographical Sub area Within a Map

It is possible to zoom in/out the map clicking on the buttons [+]/[-], alternatively you can use the mouse scroll wheel. Use the [pointed cross] button to restore the original zoom (*Figure 1.2.6.1*). .

A particular area can be selected by clicking on [**Select on map**] button above the source list and then hold down the [ctrl+left] mouse button while dragging the mouse pointer to select the 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 area selected.

Pan

To display another area of the map with the same scale, then while the mouse pointer is over the map, click on the left mouse button and move you mouse over the map, release the button when you are done.

To Clear a Map

Pressing the [**SHOW**] button will show the emission sources on the map, to clear them

out, press the button [**Clear**] in the map dialogue area (*Figure 1.2.6.1.*).

1.2.7 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.

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.

1.3 Point sources in the EDB

The emission from a point source can be defined in three different ways:

1. By defining the total amount of each substance emitted in a year.
2. By using emission factors, i.e by defining the amount used by an activity and applying an emission factor for that activity.
3. By defining an emission formula with a number of variables and specifying values for the variables.

The following steps will be explained:

- Information required when entering a point source.
- How to specify a time variation.
- Static information needed for dispersion modelling.
- Using the search conditions to calculate emission values from your sources.
- Defining a point source with emissions based on a dependency of temperature using a time series macro.
- Creating an emission formula.
- Defining a point source based on an emission formula.
- Grouping sources using facilities.
- Defining a company and associating facilities to the company.

1.3.1 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.

1.3.2 General Principles

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

- **Name information** assigns the name of the source plus two information strings (Info, Info2). These strings can be used as search conditions when searching in the EDB.
- **Coordinates:** assigns the x and y coordinates.
- **Emissions:** assigns the information that is directly associated with the emission, such as a yearly emission from a substance and a time variation that describes the emission as a function of day type and hour.

Emission from the source either directly in terms of the substances emitted, or linked to an emission factor or an emission function.

It is also possible to link the emission to an *Indico Presentation* macro. Instead of specifying the emission for a substance, you can select a macro previously defined in *Indico Presentation*. The unit of the resulting time series from the macro must be g/s.

The emission can be defined with a substance, an emission factor, and/or an emission function at same time.

- **Chimney** assigns values such as chimney height, exhaust gas temperature, house width/height, etc. These values 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.
- **Searchkey** it is possible to assign up to five groups of search keys in order to organise the pollution sources into groups that can be used to separate the total emissions.
- **Other** such as **geographical codes**, **additional info** and AERMOD data.

1.3.3 Time variation for a point source

Before entering any general or static information it is important to create a time variation that describes how the emission changes over a period of time. In most cases, we know that emissions variation within a large city have the same order of magnitude as long-term average emission. An empty Edb, contains only one predefined time variation , the so-called **STANDARD** time variation, which contains a time constant emission.

The emission variations specified in the time variation tables are interpreted in two ways: The yearly variation is given as absolute values but all other variations are normalized in a way that the yearly emission always will be the percentage of the annual emission specified by the yearly variation percentage.

We will begin by considering the first group as this expresses a more general formulation of emission variations. In *1.3.7 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 time variation:

- Click on **Time Variation Point** under the **SUBTABLES** menu to open the Time variation Point window. .
- Click on **[Add]** (or click on **STANDARD** if you want to edit the default Time Variation).
- Type in a Time Variation name in the **Name** text box.
- Define the corresponding variations for **DAY TYPE**, and **SCENARIO & MONTH**.

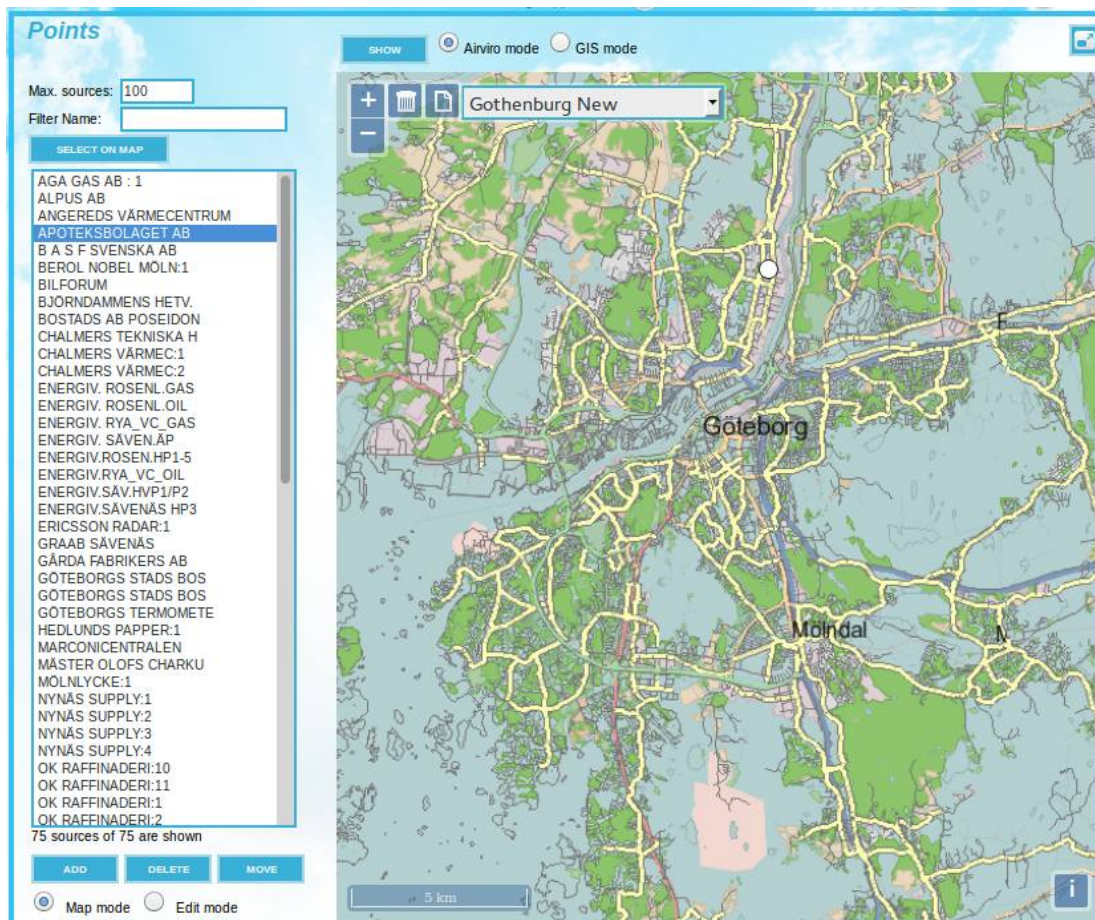


Figure 1.3.3.1. The Point sources subwindow

The **Scenario & Month** sub window has 12 text fields for Monthly variation values to describe the relative variation of emission during the year. It also has 10 text fields for Scenario variation labelled yearly, (see section 1.2.3). In these text fields you can enter the absolute variation of emission in percentage over the years.

Time Variation >> Scenario & Month

Options

Scenario variation	Monthly variation
1993 <input type="text" value="100"/>	january <input type="text" value="100"/>
1994 <input type="text" value="100"/>	february <input type="text" value="100"/>
1995 <input type="text" value="100"/>	march <input type="text" value="100"/>
1996 <input type="text" value="100"/>	april <input type="text" value="100"/>
1997 <input type="text" value="100"/>	may <input type="text" value="100"/>
1998 <input type="text" value="100"/>	june <input type="text" value="100"/>
1999 <input type="text" value="100"/>	july <input type="text" value="100"/>
2000 <input type="text" value="100"/>	august <input type="text" value="100"/>
2001 <input type="text" value="100"/>	september <input type="text" value="100"/>
2002 <input type="text" value="10"/>	october <input type="text" value="100"/>
	november <input type="text" value="100"/>
	december <input type="text" value="100"/>

Apply your choices

Ok Cancel

Figure 1.3.3.2. Scenario and Month

Usually, 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.

Day Type: In the same way, describe the daily and hourly emission variation according to the type of day; that is, working day, weekend, etc (see Figure 1.3.3.3).

The values entered here will be normalised at the moment EDB uses them to estimate emissions. This will be explained mathematically in **Appendix 1B**, and you will see the effects and understand the principles later on when you perform dispersion calculation (simulations).

Example1: If you write 100 for all months but set June and July = 0 then it means that no pollutants are 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 = 100 the result would have been the same.

Example2: 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.

Exercise 1.3.3.1

Create a Time Variation named **industry_2shift** with 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.

- Define the daily and hourly variation by clicking on **Day type**. This subwindow has 4 columns labelled with the day types: Monday-Thursday, Friday, Saturday and Sunday are displayed. The 24 text fields on each column define the hours during the days. In these text fields you can enter the relative variation of emissions during the week.

Example3: If you write 100 for all hours during Monday-Thursday and Friday but 0 for the weekend days, then no pollutants are emitted during Saturday and Sunday but 7/5 of the weekly average emissions will be emitted during workdays.

Time Variation >> Day type

◆ Day type variation

	Mon-Thu	Fri	Sat	Sun
00 - 01	100	100	100	100
01 - 02	100	100	100	100
02 - 03	100	100	100	100
03 - 04	100	100	100	100
04 - 05	100	100	100	100
05 - 06	100	100	100	100
06 - 07	100	100	100	100
07 - 08	100	100	100	100
08 - 09	100	100	100	100
09 - 10	100	100	100	100
10 - 11	100	100	100	100
11 - 12	100	100	100	100
12 - 13	100	100	100	100
13 - 14	100	100	100	100
14 - 15	100	100	100	100
15 - 16	100	100	100	100
16 - 17	100	100	100	100
17 - 18	100	100	100	100
18 - 19	100	100	100	100
19 - 20	100	100	100	100

◆ Apply your choices

OK CANCEL

Figure 1.3.3.3. Day type variation

1.3.4 Static Emission Information

There are important emission characteristics that do not affect the emission strength, but must be known so as to be used by a dispersion model in order to determine the effect of emissions in the ambient air.

The static information required is :

- **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 calculate 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 values to calculate the so-called *effective stack height*.

It is also important to know the **Exhaust gas temperature** 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.

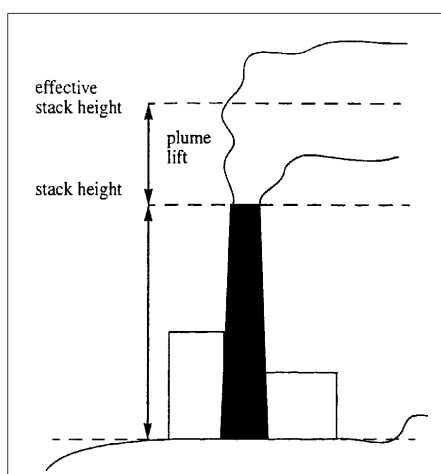


Figure 1.3.4.1. *Effective stack height*

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.

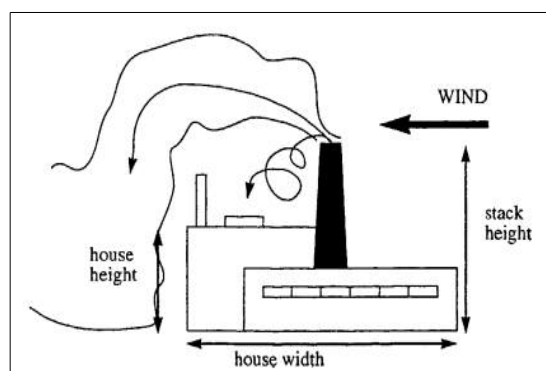


Figure 1.3.4.2. *Buildings*

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

Note: The static information is not necessary to simulate emissions in the EDB module, but it is vital to simulate the air quality effects using the dispersion models in the Dispersion module. Therefore, we recommend that you always enter the static information when adding a point source to the EDB.

1.3.5 Specifying a Point Source Based on Yearly Total Emission Figures

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 figures for the year and indicated the periods during which the factory is closed. Additional information about stack height, exhaust temperature, etc. has also been provided 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 m¹ 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 add your First Point Source in the EDB

Under the menu **Sources**, click on **Points** and then click on **[SELECT ON THE MAP]** button. Select an area as already explained (see *section 1.2.6*).

Figure 1.3.5.1. Point source

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 one.

The list box to the left of the map will list all existing sources in the selected area . If you are working with the personal EDB: **My_first_EDB** (see *Exercise 1.2.2.2*), there should not be any sources.

Click on **[ADD]** and move the mouse pointer over the map area to the desired location for the emission source, then click on the left mouse button. The edit **Points** sub window (*Figure 1.3.5.1*) will replace the map and you can start filling in the required information.

- Fill in the name of the company in the upper text field **Name**.
- Fill in the **Name Information**, **info** and **Info2** string (we will explain them later on in *1.3.8 Using Search Keys and Pattern Matching Facilities as Search Conditions*).

- To change the location of the source you can manually enter the **X Coord and Y Coord**, alternatively, you can use the button **[MOVE]** below the source list.
- Fill in the emission values by clicking on **SUBSTANCES**. The **Substances** sub window appears. Select NO_x from the list box and fill in the total yearly emission (tons/year) in the relevant text field. Select the appropriate **Time Var** (time variation) **industry_2shift** for this exercise. Select the available **Additional information, Code** or **Time series** . Confirm by clicking on **[OK]**.

Using the **[COPY FIRST]** button you can copy the values/selections in the first row of the list to the others

Select the available **Actd.Code** and **Add. info**.

Codes are used to categorise sources in EDB. These can be geographic codes or activity codes. These codes are defined in the **Basic Setting** menu.

The **Additional information** can contain any amount of text. It is used to store data that is not categorised. The format required to include data in **Additional information** is **[tag_name] = [value]**, for example:

NO_CARS=12

FUEL_CONSUMPTION=1000

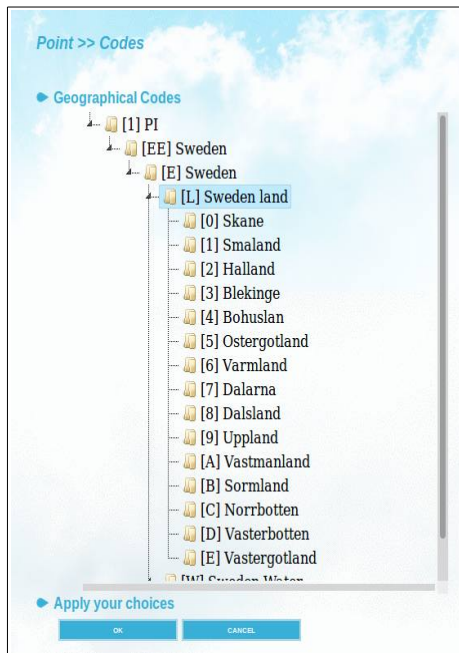


Figure 1.3.5.2. Codes

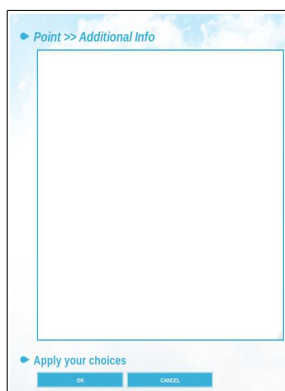


Figure 1.3.5.3. Additional info

Fill in the **Aermod** menu, with the characteristics of surrounding buildings . These will be used in the Dispersion Module (Aermod Model). Width, height, length, centre, and distance to the farthest wall, must be entered for each building. All values must be in metres.

At least one segment must be defined for each point source.

Point >> Air model

Building information

Nr. segments: 1

segment 1

Width (m): 1

Height (m): 2

Length (m): 3

Dist. farthest wall (m): 4

Center (m): 5

Apply your choices

OK CANCEL

Figure 1.3.5.4. Air Model

- Finally, save your new point source by clicking on **[Apply]**.

1.3.6 Emission calculation from a Point Source

We can use a point source to perform an emission calculation. Emission calculations are performed using the Search criteria subwindow. A search is carried out over the map area that you see on the screen, if you zoom in/out the map area then that visible area will be searched.

Click on **SEARCH CRITERIA** in the EDB main menu. The **Emission** search window will appear on the screen. See *Figure 1.3.6.1*.

Emission

Name Information

Name: []

Info: []

Info2: []

Substance

NO Only emission

Sources

Point Area Road Grid Ship Treat ships as points

Restrictions

POINT AREA & GRID ROAD SEARCHBODY SUB AREA CORRS ADDITIONAL INFO

Correction

Point 1 Area & Grid 1 Road 1

Variation

TIME From: [] To: [] Resuspension From: []

Scenario: 2007

Apply your choices

CLEAR ALL APPLY APPLY & SHOW EMISSIONS

Figure 1.3.6.1. Search criteria

The following restrictions can be use to perform the search:

Name Information: The three text fields **Name**, **Info** and **Info2** give you the possibility to enter the character string you want to match when searching for sources . If you write **Cement and Son Ltd.** in the **Name** text field then all sources matching that name will be searched for, and not others . There is the possibility to use the so-called "wild cards" in connection with the character strings. For example: If you write **Cem*** then all sources with a name beginning with **Cem** will be searched for. For further information see *1.3.8 Using Search Keys and Pattern Matching Facilities as Search Conditions*.

- **Substance:** The substance for which you want to know the emission value must be selected from the dropdown list
- **Sources:** You can select any combination of point, area, road, grid and ship sources. Also the option to treat ship as point sources instead of line sources is available.

For example, if you tick off **POINT** and **AREA** then only point and area sources will be included in the search.

- **Restrictions** consist of six subwindows with other optional restrictions.
 - **POINT, AREA & GRID:** Restrict the search to point/area/grid sources defined with a specific **Emission factor**, **Emission function** and/or **Time Variation**. A maximum of 10 selections can be made in each list.
 - **ROAD:** Restrict the search according to the number of vehicles per day (minimum and maximum) and road length (minimum and maximum), speed, etc. You can select line sources (traffic roads) that are based on a specific **Road type**, **Road Vehicle**, **Vehicle** type and typical **Speed**. Restrictions can also be made on the alternative emission model for road, **Road vehicles** and **Road time variation**. (see *1.6 Traffic Emissions in the EDB*). A maximum of 10 selections can be made on each list.

- **SUBAREA** :Change the map or select a sub area within a map. Define a geographical area in which to perform the search for emission sources.
- **SEARCHKEYS** : Restrict the search according to the searchkeys, Emissions from sources that have been given specific search key (see *1.3.8 Using Search Keys and Pattern Matching Facilities as Search Conditions*). An unlimited combination of search keys can be made.
- **CODES** and **ADDITIONAL INFO**: Restrict the search according to the codes that were previously defined or to filter sources depending on the additional info.
- **Correction**: It gives you the choice to multiply the emission values from point, area & grid and road sources by an arbitrary factor.
- **Variation**: button **[TIME]** allows you to restrict the search to a different set of hours, day types and months and scenarios (years).
- **From/To**: Used to restrict calculations to emissions within a specific time period. If the EDB contains sources that use time series to define the emission, this is the only way to calculate the emission from these sources.
- **CLEAR ALL**: This button resets all the selections to default.
- **APPLY**: This button saves your settings.

OUTPUT SETTINGS:

- There are five different types of outputs :
 1. **Sources**: All sources matching the search criteria will be displayed on the map (on the screen), both location and emission value. You can use the option *Show emission sources with nr of decimals*. A maximum of 8 decimals can be select in each list. Emission rates are usually expressed as grams per second (g/s) or other units.

2. **Grid:** 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. One can define the grid resolution, colours, etc.
3. **Report:** Unlike the previous options, this output only displays different text formats. Here you can define several types of reports to display information from the EDB. The Report Generator is described in *1.8 Creating EDB Reports and displaying the Database structures*.
4. **Noise:** All road noise emission levels will be displayed with different colours on the map. This is standardised with colour-coded range.
5. **Codes:** This output includes Geographical and Activity codes.

Example. Make the following selections in the **Search Criteria** subwindow:

Search strings:	Name: Cem*				
Substance:	NOx				
Sources:	Point				
Restrictions:	-				
Variation: Corr. Factors	Point: 1	Area: 1	Road: 1		

Then click on **Output** (Map or PDF) menu. The location of the source and an emission estimation of 19 g/s for source named "Cement and Son Ltd." will be displayed. That is exactly the average value that will be emitted during the period selected. If you want that same value expressed as tons/year, the value displayed will be 600 tons, i.e. the yearly emission value that you entered when the source was defined. Click on **Output** (GIF or

PDF)menu and then the estimated emissions will be 43.6 g/s. This is the mean emission rate coming from the stack during production time. The yearly emission equivalent represent the total emission during a year if the factory were running 24/7 during the whole year at that emission rate.

Exercise 1.3.6.1

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

Simulate the yearly mean emission for 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.

Exercise 1.3.6.2

We will calculate the mean emission for an energy producer were the production and hence the emission, depends on the temperature.

Create a point source, similar to ENERGY.RYA_VC_GAS, with an emission specified as a time series. That is, selecting **emission substance** and specifying a time series defined as a macro in Indico Presentation. The source is an energy producer with a maximum effect of 120 MW. The emission factor for the fuel used is 0.5 g/MJ for NOX. The needed energy production is as:

Out door temperature	20	15	10	5	0	-5	-10
Needed Energy MW	0	20	40	60	80	100	120

To accomplish this, do the following:

1 – In Indico Presentation: Select hourly values, the station Lejonet, Temperature, Instance 002 and value.

2 – The emission during full energy production is calculated as:

$$E = \text{Production} * \text{Emission Factor} \Rightarrow E = 120 * 0.5 = 60.$$

Create a formula in Indico that calculates the emission in g/s depending on the temperature:

$0.5 * (x1 < 20 \ \& \ x1 \geq 15) ? 20 : ((x1 < 15 \ \& \ x1 \geq 10) ? 40 : ((x1 < 10 \ \& \ x1 \geq 5) ? 60 : ((x1 < 5 \ \& \ x1 \geq 0) ? 80 : ((x1 < 0 \ \& \ x1 \geq -5) ? 100 : ((x1 < -5) ? 120) : 120))))))$

3- Save this settings in Indico Presentation as a macro.

4- In EDB Module, use this macro when you define the emission in emission substance.

5- Now, calculate the mean emission using Search Criteria and Output menus. Select the time period 89030700 – 90030700.

1.3.7 Introducing a Source Based on Knowledge About the Emission Process

The emission from a source can be calculated using emission functions. An emission function can be defined with any number of variables such as maximum effect, energy value or filter efficiency.

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

1. Create a **Time Variations Point** describing the time variation of the source, specifying the daily, monthly and annual variation.
2. Create an **Emission Function** and specify the equation for the calculation of the emission and the variables that are used in the equation.
3. Create a point source linked to the time variation and use **Emission Function** to select the emission function. Here the values for the variables used in the emission function are specified.

The following example adds a point source with two emissions functions for a combustion process:

We start defining a **Time Variation Point** named **06-22** (*Figure 1.3.7.2 Time Variation*)

- (10 p.m. – 6 a.m.): no emission
- (6 a.m. – 10 p.m.): emission 100%

Please note that the Time variation for emission functions is not normalised. All figures are

percentages.

Once this is done, we can define the emission functions. The emission functions are defined for one single substance only. So we will have to define two functions: One for NOX and one for SO2. To do that, go to the menu **Sub Tables** -> **Emission function** and add the new emission functions. The required information is: the name of the function, the function itself (an equation), the name of the variables used in the function and the type of time variation.

In our example:

The emission function for SO2 has three variables (Effect, Energy value, and the emission factor for the fuel for SO2 [%]). The emission function for NOx has two variables (Effect [MJ/kg] and emission factor for NOX in [g/MJ]).

1. For NO_x (the emission factor is specified in g/MJ) the emission function is

$$\text{Total Emission [ton/year]} = f_a \text{ [g/MJ]} \times \text{Effect [MJ/s]} \times (1000 \times 1000 / (3600 \times 24 \times 365))$$

where f_a is the emission factor for NO_x. The factor $(1000 \times 1000 / (3600 \times 24 \times 365))$ is used to convert the result of the equation from g/s to ton/year. The result from the emission equation must always be in ton / year. The Effect should be variable and the emission factor constant.

For SO₂ (with an emission factor in %) the emission function is

$$\text{TotalEmission [ton / year]} = \frac{f_b \times \frac{\text{Effect [MJ/s]}}{\text{EnergyValue [MJ/kg]}} \times 1000 \times 1000}{(3600 \times 24 \times 365)}$$

f_b is the emission factor for SO₂. The factor $(1000 \times 1000 / (3600 \times 24 \times 365))$ is used to convert the result of the equation from g/s to ton/year. The result from the emission equation must always be in ton / year. The Effect should be variable and the emission factor and EnergyValue constant.

2. After you have created the emission functions you have to define a point source with the emission specified as **Emi.Activ**:

- Click on menu **SOURCES -> POINT**. The edit **Points** subwindow will appear. Click on **[ADD]** and select a position on the map. Then, write the **Name** name **_VC_OIL** for the source , complete the chimney **[SETTINGS]**
 - 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

and save your source pressing **[APPLY]**.

- Go to menu **SUBTABLES-> Emission function** and enter the following values for the variables used in the emission functions, (*Figure 1.3.7.1 Emission Activity*).

Fuel NOX, Fuel SO2 (two different):

Maximum effect: 20 MW

Energy value: Oil (42.7 MJ/kg)

Emission factor SO2: 0.40 %

Emission factor NOx: 0.1 [g/MJ]

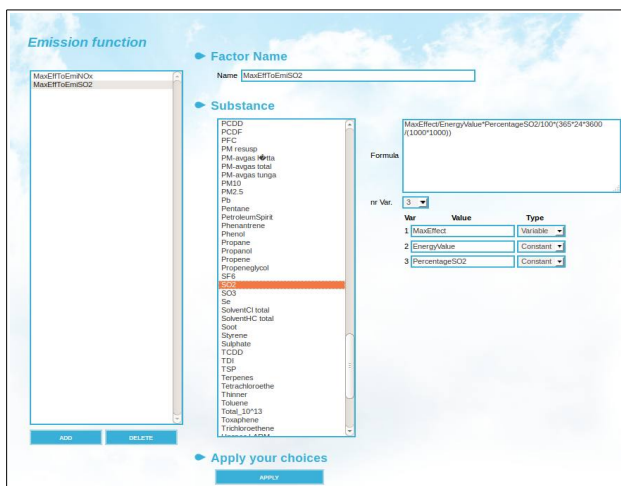


Figure 1.3.7.1 Emission Function

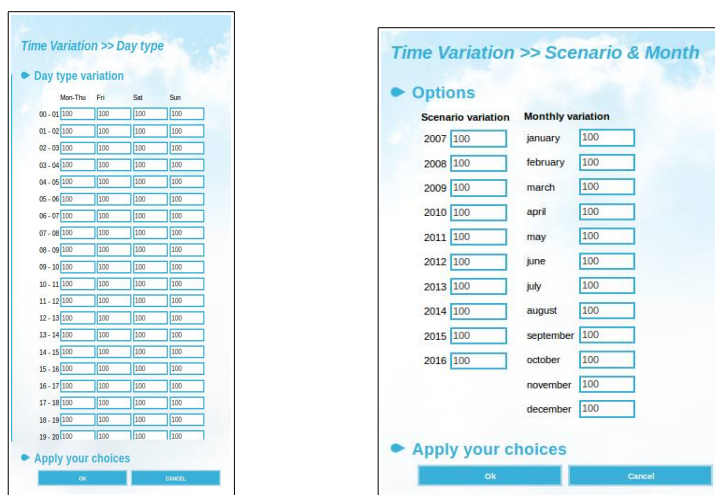


Figure 1.3.7.2 Time variation point

Note: Use the SEARCH CRITERIA Subwindow to verify the emission. Observe that the time variation is NOT normalised.

1.3.8 Using Search Keys and Pattern Matching as Search Conditions

The Search Keys

All emission sources in the EDB can be classified using five groups of search keys. The first two groups can hold up to 128 individual search keys and the other three up to 32 each. The benefits of the search keys are obvious by looking at some examples:

Assume that you have a large number of districts (municipalities) in your territory. You could use the first group of search keys to define all the districts by name . The second, to group different activities that contribute to pollution, such as **Petrochemical industry, Automotive industry, Traffic, Lawn mowers**, etc. The third, to categorise your emitters into classes such as: **Private industry, State owned industry, Public sector, Private consumption**, etc. And the fourth, to categorise the areas in which the emitters are located, such as: **rural, sub-urban, residential, inner city**, etc.

Later on, when estimating the total emission from lawn mowers in a certain district in the residential areas you can obtain this result very easily.

If you analyse your future needs concerning emission estimation, before filling the emission database with data, you will find that the search keys can play an important role, giving you a convenient way to organise and handle your data.

You will benefit from building and using good search key lists. They provide a very efficient way of searching in the database for certain groups of pollution sources. You can perform searches using any combination of search keys from the different searchkey lists.

The Search Strings

The **fields Name, Info1** and **Info2** could be defined in all sources and can be extremely valuable as a complement to search keys when performing a search (see **SEARCH CRITERIA** section). The length of the field **Name** is 47 characters. You should always write the name of the source in this field (such as **Oxford street** or **Shell**, etc.) when adding a new source to the database. This name should be a string of alphanumeric characters that can be useful to classify the source in a convenient way. For example, a name could be a national identification code, property code, etc. If you use unique characters to separate the information written in this field, it will be easy (as shown in next paragraph) to use pattern matching when searching for emissions in the database.

The other two fields **Info** and **Info2** have a length of 47 characters each and can be used in the same way as **Name** to input information related to the emission source.

Matching Search Keys

Emission calculations can be restricted by searching for emission sources that has their searchkeys set to specific values. This is made by selecting the searchkeys in the sub windows SEARCHKEYS in the SEARCH criteria page. Hold down the [ctrl] key for multiple selections.

If more than one search key has been selected in a group, all sources belonging to any of the searchkeys selected will be searched for in the database (*or-criteria*). If combinations of searchkeys belonging to two different search key groups have been selected, then sources matching any searchkey in the selected subset in the first group and any searchkey in the selected subset in the second group will be searched for in 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 match the criteria and therefore 'found' and used in the emission calculations :

All sources with 5 search key defined as:

- a) District1, Lawnmowers, Private consumption, Resident, Green
- b) District2, Lawn mowers, -, -, -
- c) District3, Traffic, -, -, Yellow

The following sources will **not** match the criteria and therefore will not be 'found' nor used in the emission calculations :

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

e) -, -, -, -, Brown

f) District3, -, -, -, -

The - indicates that no search key has been defined (empty list).

Matching Search Strings

Using the **SEARCH CRITERIA**, you can specify **Search** strings that match a specific source or that match all the sources that have some characters or numbers in common in the search string definition. The possible pattern matchings are:

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

Considering the matching potential, a carefully prepared strategy concerning the search string definitions will allow you to have an unlimited number of possible selection criteria.

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

1.3.9 Saving your search criteria and output settings

Once you have defined your **SEARCH CRITERIA** and **OUTPUT SETTINGS**, you may save them as an EDB macro. An EDB macro contains all your selections in these user interfaces, so they can be used any other time.

Go to **MACRO** menu to load/save/delete macros. Macros are saved in folders,. Each user has his own folder, a common folder and some other folders may also be created. The system administrator decides who is allowed to save macros in the common folder. You can always save macros in your own folders, but usually not in other users' folders, although it is possible to load macros from any folder.

Buttons [**LOAD MACRO**] allows to load a macro, [**SAVE MACRO**] allows you to save macros, and [**DELETE MACRO**] allows you to remove existing macros.

It is recommended that you save your Macro with a meaningful file name so that you can easily recognise the content.

1.3.10 Companies and Facilities

Various point sources can be grouped in a Facility, for example, all point sources belonging to the same installation. A facility can also be associated to a company previously defined in **Sub tables -> Companies**. A facility is typically an industrial plant that contains several sources.

1.3.10.1 Company

A facility can be associated to only one company. However, a company can be associated to multiple facilities.

Each company is identified by a unique ID and contains administrative information for the company.

Adding a Company:

- Click on **SUBTABLES -> Companies** in the main menu
- Click on the **[ADD]** button.
- Specify a unique ID for identifying the company. The ID is a string of up to 31 characters. e.g.: The Tax Office ID (RUT) for the Company can be used .

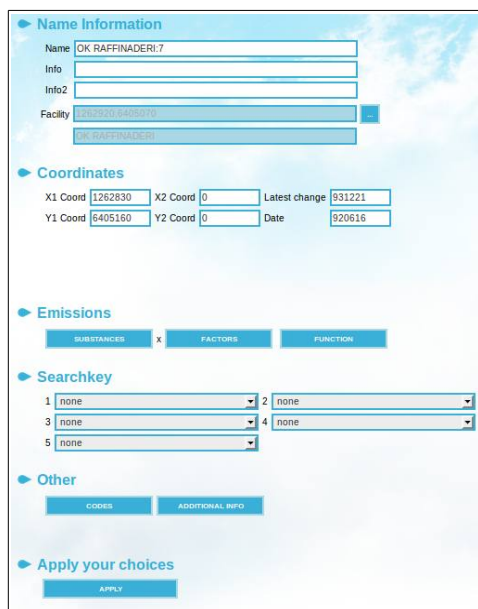
Once an ID has been assigned and the company saved, the ID can not be changed.

- Continue filling in the rest of the fields
- Click on **[ADDITIONAL INFO]** if you want to add complementary information.
- Click on **[APPLY]** to save the company.

1.3.10.2 Adding a facility

Unlike **Companies** which is found under **SUBTABLES**, **Facilities** are found under the menu **SOURCES** To add a facility: :

- Click on the **[ADD]** button.
- Write the name of the facility in the text field **Name**
- Continue filling in the rest of the fields
- **Click on [ADDITIONAL INFO]** if you want to add complementary information.
- You can change the location of the facility manually changing the values X Coordinate, Y Coordinate, or alternatively using the button **[MOVE]** below the facilities list.
- Click on **[APPLY]** to save the facility. (*Figure 1.30.10.3 Facilities.*)



The screenshot shows a web form titled "Source" with several sections:

- Name Information:** Includes text input fields for "Name" (containing "OK RAFFINADERI.7"), "Info", "Info2", and "Facility" (containing "1262830 6405160").
- Coordinates:** Includes input fields for "X1 Coord" (1262830), "X2 Coord" (0), "Y1 Coord" (6405160), "Y2 Coord" (0), "Latest change" (931221), and "Date" (920816).
- Emissions:** A tabbed interface with "SUBSTANCES" selected, showing "x" and "FUNCTION" columns.
- Searchkey:** A table with 5 rows and 2 columns, all containing "none".
- Other:** Includes "CODES" and "ADDITIONAL INFO" buttons.
- Apply your choices:** An "APPLY" button at the bottom.

Figure 1.30.10.1 Source

Emission sources can be added to a facility, either using the facility interface (*Figure 1.30.10.2*) or using the interface for the source type (point or area) you want to associate to

a facility with.(Figure 1.30.10.1 Source)

Facilities

Max. sources: 100
Filter Name:

SELECT ON MAP

- AGA GAS AB
- ALPUS AB
- ANGEREDS VÄRMECENTRUM
- APOTEKSBOLAGET AB
- B A S F SVENSKA AB
- BEROL NOBEL MOLN**
- BILFORUM
- BJÖRNDAHMENS HETV.
- BOSTADS AB POSEIDON
- CHALMERS TEKNISKA H
- CHALMERS VÄRME C
- ENERGIV. ROSEN L GAS
- ENERGIV. ROSEN L OIL
- ENERGIV. RYA_VC_GAS
- ENERGIV. SAVEN AP
- ENERGIV.ROSEN HP1-5
- ENERGIV.RYA_VC_OIL
- ENERGIV.SAV.HVP1/P2
- ENERGIV.SAVEN L HP2

47 facilities of 47 are shown

ADD DELETE MOVE

BEROL NOBEL MOLN.1

ADD POINT ADD AREA
DELETE MOVE

Map mode Edit mode

Name Information

Name: BEROL NOBEL MOLN.1
Info:
Info2:
Facility: 1273730 6400380
BEROL NOBEL MOLN

Coordinates

X1 Coord: 1273730 X2 Coord: 0 Latest change: 140910
Y1 Coord: 6400380 Y2 Coord: 0 Date: 920616

Emissions

SUBSTANCES x FACTORS FUNCTION

Searchkey

1: none 2: none
3: none 4: none
5: none

Other

CODES ADDITIONAL INFO

Apply your choices

APPLY

Figure 1.30.10.2 Linking a Facility to a Point Source

Facility Information

X1 Coord: 1262920
Y1 Coord: 6405070
Name: OK RAFFINADERI
Company: OK RAFFINADERI
Info:
Info2:
Address: Box 23037
Post address: 400 73 Göteborg
Informant: Ist/Gösta Sjönell
Miscellaneous: Fackla

ADDITIONAL INFO

Apply your choices

APPLY

Figure 1.30.10.3 Facilities.

1.3.11 Ships

Maritime transport emits considerable amounts of different air pollutants, therefore it is considered as a particular emission source type with its own user interface . Example of ships: boats, ferries, merchant ships and other ships (cargo ships, sightseeing boats, navy ships , ice-breakers etc.).

Ships can be described as mobile point sources. Normally Airviro is connected to an AIS receiver. AIS is a standard radio protocol used by all ships above 50 tons. AIS messages are sent from the vessel every 30 seconds containing an unique identifier for the ship as well as its coordinates (position) . All these coordinates are stored in the Time Series Database with a time resolution of 5 minutes for each ship.

In the **Ships** interface you can display the ships on the map for a certain period and area. Use **From/To** and **Filter on position**. Ships movements are displayed as trails when you click on a ship in the list. Colours are defined by the system administrator .

To add a ship:

- Click on **Ships** under the **SOURCES** menu, to load the Ships subwindow . *Figure 1.4.1*
- Click on the **[ADD]** button and fill out the data requested (*Figure 1.4.2 Ships*)
- Type in a name in the **Name** text field.
- Input the number IMO and transport number MMSI .
- Select the ship type in the list (searchkeys). For example, fishing, sailing, medical transport and passenger ship.

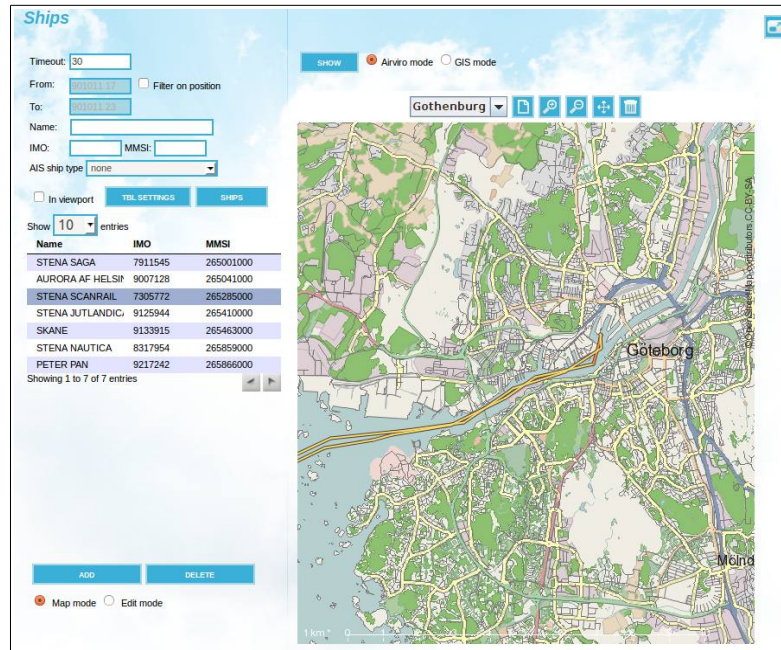


Figure 1.3.11.1 Ships.

Complete the general information, engine properties, miscellaneous properties and other information with the ship data.

In emission activity is used to calculate the emission from emission factors. *Figure 1.4.3.* Press [APPLY] to save the ship.

The screenshot shows the 'Edit mode' for a ship. It is divided into several sections:

- General Info:** Name (STENA SAGA), AIS ship type (60 Passenger ship), IMO (7911545), MMSI (265001000), Design speed [kn] (23.22).
- Properties:**

	Main Engines	Auxiliary Engines
Installed power [kW]	22948	6065
Nr. of engines	4	4
SFOC [g/kWh]	170.88934	220
Usage factor, maneuvering	0.2	0.50
Usage factor, hotelling	0.0	0.20
Usage factor, cruising	0.0	0.20
Max usage factor	1.05	
Load limit	0.85	0.85
- Other:** Created (121113) with 'Chimney' button, Latest change (140514) with 'Additional info' button.
- Emissions:** A button for 'Emission Activity' with an 'x' icon.
- Apply your choices:** An 'Apply' button.

Figure 1.3.11.2. Edit mode . Ships.

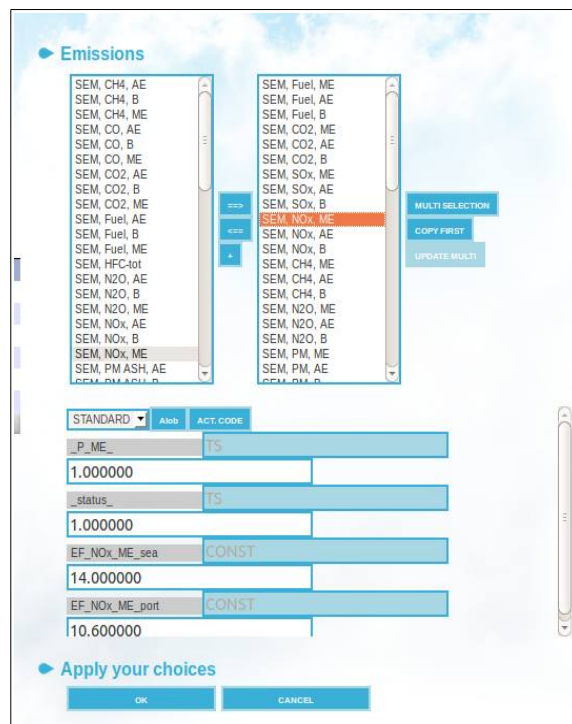


Figura 1.3.11.3. Emission Activity

1.4 Area Sources in the EDB

1.4.1 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 the exact locations of these emissions, so we treat the whole area as a source assuming that the emission is evenly distributed.

Static information (Chimney settings) used for point sources is not required for 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 the simulation time, so that an area source simulation could run faster than a point source simulation, if there are many small point sources. In a simulation, the area source emission is considered to take place at 2 m above the ground and there is no emission velocity.

1.4.2 General Principles

The general principles are the same as for point sources. In EDB you can define an area source as a rectangle. Adding an area source in the database is like adding a point source, but instead of clicking on a point you must define an area by dragging the mouse pointer over the map.

Likewise, emissions can also be defined using an Indico macro previously defined in Indico Presentation, you can save the **Search Criteria** and **Output Settings** as macros, and use **Emission factor**, **Emission Functions**, etc. in the same way you do for point sources.

1.5 Grid Layers in the EDB

1.5.1 What is a Grid Layer?

A grid layer in the EDB is a collection of area sources spread over a larger area. These sources are grouped into a grid layer. A typical example is household heating: it is often possible to estimate the amount of fuel that is consumed in each area of a city. From this information it is 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, including the emissions, is stored for each grid cell.

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:

- Higher calculation speed.
- Lower disc space requirements , often quite dramatically.
- Simpler import format for grid sources than for area sources.

1.5.2 General Principles

A grid layer can only be created from the grid ASCII interface, a shape file or **Wedbed**. The geographical information about the grid, the specific data for each grid cell and the common information are used as an input to generate the grid.

The input menu for the grid layers is similar to those for area sources but only the common information of the grid layer can be modified. The emission from a grid layer must be

specified as substances or Emission Factor.

Once you have created the grid files using griddb command in linux, **Wedbed** in excel or **IMPORT GRID FROM SHAPE** in **EDB**(see section 1.2.2), click on **Edb -> Grids**, to open the Grid editing window to modify any grid common data (*Figure 1.5.2.1. Grid Sources*).

The screenshot shows the 'Grids' editing window. It has a title bar 'Grids' and a main content area. On the left, there is a vertical scrollable list box labeled 'Grids'. The right side contains several sections:

- Name Information:** Name (Text), Info, Info2.
- Grid Information:** Area (1230000.6245000), Grids (30 88).
- Emission:** Substance (NOx), Searchkey 1-5 (all none), Formula (STANDARD).
- General:** Address, Post address, Informant (Energdata), Miscellaneous, Date (0).

At the bottom, there are 'CANCEL' and 'APPLY' buttons, and a section 'Apply your choices' with an 'APPLY' button.

Figure 1.5.2.1. Grid Sources

1.6 Traffic Emissions in EDB

1.6.1 What is a Road source?

A road source is a mathematical abstraction that does not exist in reality. When we talk about road sources we usually mean emissions generated by traffic. Every vehicle that travels on a road is more or less like a point source, although we can never locate or follow any individual vehicle. For an EDB user it is quite convenient to define the traffic travelling along a road by simply drawing a line on the map.

In urban areas, the major part of the air pollution is generated by road traffic emissions. Consequently, the quality of the work related to traffic emission data is the most crucial part in building an EDB. However, the number of roads and vehicles in a large city is so huge that we need to make some simplifications to be able to handle the data. Below you will find a description of Airviro's traffic emission data processing principles. The method described here can be refined however, it is still very efficient in terms of the manpower required to set up a traffic emission database for a large urban region.

1.6.2 General Principles

Choose the location of a road on the map/screen interactively.

Once the location of the road has been set, information on traffic speed, traffic intensity and variation, as well as information on the types and number of vehicles travelling on that road must be provided.

Select a simplified "Simple" speed, to use just one speed for all traffic situations, or a more complex "multiple" speeds to use different speeds for different types of vehicles, that is

between light and heavy vehicles, and different traffic situations such as free flowing, heavy traffic, congested and stop & go.

There are three alternative ways to define traffic on a road. These are:

- **Road Vehicles:** the percentage of vehicles and the time variation of the vehicles are defined for each road. However, when the traffic behaviour is similar on several roads Road types is easier to use.

- **Road types:** the traffic variation as well as percentages of different vehicles on a road can be defined and reused for any number of roads. A 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 can simplify your work by addressing the information found in the **Road type** sub table. The emission factors for all vehicles are defined in the **Vehicle** sub table. These emission factors are then used to define **Road types** in the **Road type** sub table. In order to simulate traffic emissions you will likely have to define 5 to 25 different emission tables in the Roads **Vehicle** sub table.

- **Emission:** emission factors for substances emitted and the time variation are defined for each road.

The typical amount of traffic information that you will need to provide to describe traffic emissions in a large city is:

- **Roads:** 500-1000 roads or road links
- **Road types:** 10-25 different road types
- **Road Vehicles:** 5-25 tables with emission factors from different vehicles.

To open the Road interface, click on **Source** -> **Roads** in the EDB main menu.

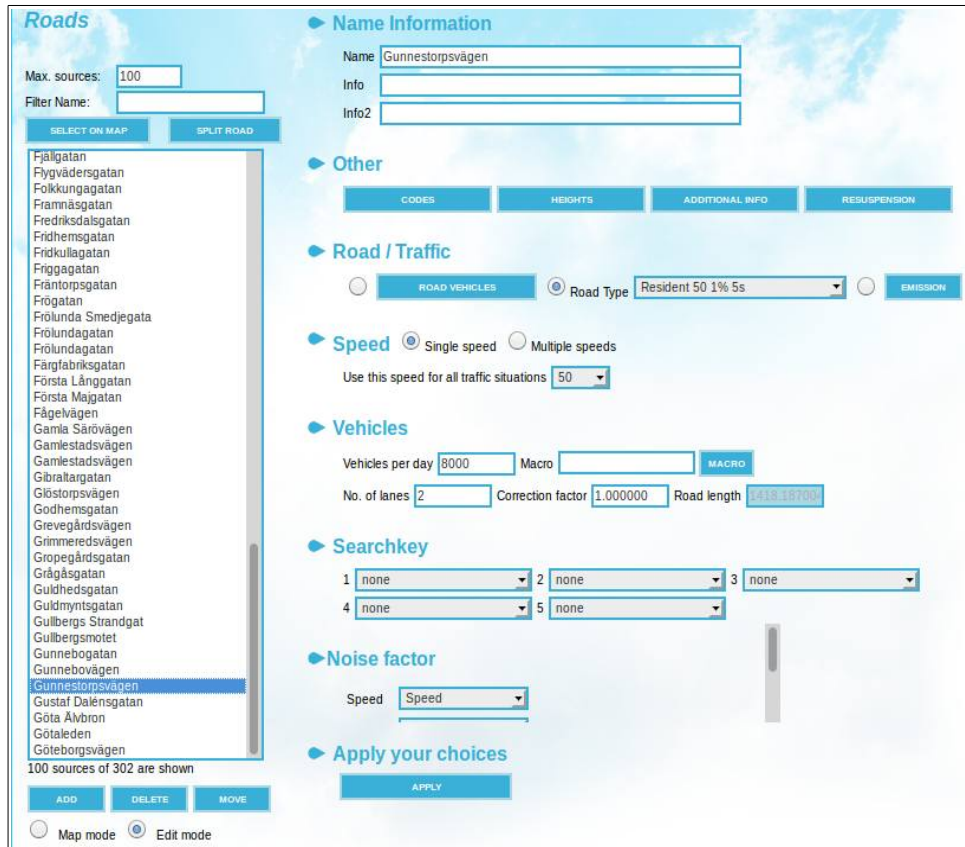


Figure 1.6.2.1 Roads

For noise calculations, noise factors can be specified. These factors depend on the noise emission selected, but typical parameters are: vehicle speed, percentage of heavy vehicles, gradient and surface type(for example, bitumen and concrete)

The following table shows the relationships between Road, Road Type and Vehicle.

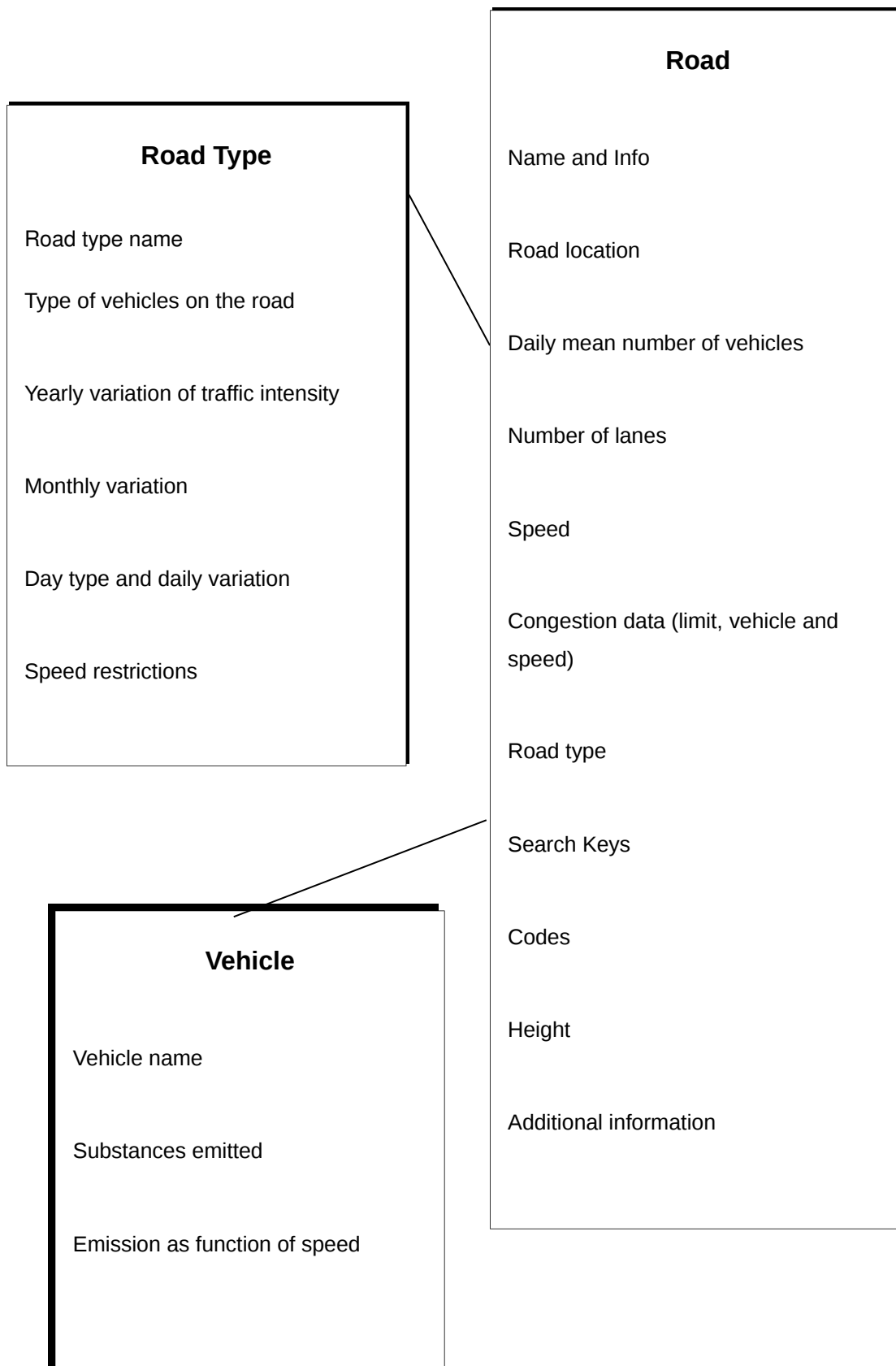


Figure 1.6.2.2 Relation between Road, Road Type and Vehicle.

When using Road Vehicles the emission factors are defined in the Road Vehicle. The emission factors for Road Vehicles are not only dependent on the vehicle type and speed but can depend on up to 11 different variables such as road type, traffic situation, slope, sinuosity etc. When using Road Vehicles the factors and their possible values are specified when defining the emission model. Then the emission factors are specified for all possible combinations of variables for each vehicle. Instead of having a table with emission factors for speeds we will have a multi dimensional cube, where the number of dimensions are the same as the number of variables. The vehicles are referred directly from the road and the percentage of each vehicle on that road is specified as well as time variations. The values of the variables are specified directly on the road.

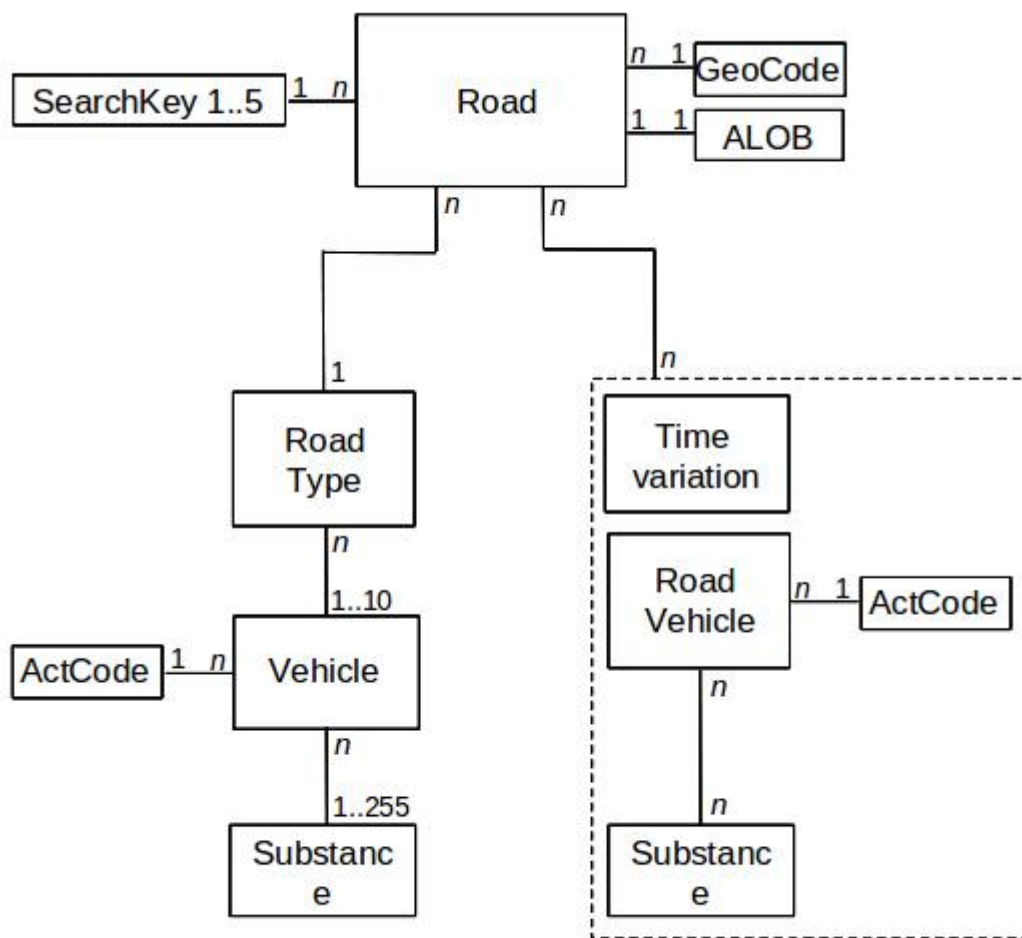


Figure 1.6.2.3 Structure of the road database describing the two emission models.

1.6.3 Introducing Emission Factors for Vehicles

Vehicle emissions depend mainly on:

- Type of vehicle, classified according to the engine type, fuel used, weight class, ambient temperature and types of pavement .
- Driving behaviour and general traffic environment.
- Vehicle travel speed

In many countries, emission factors have been obtained based on the above factors . You can include these in the EDB. Predefined emission factors are included in the **Vehicle** sub table in the Airviro Reference database. The emission factors are basically derived based on:

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

To include the driving pattern, separate emission factors must be given for various traffic situations since, for instance, vehicles circulating in the city centre tend to accelerate and decelerate more often than those on a highway. The name "**Lv cat tho 50 10s**" given to one of the vehicles types in the aforementioned sub table is a kind of acronym which indicates the emission factors for light vehicles (**lv**) equipped with catalytic converters (**cat**), travelling on a through-road (**tho**), maximum speed limit: 50 km/hour (**50**), and making 10 stops or turns/km (**10s**).

The structure of the road types and vehicle types is based on the Swedish VETO model, this is the model used here as a typical example. There are other models not exactly the same, but you should be able to adapt the EDB to these other traffic models when

defining 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 emissions due to low temperatures in the combustion process (cold start), etc.

Go to the **Vehicles** edit window by clicking on **SUBTABLES -> Vehicles** in the main menu

The list box on the left lists all the predefined emission factors in the Reference database. To edit one of the vehicle types, simply select the vehicle name in the list box. To define a new vehicle type and its corresponding emission factors, click on the **[ADD]** button below the listbox. Assign a name to the new vehicle and add the emitted substances by selecting them on the **Substance** list and then pressing the **[==>]** arrow button to copy the selection to the **Selected** listbox, hold down the [ctrl] key for multiple selections. Assign the emission factors to the selected substances, and press **[APPLY]** to save your new vehicle type.

To edit or add emission factors to each one of the substances selected based on the vehicle speeds you must click on the substance names in the Selected listbox in order to enable the **Speed table** for editing the emission factors depending on the vehicle speeds.

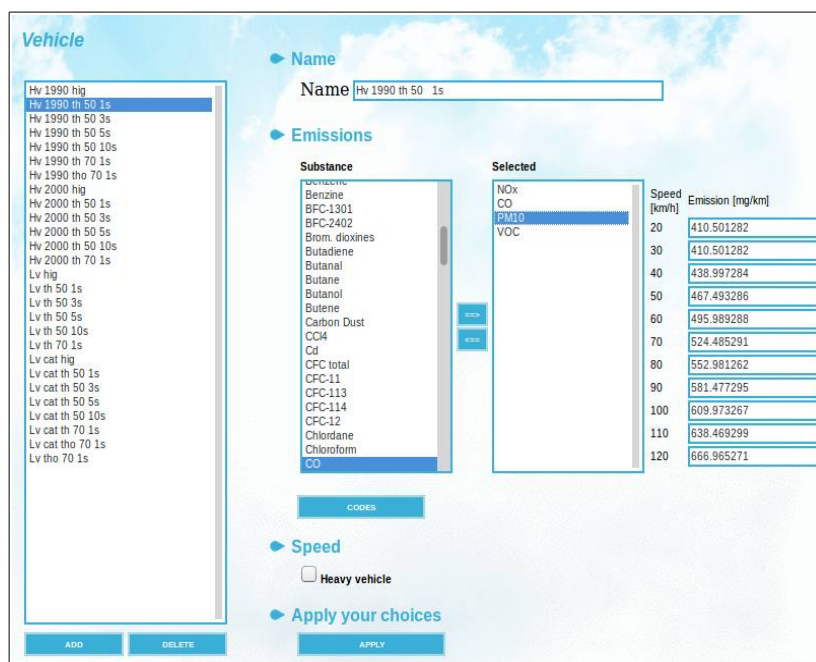


Figure 1.6.3.1 Vehicles

In the example here shown (*Figure 1.6.3.1*), the vehicle **Hv 1990 tho 50 1s** is selected. The table of emissions as a function of the speed will appear once you select one of the substances in the **Selected** listbox as illustrated in the figure. You can edit the table and save your changes by clicking on **[APPLY]**.

1.6.4 Standard for Naming Emission Factors

As soon as you start working with **Road types**, you will realise the need to have a naming convention to link different emission factors to the corresponding **Road types**. In the model used in the Airviro Reference database, the name assigned to the emission factors is defined by its characteristics: vehicle type and traffic environment, i.e. the emission factors are named as follows:

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

1.6.5 Introducing Road Types

In order to simulate the emissions generated by traffic at a specific time, 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 each road and street

in an urban region. In EDB it is assumed that typical traffic behaviour can be categorised into classes called **Road types**. These classes 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 and types of traffic)
- Hourly variation
- Speed restrictions

To add or edit a road type, go to **SUBTABLES -> Road types**. To edit an existing road type, select one from the list box to the left. To add a new **Road type**, click on the **[ADD]** button, at the bottom of the listbox and enter a name for the new road type in the **Name** input field. The next step is to define the type of vehicles that travel on this road type. Select the appropriate vehicles from the **Vehicles** list box on the right side. To define the vehicle percentages click on **[SCENARIO]**.

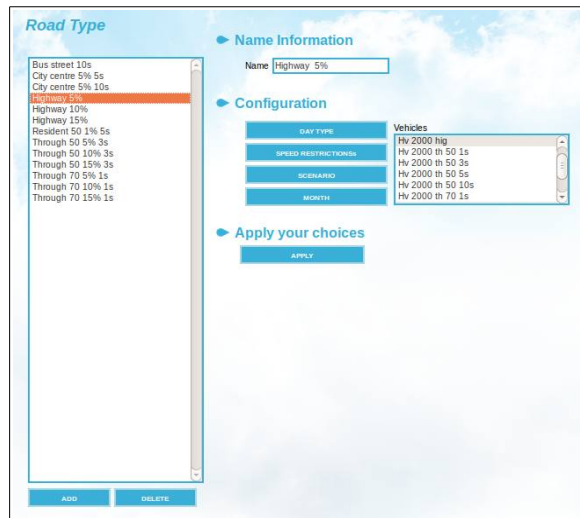


Figure 1.6.5.1 Road Type

In **Scenario** you have to assign the percentages for each vehicle types and year. You can define the expected percentages for up to 10 different years or scenarios. This table is basically the same as the **Scenario** table in the Time Variation Road sub table, i.e. these values 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 values assigned to a **Road type** can be used to forecast future changes in traffic intensity, vehicle percentages and accordingly, future emissions caused by traffic. Click on **[OK]** button to confirm these values and go back to the previous window.

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

As for the annual variation; to define monthly variations, click on the **[Month]** button. Note that this table is similar to the **Month** table in the **Time Variation Point** sub table, i.e. all figures are relative and will be normalised when used. Click on **[OK]** button to confirm these values and go back to the previous window.

To define hourly traffic variation, click on the **[DAY TYPE]** button. The principles here are

similar to those for **Day type** table in the **Time Variation Point** sub table.

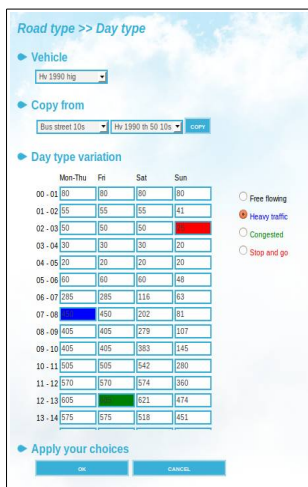


Figure 1.6.5.2 Road type -Day type

Select one of the vehicles (Figure 1.6.5.2) from the **Vehicles** combo box and fill in the hourly traffic variations . Please note that the figures are relative, i.e. they will be normalised .

It is also possible to assign a type of traffic to the hours of the day. The type of traffic is used to select alternative emission factors. The type of traffic is indicated by the colour of the text box corresponding to each hour. The radio buttons on the right side of the table are used to assign or change the type of traffic for the selected cell in the table (focus on it). White indicates Free flowing, Blue Heavy traffic, Green Congested and Red Stop and Go.

Click on **[OK]** button to confirm these values and go back to the previous window.



Figure 1.6.5.3 Speed restrictions

Finally, define speed restrictions for each type of vehicles defined on the Road type. Click on **[SPEED RESTRICTIONS]** to open this sub window, and assign a minimum and a maximum speed limit to each type of vehicle. This feature is very useful if you want to differentiate the speeds between heavy and light vehicles. Click on **[OK]** button to confirm these settings and go back to the previous window.

1.6.6 Introducing Time Variations for Roads

Time Variation for Road sources is similar to time variation for Points sources. It is used to define the time variation for a Road Vehicle. The main difference is that it is possible to define the type of traffic for each hour of the day in the same way as for a Road Type.

The screenshot shows the 'Time Variation Road' window with the 'Day type variation' section. The table below shows the current configuration for each hour of the day across different days of the week.

Hour	Mon-Thu	Fri	Sat	Sun
00 - 01	100	100	100	100
01 - 02	100	100	100	100
02 - 03	100	100	100	100
03 - 04	100	100	100	100
04 - 05	100	100	100	100
05 - 06	100	100	100	100
06 - 07	100	100	100	100
07 - 08	100	100	100	100
08 - 09	100	100	100	100
09 - 10	100	100	100	100
10 - 11	100	100	100	100
11 - 12	100	100	100	100
12 - 13	100	100	100	100
13 - 14	100	100	100	100
14 - 15	100	100	100	100
15 - 16	100	100	100	100
16 - 17	100	100	100	100
17 - 18	100	100	100	100
18 - 19	100	100	100	100
19 - 20	100	100	100	100

Figure 1.6.6.1 Day type for Time Variation Road

1.6.7 Introducing Emission Factors for Road Vehicles

Emission factors for ordinary vehicles solely depend on the speed. Emission factors for

Road Vehicle can depend on up to 11 different factors.

These factors are defined in **BASIC SETTINGS ->Road Vehicle Def.**

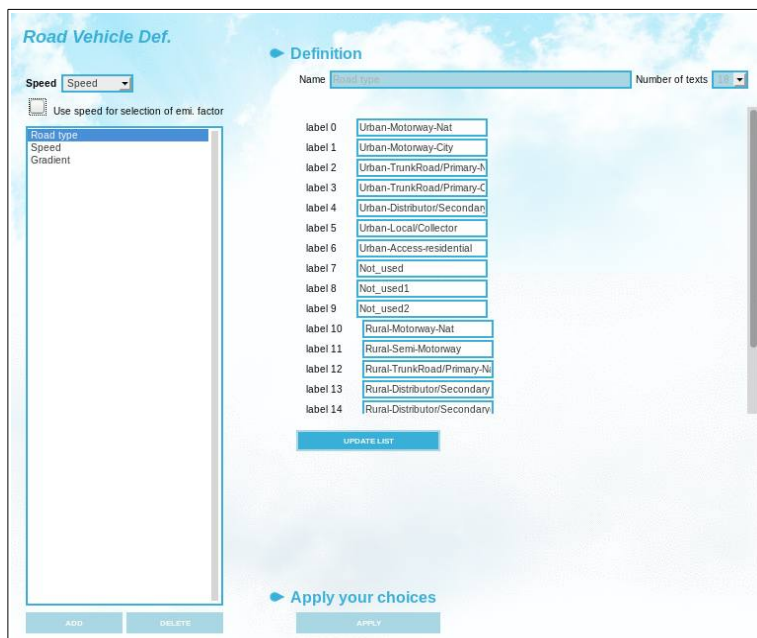


Figure 1.6.7.1 Road Vehicle Def.

In the picture above three factors has been defined: Road type, Speed and Gradient. The factor Road type has 18 possible values. In this case the emission factors are a three-dimensional cube.

So, emission factors have to be defined for each cell in the cube, that is for all possible combinations of the three factors.

Definition

Name: car petrol CODES

Heavy Traffic Emission Model: Normal

Weight: 0 Flow: 0.000000

Info:

Emission factors

NO2 Urban-Motorway-Nat 90 0 43.171 26.759 53.719 50.88
NO2 Urban-Motorway-Nat 110 0 65.589 43.645 53.395 52.839
NO2 Urban-Motorway-Nat 120 0 81.444 41.234 53.395 52.839
NO2 Urban-Motorway-City 60 0 26.453 53.409 52.332 50.88
NO2 Urban-Motorway-City 70 0 34.259 48.969 53.776 50.88
NO2 Urban-Motorway-City 90 0 41.666 25.029 53.395 50.88
NO2 Urban-Motorway-City 110 0 63.262 41.234 53.395 52.839
NO2 Urban-TrunkRoad/Primary-Nat. 70 0 33.788 48.871 54.107 51.584
NO2 Urban-TrunkRoad/Primary-Nat. 90 0 42.197 53.24 54.107 51.584
NO2 Urban-TrunkRoad/Primary-Nat. 110 0 63.734 41.711 54.107 53.597
NO2 Urban-TrunkRoad/Primary-City 50 0 27.793 54.842 45.028 61.633
NO2 Urban-TrunkRoad/Primary-City 70 0 34.759 48.871 54.107 51.584
NO2 Urban-TrunkRoad/Primary-City 90 0 42.984 53.24 54.107 51.584
NO2 Urban-Distributed/Secondary 50 0 25.948 36.754 50.563 61.633

ADD UPDATE DELETE SHOW ALL

substance: NO2

Road: Urban-Motorway-Nat

Speed: 90

Gradient: 0

EmiFac 1 [mg/Kg]: 43.171

EmiFac 2 [mg/Kg]: 26.759

EmiFac 3 [mg/Kg]: 53.719

EmiFac 4 [mg/Kg]: 50.88

Apply your choices

APPLY

Figure 1.6.7.2 Road Vehicles

Factors are defined for 4 types of traffic. Normal, Heavy traffic, Congested and Stop and go. Which emission factor should be used, free flowing, or heavy traffic or ,congested, or stop and go, is defined in the hourly time variation in Time Variation Road.

Activity codes can be selected from the tree view after pressing the **[Codes]** button. It is also possible to define if the vehicle is heavy or not using the **Heavy** check box. This setting is used by the OSPM model in the Dispersion module. Some vehicles do not generate traffic flow. Usually, the additional emission from cold start vehicles is defined as an additional, fictitious vehicle. This can be configured using the **Traffic** check box. Airviro has several alternative emission models available. These are not described here and the traffic model selected should be "Normal". Vehicle weight can be specified to be used with US EPA Resuspension model, on the other hand, MODEM IV & MODEM V models use the Flow value to adjust the flow, NORMAL model do not use any of these two values. For each combination of factors and substance, emission factors must be entered for each of the four types of traffic.

1.6.8 Introducing Traffic Information in the EDB

Once 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. Select **SOURCES** and **Road** from the main menu, then click on **[SELECT ON MAP]**, and select an area using the mouse pointer and the [ctrl] key as already explained (see section 1.2.6). The list box on the left will list all the roads within the selected area . Clicking on the name of a road in the list, its location will be displayed on the map. To add a new road, click on the **[ADD]** button below the listbox and move the mouse pointer over the map area to the desired location for the starting point of your new road. Click on the left mouse button. Move the mouse pointer to the next position of your road and click on the left mouse button again, a blue line will stretch between these two points. Repeat this until you have defined the whole length of the road . Then click the middle mouse button (escape) or right mouse button. The edit Road sub window (*Figure 1.6.8.1 Roads*) will replace the map and you can start filling in the required information.

Figure 1.6.8.1 Roads

Write the name of the road in the **Name** input field, use **Info** and **Info2** input fields for

adding additional information. Fill in the total number of **Vehicles per day** (this should be the yearly mean traffic for a day). Enter **Number of lanes** , although this field is not currently used. You may also assign a **Correction factor**, by which the **Vehicles per day** is always multiplied. This factor should be set to 1 (default value) if you do not want to apply any correction . If there are traffic flows defined as time series in Indico Presentation, these can be linked to the road using an Indico macro. In this case, the flow will then be read from the time series database, hour by hour and the fixed value entered in **Vehicles per day** will be disregarded.

As already explained (section 1.6.2), emissions from road sources can be described in three different ways. 1) Road Types are used: Select the appropriate road type from the **Road type** list. The hours of the day which have alternative driving patterns are defined in the Road Type. Then select the typical speed for the road using the option single speed, alternatively use the option multiple speeds for heavy traffic, congested and stop and go .

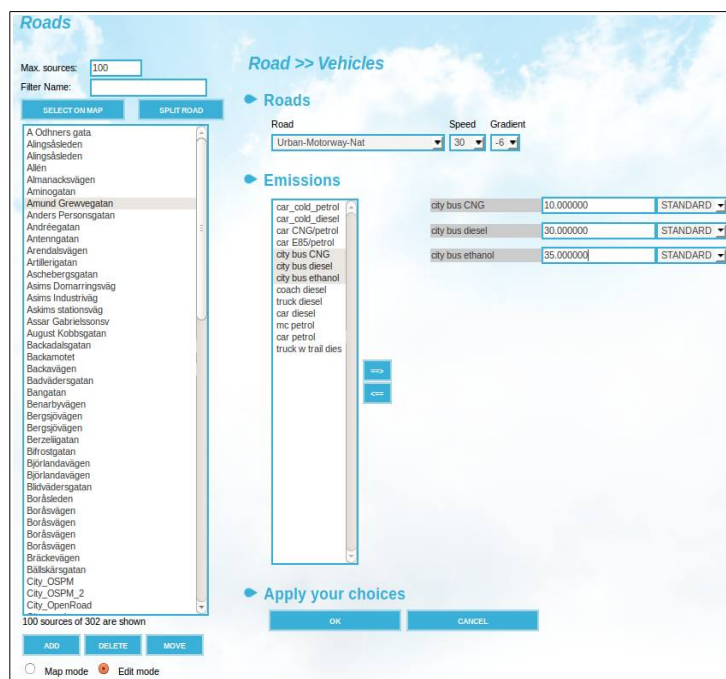


Figure 1.6.8.2 Road using Road vehicles.

2) Road vehicles are used: press the [**ROAD VEHICLE**] button to open the window

depicted in *Figure 1.6.8.2* . Select the appropriate road vehicle factors from the drop down lists (see section 1.6.7). Select the appropriate road vehicles for the road, then specify their percentage of traffic and select a monthly/daily distribution (time variation). Hold down the [ctrl] key and the press the [==>] arrow button for multiple selections.

3) Emission is used: press the [**EMISSION**] button to open this window. Select the appropriate substances and add them to your selection pressing the [ADD TO EMISSION] button. then specify their emission factors and a monthly/daily distribution (time variation) from the drop down list.

Select suitable search keys from the drop down lists and a geographic code from the tree view in **CODES** as you did for point sources. Remember all these lists are defined in **BASIC SETTINGS**.

Press the button [**HEIGHT**] to include complementary information about surrounding buildings (slope, distance to house, house width and house height) and [**ADDITIONAL INFO**] to include additional information as already explained for point sources.

Finally, if the EDB has been configured for noise calculations, noise factors can be specified. These factors depend on the noise emission chosen but typical parameters are: vehicle speed, percentage of heavy goods vehicles, gradient and type of the surface (e.g. bitumen, concrete and porous asphalt).

Save your road settings by clicking on the [**APPLY**] button.

1.6.9 Emission Calculation with Road Sources and Restrictions

Emission simulations based on road sources are identical to those from point sources as described in *1.3.6 Emission Simulation from a Point Source*, for a detailed explanation. However, there are certain features unique to road emissions, as can be seen under the

SEARCH CRITERIA menu, in the Emission sub-window below.

Figure 1.6.9.1 Search Criteria.

To simulate only road emissions, in the section Sources tick off **ROAD** and uncheck the others checkboxes. Then only road sources will be included in the search.

Specific **ROAD** restrictions can be seen in *Figure 1.6.9.2 Roads Restriction*.

Figure 1.6.9.2 Roads Restriction

You can select up to 10 **Road type** restrictions and up to 10 **Vehicle** types. There are no limitations to the number of **Speed** that can be selected. (see *1.3.8 Using Search Keys and Pattern Matching Facilities as Search Conditions*).

In addition, you can change the speed by assigning a **New Speed**. For example: If you have selected all roads having a speed limit of 90 and then select a new speed of 70, then all roads defined as 90-roads will be selected but the emission will be calculated using a speed of 70.

1.6.10 Examples: traffic emission

Example 1 Traffic Emission – Road vehicles

Using the EDB menu, verify that the edb globcopy, which already contains several road vehicles is installed in your system. These road vehicles has three dimensions: Road type, Gradient and Speed. We will copy the road vehicles to a new empty EDB, create a time variation for roads and then add a road using those road vehicles.

Steps:

1. First create a new empty EDB, called RoadV

Using the menu Edb select the user airviro and then the edb named globcopy, press the button [**Add new empty**], enter a name for the new Edb and press [**OK**]. The new empty EDB has been created.

2. Use Wedbed to copy the road vehicles already defined in the edb "globcopy" from Domain REF to your newly created edb:

Open an empty sheet in ms Excel and from the control panel select the menu

“Complements”. Then select the **Wedbed** menu, configure the correct IP address to the Airviro server in the **Host** menu, select the menu **Import EDB to Excel**, and copy only the structure from the globcopy EDB to the excel spreadsheet.

Then using the menu **Export EDB from Excel**, copy the EDB structure to your newly created edb RoadV.

3 .Now we need to create a Time Variation Road:

Using the menu **Time Variation Road** under **SUBTABLES** add a new one containing the following settings: stops and go from 8-9 am, all normal week days.

Finally we need to add a Road:

Using the **SOURCES** menu. Select **Road** and Add a new one named “TrainingRoad”, press the button [**Road Vehicles**] to add the following vehicles to the new road.

92% cars-petrol

1% Motorcycles

7% Buses.

Questions:

5 a) Which is the average NOx emission during week days?

Enter the following:

Substance: NOx

Time: Hours: (All)

Day type: (All)

Months: All months

Click on [**Apply**] and select an **Output** option from the menu (MAP, PDF, Text). The answer should be 7.03 Ton/Year

4b) Which is the average for NOx between 8-9 AM during week days?

Substance: NOx

Time: Hours 8-9

Day types: (All)

Months: All months

The answer should be 11.37 Ton/Year. Because cars emits more NOx when they stop more frequently.

1.7 Emissions Displayed as a Grid

In previous examples, emissions have been estimated and presented as values located at each individual source on the map and added up for the visible area displayed. In several applications, you might be interested to see the spatial distribution of emissions that point out to hot spots. EDB provides you with the possibility of defining a grid in which all sources located in each grid cell are added up and displayed with a colour code.

To display emissions as a coloured grid select the **GRID** tab in the **Output Settings** subwindow.

Intensity values range from -100 (black) to +100 (white), moving in the RGB values. Use **Color Fade** to reduce the colours in grayscale. **Colour fade** values range from -100 (grey) to +100 (very grey).

There are two different ways to define the grid resolution. Tick off the **Grid size/Number of cells** check button to define the length of the grid in the east-west direction (**dx**) and north-south direction (**dy**). These figures are given in metrical units. Uncheck the **Grid size/Number of cells** check button to define the numbers of grid squares in the east-west direction (**nX**) and north-south direction (**nY**). The grid size will now be determined by the size of the map area that you have chosen.

Using the colour palette and the colour table, define the number of levels, colours and emission intervals corresponding to the emissions per area unit. Colour intervals values can be integers or floats. Click on the coloured table cell to choose a colour from the colour palette. See *Figure 1.7.1*.

Use buttons [**COLOUR AUTO RANGE**], and [**LEVEL AUTO RANGE**] to automatically set the scale for both items. Use button [**COLOUR RAINBOW RANGE**] to automatically

set the rainbow scale.

Click on **[APPLY]** to save your settings.

If you set your resolution to 50x50 m and do a search for road emissions, then you will get a road map, displaying the roads in different colours depending on the traffic emissions.

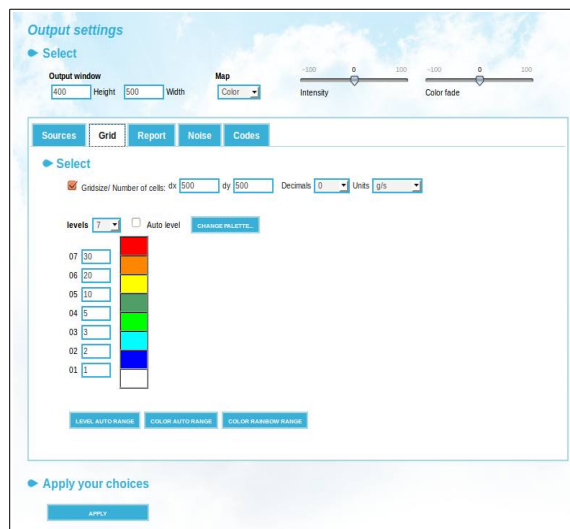


Figure 1.7.1 Output Settings: Grid

1.8 Creating EDB Reports and displaying the Database Structures

EDB contains many different tables. Summaries of these tables, along with the substance list and searchkey lists can be printed.

It is also possible to create reports containing different information about the sources stored in the EDB.

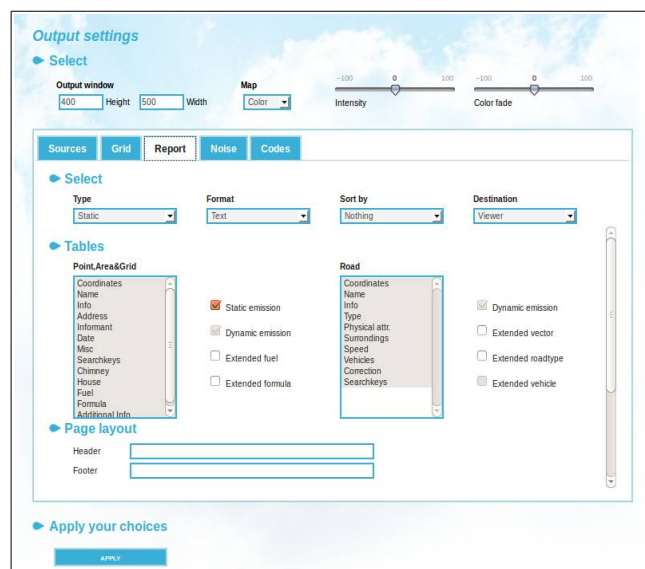


Figure 1.8.1 Output Settings: Report.

To display emissions as reports select the **REPORT** tab in the **Output Settings** subwindow. Select the characteristics of the sources (point, area, grid and road) to be included in the report.

There are two types of reports: **static** and **dynamic**. **Static** reports can only be displayed in **Text** format. **Dynamic** reports also include the calculated emission and can be displayed 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). Other available formats are **Shape**, **ESRI Grid** and **NETCDF Grid**

For text , SKV and Shape formats it is possible to select what information from the sources should be included in the report . See the lists in section **Tables**, in the middle part of the window.

Select a **Destination** for your report from the available options in the **Destination** dropdown list . If you select the option **File** then a **File name** must be entered. The report will be saved in a file Under **Page layout** specify a header and footer for each page and select whether to print each record on a new page, print empty fields, and search conditions ticking off the corresponding checkboxes.

Some format options allow you to select a **Filter** to the output.

The following is an example of the SKV output, generally quite suitable for exporting data to other applications.

```
"X1";"Y1";"X2";"Y2";"Name";"g/s";  
1280000;6410300;0;0;"ANGEREDS VÏRMECENTRUM";0.221816;  
1273730;6400380;0;0;"BEROL NOBEL MÏLN:1";0.0982328;  
1280250;6406300;0;0;"BJÏRNDAMMENS HETV.";0.348568;  
1271750;6402500;0;0;"CHALMERS VÏRMEC:1";0.126752;  
1271751;6402501;0;0;"CHALMERS VÏRMEC:2";0.31688;  
1274000;6399950;0;0;"ERICSSON RADAR:1";0.131505;  
1276540;6406970;0;0;"GRAAB SÏVENÏS";17.3016;  
1268600;6401600;0;0;"GÏTEBORGS STADS BOS";3.1688;  
1270430;6397410;0;0;"HEDLUNDS PAPPER:1";0.00507008;  
1268550;6399350;0;0;"MARCONICENTRALEN";2.24985;  
1280800;6398900;0;0;"MÏLNLYCKE:1";0.522852;
```

Figure 1.8.2 SKV output.

1.9 Creating Noise Reports

To display noise emission reports select the **NOISE** tab in the **Output Settings** subwindow.

Settings for this option are similar to those already described in *1.7 Emissions Displayed as a Grid*. We refer you to that section for a detailed explanation.

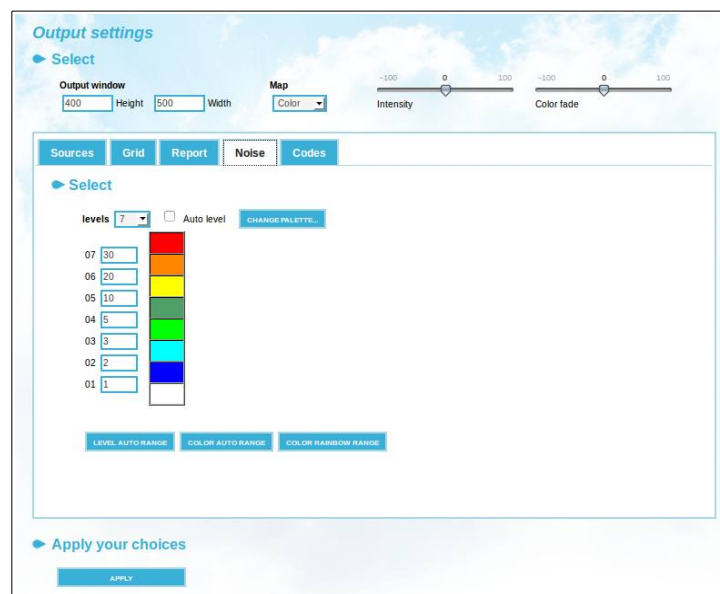


Figure 1.9.1 Output Settings: Noise

1.10 Creating Code Reports

To display emission code reports select the **NOISE** tab in the **Output Settings** subwindow.

Select units and the activity and/or geographic codes from the lists.

When done, click on **[APPLY]** button .

From the main menu, use the **OUTPUT** option Text to display the results

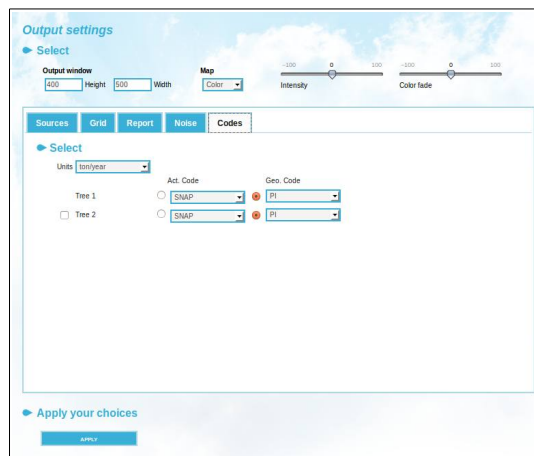


Figure 1.9.2 Output Settings: Codes

Appendix 1A: Suggested Substance List

1A.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 ₂ O	8
Gaseous Sulphur Compounds		
Sulphur dioxide	SO ₂	15
Sulphuric acid	H ₂ SO ₄	16
Sulphur trioxide	SO ₃	17
Hydrogen sulphide	H ₂ S	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 ₂ O ₂	32

1A.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

1A.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

1A.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	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	

1A.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 ₂ H ₂ F ₂)	HFC-134a	203
Bromium-chlorine-fluorine carbons (Halons):		
Completely halogenated halons	Halons total	210
(= CF ₂ ClBr)	BCFC-1211	211
(= CF ₃ Br)	BFC-1301	212
(=C ₂ F ₂ Br ₂)	BFC-2402	213
Incompletely halogenated halons (=CHF ₂ Br)	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

1A.6 Others (250-)

Number of vehicle kilometres	vekm	250
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Appendix 1B: Mathematical Definitions of the Formulae Used in the EDB

1B.1 Point, Area and Grid Source Emissions

In Airviro EDB, emissions are usually calculated as a function of the hour, day, weekday, month. Emissions can also be calculated using an arithmetic and logical function that depends on any number of variables. Finally, the emission can be calculated using a time series macro from Indico, i.e. using a number of time series that are combined with arithmetic and logical functions.

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
E_0	= mean emission during the year (g/s)
func(V1,...Vx)	= a function with x variables. The variables can be constant or they can vary with the time variation in a Time Variation Point. In that case the time variation is not normalized.
$E(h,dty,m,s)$	= 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 normalized.

TabM(m) and TabD(dty,h) are the tables defined in the EDB Time Variation Point that define the variation for months, for all hours of the day and all day types. TabS(s) is the table that defines the variation with scenarios. This table is not normalized.

A normalization constant k is calculated in order to fulfil the following condition :

$$k \times \frac{1}{12} \sum_m TabM(m) \times \frac{1}{24} \sum_h \sum_{dty} w(dty) \times TabD(dty, h) = 1 \quad (\text{eq B1.1})$$

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

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

$$E(h, dty, m, s, V_1, \dots, V_x) = func(V_1 \times Amp, \dots, V_x \times Amp) \quad (\text{B1.3})$$

$$\text{where } Amp = TabS(s) \times TabM(m) \times [TabD(dty, h)] \quad (\text{eq B1.4})$$

The variables V_1, \dots, V_x might or might not be variable with time, ie $V(t)$. This is decided when the function is defined. The Time Variation is not normalized, all the numbers in the Time Variation are treated as percentages.

Equation B1.3 can represent an upper emission limit constraint. If you describe the emission as originated from an oil-burning power plant, then the energy production rate and consequently the emissions will depend on the load. There is, however, an upper limit to the production rate, given 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 **Emission Activity**.*

In equation B1.2 there is no such a 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 $TabM$, $TabD$ 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 Emission Factors)** and yearly emission figures.*

Consequently, equation B1.2 allows you to describe a scenario in which all pollutants generated from a source are concentrated within a few hours.

1B.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 $m = \{1, 2, \dots, 12\}$
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 that give 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 normalization constant **k(v)** is calculated in order to fulfil the following condition :

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

The emission for a road is then calculated as:

$$E(\text{speed}, h, dty, m, s) = \text{corr} \times n \times 1 \times \sum_v (\text{TabS}(s,v)) \text{TabR}(\text{speed}, v) \times k(v) \text{TabM}(m,v) \times \text{TabD}(dty,h,v) \quad (\text{eq B2.2})$$

Four speeds are defined for each road: Free flowing, heavy traffic, congested and stop and go. In the daily time variation it is specified, hour by hour, which of these speeds should be used.

1B.3 Normalisation of Time variations in an EDB

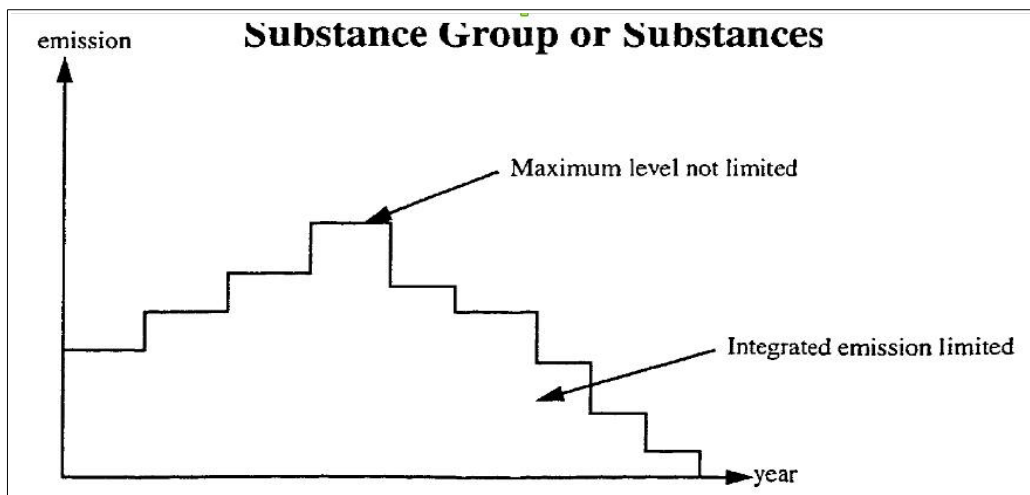
Normalisation is needed whenever emission data is given as a total yearly emission, that is, for emission factors and for substances emitted from point sources, area sources and traffic . The normalisation guarantees that the yearly emission will always be exactly the one specified, despite the emission variations over 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

A total average emission E_0 is given for the whole year. If the emission is generated evenly

throughout the whole year then the emission per second will be E_0 . However if the emission is generated 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.



The most common emission specification is one where a yearly average emission is specified.

When emissions are described by an emission function there will be no normalization. All variations specified in the tables will be interpreted as absolute percentage values.

Appendix 1D: Wedbed

1D.1 Introduction

1.D1.1 What is Wedbed?

Wedbed is a tool that integrates the Airviro emission database into MS Excel®. With **Wedbed** the following tasks can be easily performed:

- Wedbed allows you to use the whole power of MS Excel® with data from the fast and compact emission database of Airviro.
- With Wedbed it is easier to edit data. You just export the data to MS Excel®, make the changes there and import the data back to Airviro.
- Once you have the data in your MS Excel® workbook, you can either use the excellent reporting features of MS Excel® or easily cut and paste the data to other reporting tools.
- With Wedbed you can store an emission database in your PC as an MS Excel® workbook.
- With Wedbed you can make an extensive consistency check on the loaded emission database.

1.D1.2 How does it work?

Dialogs for Airviro emission database access are added to the MS Excel® interface. Just choose import or export, select an emission database in Airviro and the transfer will take place instantly. The transfer of data between MS Excel and Airviro is done directly through internet or the local area network.

1.D.2.Overview and definitions

With Wedbed emission databases can be imported to MS Excel® from Airviro or exported to Airviro from MS Excel®. Each table or grid in the Airviro emission database is stored in separate sheet in MS Excel®. All the information from an emission database is stored in MS Excel® and can be easily changed. The emission database can reside in Excel until it is exported back to Airviro, i.e. the information can be manipulated “off line”. The emission database in MS Excel® can be thought of as a “pocket emission database.”

MS Excel®, a registered trademark by Microsoft Corporation, will be referred to as Excel in the rest of the document. EDB is an abbreviation for emission database.

1.D.3.Getting Started

The following steps are needed in order to use **Wedbed**:

- Download Wedbed from web site: www.airviro.se It is found under DOWNLOADS.
- Install **Wedbed** on your computer: Open the zip file and follow the instructions in the README file.
- Start Excel. Click on **Complements**, and select **Wedbed** from the list.
- Under the **Host** menu, you must enter the name or the IP address to the Airviro server you want to import/export data from/to.
- To transfer data from Airviro to Excel click on the **Import EDB to Excel** in the **Wedbed** drop down menu. The **Login** dialog box will appear the first time Wedbed is used in a working session.
- The procedure to transfer data from Excel to Airviro is very similar. Just select **Export**

EDB from Excel from the drop down menu.

1.D.4. The Wedbed menu in Excel

When **Wedbed** is installed the **Wedbed** menu is added in the Excel menu bar.

The following menu options are available:

1. Import EDB to Excel: Displays the import dialog box.
2. Update sub tables: Updates the **Wedbed** tool bar. Each sub table has a list in the tool bar. The list contains the names of the sub table records. The list is used when the sub table is referred from e.g. a source. A warning and error list exist as well. The sub tables are described in the *"Working with Wedbed sheets in Excel"* section below.
3. Check: Checks the consistency of EDBs in Excel. Warnings and errors are reported in **Wedbed** tool bar.
4. About: Displays information about Wedbed.

1.D.6. Import EDB to Excel

In the **Import EDB to Excel** dialog the databases, users and EDB:s are shown in three separate lists. The type of sources to import can be selected. Grid layers to import can be selected.

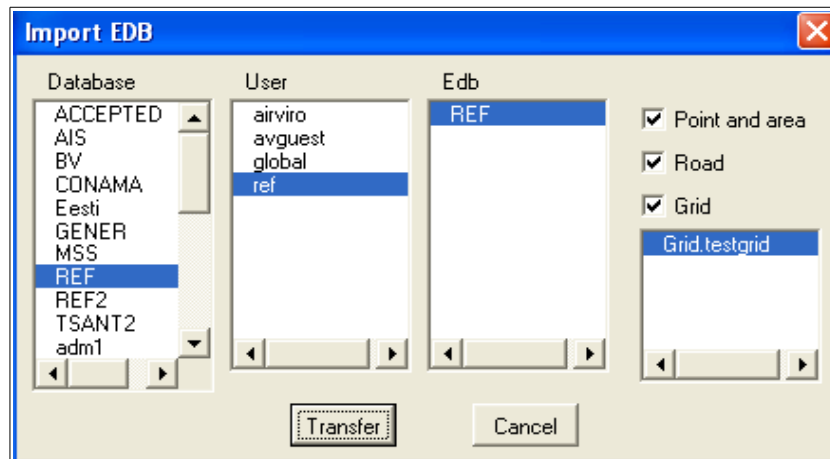


Figure D1. Import EDB

Once a database is selected, the users available for this database are shown in the users list. When a user is selected, the EDBs belonging to that user are shown in the EDB list. When an EDB is selected the *Point and Area*, *Road* and *Grid* check boxes are checked. The grid layers of the EDB are listed in the list box below the *Grid* check box. All grid layers are selected. The source types to import, can be limited by unchecking the check boxes. If the *Grid* check box is ticked off, a certain grid layer can be selected from the grid layer list. For multiple selections, hold down the *[Ctrl]* key on the keyboard while clicking on the grid layers

When the *Transfer* button is pressed the EDB is imported to Excel. Each table in the selected EDB is imported to a separate Excel sheet. Information about what happens is printed in the status bar of Excel.

Limitations: the sub tables will always be imported. No search criteria for the sources can be specified. Future versions will allow to select only sources that match search criteria.

1.D.7. Working with Wedbed sheets in Excel

1.D.7.1 Sub tables and sources

Emission sources in Airviro are point, area, road and grids. Point and area sources are stored in one sheet. Road sources are stored in another sheet. Each grid is stored in its own sheet. Each source is stored in one row. Sources are added by adding a new row.

The sub tables sheets are: Units, Speed-Temp-Scenario, Rsrc, Substance, Searchkey, Emission factor, Emission Function, Source timevar, Road timevar, Company, Facility, Source, Vehicle, Road Vehicle Def, RoadVehicle, Roadtype, Road. Each sub table entry is stored in one or more rows. Sub table entries are added by adding the proper number of rows.

1.D.7.2 General information about sheets

All sheets have a title row that defines the information stored in the sheet. Usually, cells that are not meant to be changed are write protected. The title row is write protected with the exception of sheets that refers to substances. In these sheets, substance/unit pairs can be added in the title row.

1.D.7.3 References to sub tables

References from sources or sub tables to other sub tables are made using names instead of indices. The Wedbed toolbar can be used when referring sub tables.

1.D.7.4 Wedbed Toolbar

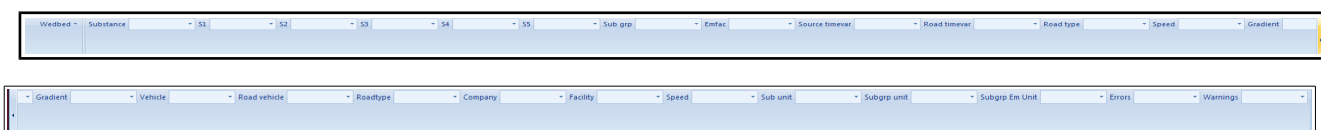


Figure D2. Sheets.

The Wedbed toolbar contains a number of lists. Each list corresponds to a sub table and contains the names of the entries in that sub table. By selecting an entry in the list, that name is copied to the active cell in the active sheet. This way, references to sub tables can be made in an easy way from sources or other sub tables. The lists are loaded when an EDB is imported or by selecting “*Update sub tables*” in the Wedbed menu.

Besides the sub table lists, there are two special lists: Errors and Warnings. These contain errors and warnings from the consistency check in Wedbed. By selecting an error or warning in one of these lists, the cell that caused the error /warning becomes the active cell in the active sheet.

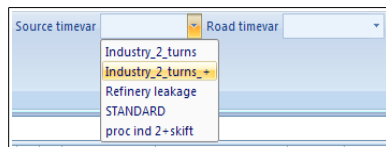


Figure D3. Toolbar: Source timevar Sheet.

1.D.8. Export EDB from Excel

In the **Export EDB from EXCEL** dialog box the possible databases to export to are shown in a list box. There are two choices: Either to export the data to an *Existing Edb* or to create a *New Edb*. These alternatives are chosen with the radio buttons to the right of the database list.

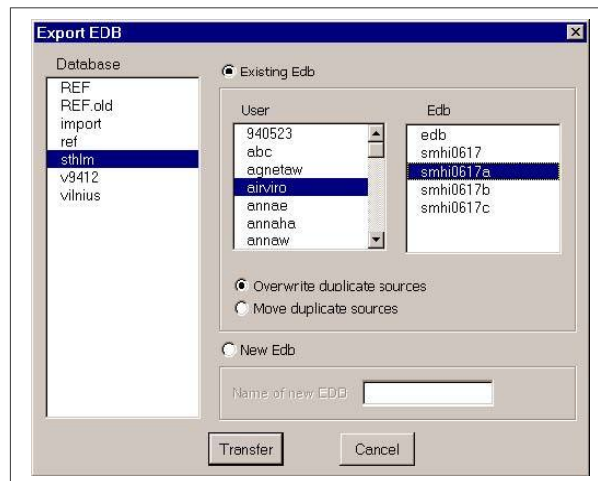


Figure D4 Export EDB Sheet.

When *Existing Edb* is chosen the User and the Edb can be selected from the lists. The sub tables and grid layers of the chosen Edb are always overwritten. Grid layers in the chosen Edb that do not exist in Excel are left as they are. For point, area and road sources two alternatives exists: Either to *Overwrite duplicate sources* or to *Move duplicate sources* until their coordinates become unique. These alternatives are chosen with the radio buttons below the User and Edb lists.

When *New Edb* is selected the name of the new Edb is input. The new Edb is created for the user used when logging on.

When [*Transfer*] button is pressed the following happens:

- The sub tables are updated.
- The consistency of the EDB is checked.
- If *Existing Edb* is chosen a check is made between the sub tables of the Airviro Edb to export to and the sub tables in Excel. Sub table entries having the same index in Airviro and Excel must have the same name. If errors are encountered, the export is aborted.
- The EDB is exported to Airviro.

Information about what happens is printed in the status bar of Excel.

1.D.8.1. Consistency Check

When an EDB is exported, a consistency check is performed. The check consists of the following steps:

- The sub tables are updated. If errors are encountered, the consistency check and export is aborted. The error and warning lists contains more information about the errors and warnings.
- Verification of the EDB in Wedbed. This includes syntax check of sheets, references to sub tables, length of strings, limits of values, required values, etc. If errors are encountered, the consistency check and export is aborted.

1.D.8.2. Setting up privileges for export from Excel

The same privileges are valid for Wedbed as for the Airviro EDB. The privileges for the Airviro EDB are set up in the *IADM* module in Airviro. For information about the resources effecting the Airviro EDB see the manual for the *IADM* module.

1.D.9. Layout of the Wedbed sheets in Excel

1.D.9.1. Units Sheet

This sheet corresponds to the unit part of the *edb.rsrc* file in Airviro. Units for different quantities in EDB are listed with their conversion factors. The first line below the title row states the default units of Airviro and may not be changed.

	A	B	C	D	E	F	G	H	I
1	Sub unit	Conv fact	Sub grp unit	Conv fact	Sub grp em unit	Conv fact	Search unit	Conv fact	
2	ton/year	1.0	%	1.0	ton/year	1.0	g/s	1.0	
3	g/s	31.557667	ml/l	0.1	g/s	31.557667	kg/h	0.2778	
4	kg/day	2.73785079	kg/ton	0.1	kg/day	2.73785079	ton/year	0.0317	
5	stones/day	1.11			stones/day	666	ounce/minute	0.017	
6									
7									
8									
9									
10									
11									
12									
13									
14									

Figure D5.Unit Sheet.

1.D.9.2. Speed-Temp-Scen Sheet

This sheet contains the rest of the *edb.rsrc* file in Airviro. Three columns stating the labels to use in Airviro for **Speed**, **Temperature** and **Scenario**.

	A	B	C	D	E	F	G	H	I
1	Index	Speed	Temperature	Scenario					
2	1	20	-30--28	1993					
3	2	30	-28--26	1994					
4	3	40	-26--24	1995					
5	4	50	-24--22	1996					
6	5	60	-22--20	1997					
7	6	70	-20--18	1998					
8	7	80	-18--16	1999					
9	8	90	-16--14	2000					
10	9	100	-14--12	2001					
11	10	110	-12--10	2002					
12	11	120	-10--8						
13	12		-8--3						
14	13		-6--4						

Figure D6 Speed-Temp-Scen Sheet.

1.D.9.3. Rsrc Sheet

This sheet contains the contents of the *edb.rsrc* file. The format of the contents in *edb.rsrc* is label and value. Here are the activity and geographical codes stored as well as noise factors. Other variables can be stored here when the Airviro EDB is used for special applications such as the MODEM emission model.

A	B
1 Tag	Value
2 ac.1.kind	1
3 ac.1.entity	SNAP
4 ac.1.01.entity	COMBUSTION IN ENERGY AND TRANSFORMATION INDUS
5 ac.1.01.01.entity	Public power
6 ac.1.01.01.00.entity	Public power
7 ac.1.01.01.01.entity	Combustion plants >= 300 MW (boilers)
8 ac.1.01.01.02.entity	Combustion plants >= 50 and < 300 MW (boilers)
9 ac.1.01.01.03.entity	Combustion plants < 50 MW (boilers)
10 ac.1.01.01.04.entity	Gas turbines
11 ac.1.01.01.05.entity	Stationary engines
12 ac.1.01.02.entity	District heating plants
13 ac.1.01.02.00.entity	District heating plants
14 ac.1.01.02.01.entity	Combustion plants >= 300 MW (boilers)
15 ac.1.01.02.02.entity	Combustion plants >= 50 and < 300 MW (boilers)
16 ac.1.01.02.03.entity	Combustion plants < 50 MW (boilers)
17 ac.1.01.02.04.entity	Gas turbines
18 ac.1.01.02.05.entity	Stationary engines
19 ac.1.01.03.entity	Petroleum refining plants
20 ac.1.01.03.00.entity	Petroleum refining plants
21 ac.1.01.03.01.entity	Combustion plants >= 300 MW (boilers)
22 ac.1.01.03.02.entity	Combustion plants >= 50 and < 300 MW (boilers)
23 ac.1.01.03.03.entity	Combustion plants < 50 MW (boilers)
24 ac.1.01.03.04.entity	Gas turbines
25 ac.1.01.03.05.entity	Stationary engines
26 ac.1.01.03.06.entity	Process furnaces
27 ac.1.01.04.entity	Solid fuel transformation plants
28 ac.1.01.04.00.entity	Solid fuel transformation plants
29 ac.1.01.04.01.entity	Combustion plants >= 300 MW (boilers)
30 ac.1.01.04.02.entity	Combustion plants >= 50 and < 300 MW (boilers)
31 ac.1.01.04.03.entity	Combustion plants < 50 MW (boilers)
32 ac.1.01.04.04.entity	Gas turbines
33 ac.1.01.04.05.entity	Stationary engines
34 ac.1.01.04.06.entity	Coke oven furnaces
35 ac.1.01.04.07.entity	Other (coal gasification, liquefaction,...)
36 ac.1.01.05.entity	Coal mining, oil / gas extraction, pipeline c
37 ac.1.01.05.00.entity	Coal mining, oil / gas extraction, pipeline c
38 ac.1.01.05.01.entity	Combustion plants >= 300 MW (boilers)
39 ac.1.01.05.02.entity	Combustion plants >= 50 and < 300 MW (boilers)

Figure D7. Rsrc Sheet.

1.D.9.4. Substance Sheet

This sheet corresponds to the substance table of the Airviro EDB. No changes are allowed since this information only persists in the global EDB of Airviro.

	A	B	C	D	E	F	G	H	I
1	Index	Substance							
2	1	NO							
3	2	NO2							
4	3	NOx							
5	4	HNO3							
6	5	HNO2							
7	6	PAN							
8	7	NH3							
9	8	N2O							
10	9	-							
11	10	-							
12	11	-							

Figure D8. Substance Sheet.

1.D.9.5. Sheet Searchkey

This sheet contains the searchkey table of the Airviro EDB. Searchkeys may be empty (not

used) but duplicates should be avoided.

	A	B	C	D	E	F	G
1	Index	Searchkey1	Searchkey2	Searchkey3	Searchkey4	Searchkey5	
2	1	Botkyrka 27	27	Individ. uppv	Tillverkning		
3	2	Danderyd 62	27	Pannc. uppvärmn	Lagring		
4	3	Ekerö 25	27	Energianläggn.	Konsumtion		
5	4	Haninge 36	27	Ind. energianl.	Avfall,sopförbr		
6	5	Huddinge 26	27	Bensinstat ej 6	Förbr. fossilt		
7	6	Järfälla 23	62	Biltvättar	Förbr. övrigt		
8	7	Lidingö 86	62	Depå petroleum	Naturliga ursl.		
9	8	Nacka 82	62	Kemtvättar			
10	9	Norrtälje 88	62	Verkst ind ej10			
11	10	Nynäshamn 92	62	Lackeringsind			
12	11	Salem 28	25 Ekerö	Graf ind ej 12			

Figure D9. Searchkey Sheet.

1.D.9.6. Emission Factor Sheet

This sheet corresponds to the emission factor table of the Airviro EDB. There is one emission factor per row. Names and indices must be unique, including names and indices for the emission factors. After the **Name** and **Index** columns, pairs of *substance* and **Unit** columns follow. Add a substance/unit pair by adding them after the last existing substance/unit pair. To delete a substance remove the substance/unit columns. The order of substances is not significant.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Name	Index	NOx	m	Unit	Benzene	m	Unit	Toluene	m	Unit	Xylene (total)	m	Unit	SO2	m	Unit				
2	HC from car fuel	3	100	0	%	4	0	%	12	0	%	13	0	%	0.400345	0	%				
3	Chalmers_oil	15	0.100668	0	%										0.4	0	%				
4	Rosenlund_HP1-5_oil	16	0.1	0	%										0.4	0	%				
5	Rosenlund_MT_gas	17	0.1	0	%																
6	Rosenlund_MT_oil	18	0.1	0	%																
7	Rya_VC_gas	19	0.05	0	%																
8	Rya_VC_oil	20	0.05	0	%										0.42	0	%				
9	Sävenäs_HP3_coal	21	0.1	0	%										0.1	0	%				
10	Sävenäs_HVP1/P2_oil	22	0.1	0	%										0.4	0	%				

Figure D10. Emission factor Sheet

1.D.9.7. Emission Function Sheet

This sheet corresponds to the Airviro emission function table. There is one emission function per row. Names and indices must be unique. For each emission function a number of variables are defined. These can either be CONST (Constant) or VAR (Variable).The variables are used in the Formula. The formula can contain arithmetical and logical

expressions and uses the same syntax as the Indico interpreter.

Figure D11. Emission Function Sheet.

1.D.9.8. Source TimeVar Sheet

This sheet corresponds to the Airviro Time Variation Point table in EDB. Each time variation spans over four rows. Names and indices must be unique. After the **Name** and **Index** columns, the following information follows:

- **H.1 to H.24** stating the hourly variations. The four rows correspond to type days Mon-Thu, Fri, Sat and Sun.
- **Jan to Dec** stating the monthly variations. Only first row of each formula.
- *Scenario1 to Scenario10* stating the scenario variations. Only first row for each formula.

1• *Temperature1 to Temperature30* stating the temperature dependency. Only first row for each formula.

2• **100-95 to 5-0** stating the gas flow dependency. Only first row for each formula.

Figure D12. Source TimeVar Sheet

1.D.9.9. Company Sheet

This sheet corresponds to the Airviro company table in EDB. After the **Name** and **ID** columns, the following information follows:

- Info, Info 2: string, additional information.
- Address and post address : string.
- Info. Supp.: the informant name.
- Misc: string
- Alob: string

	A	B	C	D	E	F	G	H	I	J
1	Name	ID	Info	Info2	Address	Postaddress	Info. Supp.	Misc		ALOB
2	Scanraff	1				453 81 Lysekil	Isf/K-G Mattsson	Krackerfackla		
3	Svenska Shell AB	10								
4	Scanfuel	100				Halmstad	Isf/BA			
5	Samhall Dalväst	101		Box 24		662 00 Åmål	Isf/Jonas Edin	Panna, Eo1 0.1%/*		
6	Tre Kök Doggy	102		Box 154		447 00 Vårgårda	Isf/P-län	Panna, Eo1 & Eo5		
7	Electrolux Åmål	103		Box 127		662 00 Åmål	Isf/Jonas Edin	Panna, WRD 0.5%/*		
8	Boråstapeter	104		Box 1		501 02 Borås	Isf/U Samuelsson	Panna, Eo1/*		
9	Viared 2	105		Borås Energi,Box 49		501 02 Borås	Isf/P-län	Oljepanna/*		
10	H Kom Renhållning	106					Isf/BA			
11	Västsvenska Lantmän	107		Box 93		447 00 Vårgårda	Isf/Eva Bayard	Pannan		
12	Viared 1	108		Borås Energi,Box 49		501 02 Borås	Isf/P-län	Oljepanna/*		
13	Henrikssons Trädg	109					Isf/MHN	Panna, Koks/Kol		
14	Point_1_ExampleAermod	11								
15	Pilkington	110					Isf/JF			
16	Kragelund Trädgård	111					Isf/MHN	Panna, Koks/Kol		
17	KP Trädgårds	112					Isf/MHN	Panna, Koks/Kol		
18	Statens Provanstalt	113		Box 857		501 15 Borås	Isf/P-län	Panna, Nafta, Eo1/*		
19	Rya Kraft	114		Borås Energi,Box 49		501 02 Borås	Isf/P-län	Flis,Kol,Torv/*		
20	Göta Värme	115		Borås Energi,Box 49		501 02 Borås	Isf/P-län	Oljepanna/*		
21	Sjöbo Värme	116		Borås Energi,Box 49		501 02 Borås	Isf/P-län	Oljepanna/*		
22	Lasarettet Värme	117		Borås Energi,Box 49		501 02 Borås	Isf/P-län	Oljepanna/*		
23	Hulta Värme	118		Borås Energi,Box 49		501 02 Borås	Isf/P-län	Oljepanna/*		
24	Anderssons Sågverk	119				513 02 Borgstena	Isf/P-län	Bark/Spån/Kutter/*		
25	Panncentr Tynnered	12		L:a Grevegårdsv.2		421 44 V:a Frölunda	Isf/Paul Johansson			
26	Västsv. Fotolab.	120		Box 80		524 00 Herrljunga	Isf/U Samuelsson	Panna, Eo1 0.1%/*		
27	Herrljunga Sågverk	121		Pl.5026		524 00 Herrljunga	Isf/P-län	Panna, Bark		
28	Svenljunga Värme	122		Box 201		512 01 Svenljunga	Isf/P-län	Panna, flis/olja/*		
29	Almedahls-D	123		Box 17		516 00 Dalsjöfors	Isf/Birgitta Olsson	Ångpanna,Eo5 0.6%/*		
30	Hylte Bruks AB	124				Hylte	Isf/BA	Lutpanna P1		
31	Vårdcentral Knäred	125					Isf/MHN	Panna, Biobr/Olja		
32	Panncentral Knäred	126					Isf/MHN	Panna, Biobr/Gasol		
33	Jabo Träprodukter	127		Box 201		514 01 Tranemo	Isf/P-län	Panna 1,bark/spån/*		
34	Limmareds Skogar	128		Box 48		510 90 Limmared	Isf/P-län	Panna,Bark 70000m3		
35	PLM-Limmared	129		Box 93		510 90 Limmared	Isf/Sten Wolme	Glasugnar		
36	Vattenfall Sten	13		Kraftverksvägen		444 87 Stenungsund	Isf/Kenneth Haglund	Block B1		
37	EBE Energibränsle	130		Kvarngatan 22		502 44 Borås	Isf/Mikael Suld	Torkanläggningen		
38	Timmele Färgeri	131		Box 2044		Ulricehamn	Isf/P-län	Panna, olja/gasol/*		
39	Neste Polyeten	14				444 86 Stenungsund	Isf/Ulf Gustavson	Ångcentralen		

Figure D13. Company Sheet.

1.D.9.10. Facility Sheet

This sheet corresponds to the Airviro facility table in EDB. After the **Name** and **XY** columns,

the following information follows:

- Company: name of the associated company.
- Info, Info 2: string, additional information.
- Address and post address : string.
- Info. Supp.: the informant name.
- Misc and ALOB: string

	A	B	C	D	E	F	G	H	I	J	K
1	Name	X1	Y1	Company	Info	Info2	Address	Postaddress	Info. Supp.	Misc	ALOB
2	Scanraff	1243431	6477510	Scanraff				453 81 Lysekil	Isf/K-G Mattsson	Krackerfackla	
3	OK RAFFINADERI	1262920	6405070	OK RAFFINADERI			Box 23037	400 73 Göteborg	Isf/Gösta Sjonell	Fackla	
4	Volvo Torslanda	1264090	6406480	Volvo Torslanda				405 08 Göteborg	Isf/S Johansson	Byggnad TB1/*	
5	NYNÄS SUPPLY	1264120	6404110	NYNÄS SUPPLY			Oljevägen	417 91 Göteborg	Isf/Björn Tisen	DA-ugnen	
6	Hydro Plast	1264387	6446734	Hydro Plast			Hjälmarevägen	444 83 Stenungsund	Isf/Rune Niklasson	Ångpanna 2	
7	Statoil Petro	1265400	6446940	Statoil Petro				444 81 Stenungsund	Isf/J Andersson	S Skorstens (F-1601)	
8	Point_2_ExampleAermod	1265509	6405901						GS		
9	Berol Nobel Sten	1265520	6447450	Berol Nobel Sten				444 85 Stenungsund	Isf/Knut Andrén	Destruktionsugn	
10	Svenska Shell AB	1265648	6404066	Svenska Shell AB							
11	Point_1_ExampleAermod	1265670	6405659						Guillermo Silva		
12	Shell Raffinad	1265951	6404101	Shell Raffinad			Box 8889	402 72 Göteborg	Isf/Karin Jansson	Facklan/*	
13	Panncentr Tynnered	1266050	6398150	Panncentr Tynnered			L:a Grevegårdsv.2	421 44 V:a Frölunda	Isf/Paul Johansson		
14	Vattenfall Sten	1266290	6447130	Vattenfall Sten			Kraftverksvägen	444 87 Stenungsund	Isf/Kenneth Haglund	Block B1	
15	Neste Polyeten	1266410	6446100	Neste Polyeten				444 86 Stenungsund	Isf/Ulf Gustavson	Ångcentralen	
16	Stenungs.Fjärrvärme	1266620	6445370	Stenungs.Fjärrvärme			Hantverkargatan 32	444 32 Stenungsund	Isf/Monica Rundin	Pannan	
17	ENERGIV. RYA_VC_OIL	1266693	6403402	ENERGIV. RYA_VC_OIL							
18	ENERGIV. RYA_VC_GAS	1266700	6403400	ENERGIV. RYA_VC_GAS				401 20	Tideström Birgitta	Energianläggning	
19	Volvo Lundby	1266820	6405750	Volvo Lundby			Gropegårdsgatan	405 08 Göteborg	Isf/Kerstin Sterner	U-byggn.Lastvagnar	
20	Volvo Tuveverken	1266900	6410460	Volvo Tuveverken				405 08 Göteborg	Isf/Kerstin Sterner	Energicent.Lastvagn	
21	Neste Oxo	1267630	6448140	Neste Oxo				444 84 Stenungsund	Isf/Kjell Flodmark	Ångpannor	
22	BOSTADS AB POSEIDON	1267727	6399749	BOSTADS AB POSEIDON			Musikvägen 1	421 44 VÄSTRA FRÖLU	Johansson Paul	Panncentral Musikva	
23	PANNCENTR MUSIKV	1267900	6399770	PANNCENTR MUSIKV			Box 1	424 21 Ångered	Isf/Paul Johansson		
24	MARCONICENTRALEN	1268550	6399350	MARCONICENTRALEN			Box 5044	402 21 Göteborg	Isf/Leif Dahlquist	Värmecentral	
25	GÖTEBORGS STADS BOS	1268600	6401600	GÖTEBORGS STADS BOS			N Dragspelsgatan 2	402 21 GÖTEBORG	Hansson Fridé	Hetvattencentral	
26	Tuve Hetvattencent.	1268650	6409850	Tuve Hetvattencent.			Box 5044	402 21 Göteborg	Isf/Leif Dahlquist	Värmecentral	
27	WALCH CHARKUTERIFAB	1268817	6399089	WALCH CHARKUTERIFAB			Bildradiogatan 8	421 34 VÄSTRA FRÖLU	Walch Helmut	Rökeri	
28	AGA GAS AB	1269303	6404816	AGA GAS AB			Polstjärnegatan 12	402 72 GÖTEBORG	Lonnqvist Roy	Verkstad	
29	MASTER OLOFS CHARKU	1269380	6399541	MASTER OLOFS CHARKU			Olöf Asklunds G 20	421 30 VÄSTRA FRÖLU		Rökeri	
30	PRIPPS	1269400	6398500	PRIPPS			Box 121	421 22 V Frölunda	Isf	Bryggeri/*	
31	RIBO-VERKEN AB	1269503	6398963	RIBO-VERKEN AB			Britta Sahlgrens G	421 02 VÄSTRA FRÖLU	Lindahl	Verkstad	
32	Volvo Uddevalla	1270250	6476100	Volvo Uddevalla				451 84 Uddevalla	Isf/S Johansson	Panna/*	
33	HEDLUNDS PAPPER	1270430	6397410	HEDLUNDS PAPPER			Box 100	401 21 Göteborg	Isf/Chr Tengstrand	Pannan	
34	ENERGIV. ROSEN.L.GAS	1270490	6404094	ENERGIV. ROSEN.L.GAS			Rosenlundsgatan 2	601 20 Göteborg			
35	ENERGIV. ROSEN.L.OIL	1270499	6404090	ENERGIV. ROSEN.L.OIL			Rosenlundsgatan 2	401 20 GÖTEBORG	Tideström Birgitta	Energianläggning	
36	ENERGIV.ROSEN.HP1-5	1270582	6404108	ENERGIV.ROSEN.HP1-5							
37	WENNERGRENS KITTFAB	1270767	6407283	WENNERGRENS KITTFAB			Aröds Industriväg 1	422 43 HISINGS BACK	Wennergren Th	Kittfabrik	
38	Volvo Rollsbo	1271250	6423750	Volvo Rollsbo				442 40 Kungälv	Isf/S Johansson	*	
39	B A S F SVENSKA AB	1271550	6405859	B A S F SVENSKA AB			Stenkolsgratan 5	400 14 GÖTEBORG	Björnsson B-å	Kem-teknik, enbart	

Figure D14. Sheet Facility.

1.D.9.11. Source Sheet

This sheet corresponds to the Airviro point and area sources in EDB. One point or area source per row. Below is a description of the columns:

- 1• **Name** Name of the point or area source.

- **X1** X coordinate for point sources and left X coordinate for area sources.
- **Y1** Y coordinate for point sources and lower Y coordinate for area sources.
- **X2** Empty for point sources and right X coordinate for area sources.
- **Y2** Empty for point sources and upper Y coordinate for area sources.

- **Facility** String

- **Info** String.

- **Info2** String.

- **Date**

- **Changed**

- **Chimney hgt.** Number.

- **Gas temp.** Number.

- **Gas Flow** Number.

- **Chimney out** Number.

- **Chimney in** Number.

- **House Width** Number.

- **House hgt.** Number.
- **No. seg.**
- **Build width.**
- **Build hgt.**
- **Build len.**
- **Build dist far wall.**
- **Build dist center.**
- **S1, S2, S3, S4 and S5 (Searchkeys)**
- **Timevar macro**
- **Geographical code**
- **ALOB**

There are three different ways to specify the Emissions for a Source: Using Substance (Emission sub), Emission factor (Emmision fac) and Emission function (Emission func). The three can be used at the same time.

- **Emission sub 1:** Substance
- **Emission sub 1:** Timevar

- **Emission sub 1:** Emission

- **Emission sub 1:** Unit

- **Emission sub 1:** Macro

- **Emission sub 1:** Actcode

- **Emission sub 1:** ALOB

- **Emission fac 1:** Factor

- **Emission fac 1:** Timevar

- **Emission fac 1:**Activity

- **Emission fac 1:** Unit

- **Emission fac :** Actcode

- **Emission fac 1:** ALOB

- **Emission func 1:** Function

- **Emission func 1:** Timevar

- **Emission func Activity**

- **Emission func 1:** Unit

- Emission func : Actcode
- Emission func 1: ALOB

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	
Name	X1	Y1	X2	Y2	Facility	Info	Info2	Date	Changed	Chimney hgt.	Gas temp.	Gas Flow	Chimney Out	Chimney In	House Width	House hgt.	No. seg.	Build width.	Build hgt.	Build len.	Build dist far wall.	Build dist center.	S1	S2	S3	S4	S5		
54	Shell Raffinad	1266070	6404210		Shell Raffinad			1992/06/16	1994/09/07	40	260	2	1.45	1.45	0	0	1	1	2	3	4	5							
55	Shell Raffinad	1266100	6404190		Shell Raffinad			1992/06/16	1994/09/07	38	210	2	1.3	1.3	0	0	1	1	2	3	4	5							
56	Vattenfall	1266290	6447130		Vattenfall Sten			1992/06/16		150	140	13	7.5	5.65	0	0	1	1	2	3	4	5							
57	Vattenfall	1266350	6447130		Vattenfall Sten			1992/06/16		150	140	13	7.5	5.65	0	0	1	1	2	3	4	5							
58	Neste Poly	1266410	6446100		Neste Polyeten			1992/06/16		58	150	9	0.99	0.7	0	0	1	1	2	3	4	5							
59	Stenungs F	1266620	6445370		Stenungs Fjällvärme			1992/06/16		58	250	50	0	0.52	0	0	1	1	2	3	4	5							
60	Neste Poly	1266680	6446250		Neste Polyeten			1992/06/16		40	450	0	0.61	0.51	0	0	1	1	2	3	4	5							
61	ENERGIV_R	1266693	6403402		ENERGIV_RVA_VC_OIL			2014/09/10	2014/12/13	100	160	24	5.8	1.7	0	0	1	1	2	3	4	5							
62	ENERGIV_R	1266700	6403400		ENERGIV_RVA_VC_GAS			2014/09/10	2014/12/13	100	160	24	5.8	1.7	0	0	1	1	2	3	4	5							
63	Neste Poly	1266760	6446140		Neste Polyeten			1992/06/16		52	450	0	0.76	0.66	0	0	1	1	2	3	4	5							
64	Volvo Lund	1266820	6405750		Volvo Lundby			1992/08/26	1993/09/09	40	125	8	5.3	1.22	50	6	1	1	2	3	4	5							
65	Volvo Tuve	1266900	6410460		Volvo Tuveverken			1992/08/26		57	175	0	0.8	0.6	200	13	1	1	2	3	4	5							
66	Neste Oxo	1267480	6448330		Neste Oxo			1992/06/16		45	175	4	3.26	1.47	38	21	1	1	2	3	4	5							
67	Neste Oxo	1267510	6448270		Neste Oxo			1992/06/16		12	100	9	0.25	0.25	22	10	1	1	2	3	4	5							
68	Neste Oxo	1267630	6448140		Neste Oxo			1992/06/16		45	0	0	1.28	1.2	0	0	1	1	2	3	4	5							
69	BOSTADS A	1267727	6399749		BOSTADS AB POSEIDON			2014/09/09	2014/09/10	0	0	0	0	0	0	0	1	1	2	3	4	5							
70	PANNCENTR	1267900	6399770		PANNCENTR MUSIKV			1992/06/16	1993/12/21	50	200	25	3	0.47	0	0	1	1	2	3	4	5							
71	GÖTEBORGS	1268000	6397800		GÖTEBORGS STADS BOS			1992/06/16	1993/12/21	65	100	4	7.5	1.4	0	0	1	1	2	3	4	5							
72	MARCONI	1268550	6399550		MARCONI CENTRALEN			1992/06/16	1993/12/21	50	175	4.5	0	0	0	0	1	1	2	3	4	5							
73	GÖTEBORGS	1268600	6401600		GÖTEBORGS STADS BOS			1992/06/16	1993/12/21	50	100	4	7.5	1.4	0	0	1	1	2	3	4	5							
74	Tuve Helva	1268650	6409850		Tuve Helvattentent.			1992/06/16		50	100	4	2	0.69	0	0	1	1	2	3	4	5							
75	Volvo Lund	1268670	6405850		Volvo Lundby			1992/08/26		50	40	1.4	0.95	0.64	100	6	1	1	2	3	4	5							
76	WALCH CH	1268817	6399089		WALCH CHARKUTERIFAB			1992/06/16		0	0	0	0	0	0	0	1	1	2	3	4	5							
77	AGA GAS AB	1269303	6404816		AGA GAS AB			2014/09/09	2014/10/01	0	0	0	0	0	0	0	1	1	2	3	4	5							
78	MASTER OI	1269830	6399941		MASTER OLOFS CHARKU			1992/06/16		0	0	0	0	0	0	0	1	1	2	3	4	5							
79	PRIPPS	1269400	6398500		PRIPPS			1992/06/16	1993/12/21	10	500	0	1	1	0	0	1	1	2	3	4	5							
80	RIBO-VERK	1269503	6398963		RIBO-VERKEN AB			1992/06/16		0	0	0	0	0	0	0	1	1	2	3	4	5							
81	Volvo Udde	1270250	6476100		Volvo Uddevalla			1992/07/01		20	500	0	1	1	0	0	1	1	2	3	4	5							
82	HEDLUNDS	1270430	6397410		HEDLUNDS PAPPER			1992/06/16	1993/12/21	9	0	0	0	0	0	0	1	1	2	3	4	5							
83	ENERGIV_R	1270490	6404094		ENERGIV_ROSENL_GAS			2014/09/09	2014/09/10	50	110	25	4	1.6	0	0	1	1	2	3	4	5							
84	ENERGIV_R	1270499	6404090		ENERGIV_ROSENL_OIL			2014/09/09	2014/09/10	50	150	25	4	1.6	0	0	1	1	2	3	4	5							
85	ENERGIV_R	1270582	6404108		ENERGIV_ROSEN_HP1-S			2014/09/10	2014/09/10	100	500	50	6	2	0	0	1	1	2	3	4	5							
86	WENNERGR	1270767	6407283		WENNERGRS KITTFAB			1992/06/16		0	0	0	0	0	0	0	1	1	2	3	4	5							
87	Volvo Roll	1271250	6423750		Volvo Rollsbo			1992/06/15		10	200	0	1	1	0	0	1	1	2	3	4	5							
88	B A S F SVEN	1271550	6405859		B A S F SVENSKA AB			2014/09/09	2014/09/10	0	0	0	0	0	0	0	1	1	2	3	4	5							
89	CHALMERS	1271750	6402500		CHALMERS VARMEC			1992/06/16	2014/09/10	51	150	4	1.2	1	0	0	1	1	2	3	4	5							
90	CHALMERS	1271751	6402501		CHALMERS VARMEC			1992/06/16	2014/09/10	51	150	4	1.2	1	0	0	1	1	2	3	4	5							
91	CHALMERS	1271761	6402605		CHALMERS TEKNISKA H			2014/09/09	2014/09/10	52	160	10	1.5	1.2	0	0	1	1	2	3	4	5							
92	Nössemarks	1272000	6562890		Nössemarks Trä			1992/06/17		23	130	7	1	0.5	60	14	1	1	2	3	4	5							
93	GÖTEBORGS	1272018	6406255		GÖTEBORGS TERMOMETE			1992/06/16		0	0	0	0	0	0	0	1	1	2	3	4	5							
94	Brattäsver	1272300	6477000		Brattäsverket			1992/06/16		60	140	9	7.4	1.98	0	0	1	1	2	3	4	5							
95	ALPUS AB	1272378	6405716		ALPUS AB			2014/09/09	2014/09/10	0	0	0	0	0	0	0	1	1	2	3	4	5							
96	Riskullave	1272660	6396900		Riskullaveriket			1992/06/16		100	126	5	0	1.56	0	0	1	1	2	3	4	5							
97	GÄRDA FAB	1272702	6404304		GÄRDA FABRIKERS AB			1992/06/16		0	0	0	0	0	0	0	1	1	2	3	4	5							
98	Skansverke	1272750	6476200		Skansverket ARV			1992/08/24		13	0	0	0.3	0.2	25	7	1	1	2	3	4	5							

Figure D15. Sources Sheet.

1	A	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	En
Name	Timevar macro	Geographical code	ALOB	Emission sub 1: Substance	Emission sub 1: Timevar	Emission sub 1: Emission	Emission sub 1: Unit	Emission sub 1: Macro	Emission sub 1: Actcode	Emission sub 1: ALOB	Emission sub 2: Substance	Emission sub 2: Timevar	Emission sub 2: Emission	Emission sub 2: Unit	En	
46	Shell Raffinad			NOx	STANDARD	1	ton/year			502	STANDARD	0.04	ton/year			
47	Shell Raffinad			NOx	STANDARD	1	ton/year			502	STANDARD	0.1	ton/year			
48	Shell Raffinad			NOx	STANDARD	52	ton/year			502	STANDARD	1	ton/year			
49	Shell Raffinad			NOx	STANDARD	58	ton/year			502	STANDARD	1	ton/year			
50	Shell Raffinad			NOx	STANDARD	620	ton/year			502	STANDARD	114	ton/year			
51	Shell Raffinad			SO2	STANDARD	66	ton/year			502	STANDARD	0.8	ton/year			
52	Panncentr Tynd			NOx	STANDARD	64.6	ton/year			502	STANDARD	15.81	ton/year			
53	Shell Raffinad			NOx	STANDARD	52	ton/year			502	STANDARD	0.8	ton/year			
54	Shell Raffinad			NOx	STANDARD	52	ton/year			502	STANDARD					

	A	AX	AY	AZ	BA	BB	BC	BD	BE	BF
1	Name	Emission fac 1: Actcode	Emission fac 1: ALOB	Emission func 1: Function	Emission func 1: Timevar	Emission func 1: Var 1	Emission func 1: Var 2	Emission func 1: Var 3	Emission func 1: Actcode	Emission func 1: ALOB
78	MASTER OLOFS									
79	PRIPPS									
80	RIBO-VERKEN A									
81	Volvo Uddevalla									
82	HEDLUNDS PAPI									
83	ENERGIV. ROSEN	01.01.00								
84	ENERGIV. ROSEN			MaxEffToEmiSO2	STANDARD	20	42.7	0.4	01.01.00	MaxEffTo
85	ENERGIV. ROSEN	01.01.00								
86	WENNERGRENS									
87	Volvo Rollsbo									
88	B A S F SVENSKA									

Figure D18. Sources Sheet. Emission function.

1.D.9.12. Vehicle Sheet

This sheet corresponds to the Airviro vehicle table in EDB. Each vehicle spans over eleven rows. Names and indices must be unique. The speed column must contain the eleven speed labels ordered as in the Speed-Temperature-Scen sheet. After the **Name**, **Index** and **Speed** columns, substance columns follow. Add a substance by adding it after the last existing substance. To delete a substance remove the column of the substance. The order of substances is not significant.

	A	B	C	D	E	F	G
1	Name	Index	Activity code	Speed	NOx	CO	VOC
2	Lv	th 50 5s	21	20	2056.000000	11575.000000	1395.000000
3				30	2390.000000	12525.000000	1299.000000
4				40	2990.000000	13141.000000	1280.000000
5				50	2828.000000	14773.000000	1402.000000
6				60	2828.000000	14773.000000	1402.000000
7				70	2828.000000	14773.000000	1402.000000
8				80	2828.000000	14773.000000	1402.000000
9				90	2828.000000	14773.000000	1402.000000
10				100	2828.000000	14773.000000	1402.000000
11				110	2828.000000	14773.000000	1402.000000
12				120	2828.000000	14773.000000	1402.000000
13	Lv	cat th 70 1s	23	20	1877.000000	10843.000000	1279.000000
14				30	2178.000000	10529.000000	1234.000000
15				40	2845.000000	11631.000000	1103.000000
16				50	2826.000000	11556.000000	1235.000000
17				60	1994.000000	11901.000000	1079.000000
18				70	1755.000000	11072.000000	981.000000
19				80	1755.000000	11072.000000	981.000000
20				90	1755.000000	11072.000000	981.000000
21				100	1755.000000	11072.000000	981.000000
22				110	1755.000000	11072.000000	981.000000
23				120	1755.000000	11072.000000	981.000000
24	Lv	th 50 3s	26	20	1967.000000	11209.000000	1337.000000
25				30	2190.000000	11527.000000	1165.000000
26				40	2392.000000	11359.000000	1068.000000
27				50	1940.000000	11801.000000	1063.000000
28				60	1686.000000	11801.000000	1064.000000
29				70	1940.000000	11801.000000	1064.000000
30				80	1940.000000	11801.000000	1064.000000
31				90	1940.000000	11801.000000	1064.000000
32				100	1940.000000	11801.000000	1064.000000
33				110	1940.000000	11801.000000	1064.000000
34				120	1940.000000	11801.000000	1064.000000
35	Lv	hig	29	20	1051.000000	8014.000000	650.000000
36				30	1051.000000	8014.000000	650.000000
37				40	1051.000000	8014.000000	650.000000
38				50	1051.000000	8014.000000	650.000000
39				60	1216.000000	8729.000000	721.000000

Figure D19 Sheet Vehicle.

1.D.9.13. Road Vehicle Def Sheet

This sheet corresponds to the Airviro road vehicle definitions table.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Name	Label 1	Label 2	Label 3	Label 4	Label 5	Label 6	Label 7	Label 8	Label 9	Label 10	Label 11
2	Road type	Urban-Motorway-Nat	Urban-Motorway-City	Urban-TrunkRoad/Primary-Nat.	Urban-TrunkRoad/Primary-City	Urban-Distributor/Secondary	Urban-Local/Collector	Urban-Access-residential	Not_used	Not_used1	Not_used2	Rural-Motorway-Nat
3	Speed	30	40	50	60	70	80	90	100	110	120	130
4	Gradient	-6	-4	-2	-1	0	1	2	4	6	10	15

Figure D20 Vehicle Def. Sheet.

1.D.9.14. Road Vehicle Sheet

This sheet corresponds to the Airviro road vehicles sub table in EDB. Firstly the name, Index, Activity Code, Ls heavy, Ls traffic, Weight, Emission model, Flow equiv, and Info, are defined.

For each substance that the vehicle emits and for each combination of variables in the emission model, we can specify emission factors for four different kind of traffic: Free Flowing, Heavy Traffic, Congested and Stop and go.

In the example below we have defined, in Road Vehicle Def., three variables. The variables appear as columns: Road Type, Speed and Gradient, For each combination of values for the variables emission factors are defined.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Name	Index	Activity code	Is heavy	Is traffic	Weight	Emission model	Flow equiv.	Info	Substance	Road type	Speed	Gradient	Free flowing	Heavy traffic	Congested	Stop and go
2	car_cold_petrol	5		0	0	0	0	0.000000		NOx	Urban-Motorway-Nat	90	0	553.543	553.543	553.543	553.543
3										NOx	Urban-Motorway-Nat	110	0	553.543	553.543	553.543	553.543
4										NOx	Urban-Motorway-Nat	120	0	553.543	553.543	553.543	553.543
5										NOx	Urban-Motorway-City	60	0	553.543	553.543	553.543	553.543
6										NOx	Urban-Motorway-City	70	0	553.543	553.543	553.543	553.543
7										NOx	Urban-Motorway-City	90	0	553.543	553.543	553.543	553.543
8										NOx	Urban-Motorway-City	110	0	553.543	553.543	553.543	553.543
9										NOx	Urban-TrunkRoad/Primary-Nat.	70	0	553.543	553.543	553.543	553.543
10										NOx	Urban-TrunkRoad/Primary-Nat.	90	0	553.543	553.543	553.543	553.543
11										NOx	Urban-TrunkRoad/Primary-Nat.	110	0	553.543	553.543	553.543	553.543
12										NOx	Urban-TrunkRoad/Primary-City	50	0	553.543	553.543	553.543	553.543
13										NOx	Urban-TrunkRoad/Primary-City	70	0	553.543	553.543	553.543	553.543
14										NOx	Urban-TrunkRoad/Primary-City	90	0	553.543	553.543	553.543	553.543
15										NOx	Urban-Distributor/Secondary	50	0	553.543	553.543	553.543	553.543
16										NOx	Urban-Distributor/Secondary	70	0	553.543	553.543	553.543	553.543
17										NOx	Urban-Local/Collector	50	0	553.543	553.543	553.543	553.543
18										NOx	Urban-Local/Collector	60	0	553.543	553.543	553.543	553.543
19										NOx	Urban-Access-residential	30	0	553.543	553.543	553.543	553.543
20										NOx	Urban-Access-residential	50	0	553.543	553.543	553.543	553.543
21										NOx	Rural-Motorway-Nat	90	0	553.543	553.543	553.543	553.543
22										NOx	Rural-Motorway-Nat	110	0	553.543	553.543	553.543	553.543
23										NOx	Rural-Motorway-Nat	120	0	553.543	553.543	553.543	553.543
24										NOx	Rural-Semi-Motorway	90	0	553.543	553.543	553.543	553.543
25										NOx	Rural-Semi-Motorway	110	0	553.543	553.543	553.543	553.543
26										NOx	Rural-TrunkRoad/Primary-Nat	60	0	553.543	553.543	553.543	553.543
27										NOx	Rural-TrunkRoad/Primary-Nat	70	0	553.543	553.543	553.543	553.543
28										NOx	Rural-TrunkRoad/Primary-Nat	90	0	553.543	553.543	553.543	553.543
29										NOx	Rural-TrunkRoad/Primary-Nat	110	0	553.543	553.543	553.543	553.543
30										NOx	Rural-Distributor/Secondary	50	0	553.543	553.543	553.543	553.543
31										NOx	Rural-Distributor/Secondary	70	0	553.543	553.543	553.543	553.543
32										NOx	Rural-Distributor/Secondary	90	0	553.543	553.543	553.543	553.543
33										NOx	Rural-Local/Collector	50	0	553.543	553.543	553.543	553.543
34										NOx	Rural-Local/Collector	70	0	553.543	553.543	553.543	553.543
35										NOx	Rural-Local/Collector(sinusuous)	50	0	553.543	553.543	553.543	553.543
36										NOx	Rural-Local/Collector(sinusuous)	70	0	553.543	553.543	553.543	553.543
37										NOx	Rural-Access-residential	30	0	553.543	553.543	553.543	553.543
38										NOx	Rural-Access-residential	50	0	553.543	553.543	553.543	553.543

Figure D21 Road Vehicle Sheet.

1.D.9.15. Roadtypes Sheet

This sheet corresponds to the Airviro roadtype table in EDB. Names and indices must be unique. Each roadtype may contain up to ten vehicle variations. Each vehicle variation spans over four rows. In the first line of each vehicle variation, the **Vehicle**, **Min vel** and **Max vel** must be specified. The **Vehicle** column contains reference to the Vehicle sub table. The **Min vel** and **Max vel** columns contain references to the **Speed** sub table. After the **Name**, **Index**, **Vehicle**, **Min vel** and **Max vel** columns, the following columns follow:

- **H.1** to **H.24** stating the hourly variations. The four rows correspond to type days Mon-Thu, Fri, Sat and Sun.
- **Jan** to **Dec** stating the monthly variations. Only first row of each vehicle variation.
- *Scenario1* to *Scenario10* stating the scenario variations. Only first row of each vehicle variation.

	A	B	C	D	E	F	G	H	I	J	K
1	Name	Index	Vehicle	Min vel.	Max vel.	H.1	H.2	H.3	H.4	H.5	H.6
2	A 70 07 reg hv SSS	1	pb A 70/ 3VTI	20	120	166	104	73	73	93	35
3						230	161	115	104	115	35
4						328	248	200	168	112	12
5						459	378	306	243	153	11
6			pb B 70/ 3VTI	20	120	166	104	73	73	93	35
7						230	161	115	104	115	35
8						328	248	200	168	112	12
9						459	378	306	243	153	11
10			pb C 70/ 3VTI	20	120	166	104	73	73	93	35
11						230	161	115	104	115	35
12						328	248	200	168	112	12
13						459	378	306	243	153	11
14			lb A 70/ 3VTI	20	120	166	104	73	73	93	35
15						230	161	115	104	115	35
16						328	248	200	168	112	12
17						459	378	306	243	153	11
18			lb B 70/ 3VTI	20	120	166	104	73	73	93	35
19						230	161	115	104	115	35
20						328	248	200	168	112	12
21						459	378	306	243	153	11
22	A 70 10 reg hv SSS	3	pb A 70/ 3VTI	20	120	166	104	73	73	93	35
23						230	161	115	104	115	35
24						328	248	200	168	112	12

Figure D22. Sheet Road types.

1.D.9.16. Road Sheet

This sheet corresponds to the Airviro road database in EDB. One road source per row. Below is a description of the columns:

- **Name** Name of the point or area source.
- **Info** String.
- **Info2** String.
- **Vehicles** Number.
- Macro
- **Corr** Number.
- **Lanes** Number.
- **Speed** Reference to **Speed** sub table.
- **Roadtype** Reference to **Roadtype** sub table.
- Emifac: The values that specify which emission factor to use for road vehicles. There is one number per dimension specified in the road vehicle definition.
- **Cong. Limit, Cong. speed and Cong, veh** : References to congestion data (limit, speed and vehicles).
- **S1 to S5** References to **Searchkey** sub tables.
- **Geografical code**
- Width
- Dist Houses

vehicles.

1.D.9.18. Grid Sheet

Since there can be any number of grids in an Airviro EDB, each grid corresponds to a sheet in **Wedbed**. This sheet is named **Grid.gridname**. In a grid, there can exist both static and dynamic information. Below the title row, a row follows that states if the information in that column is static or dynamic. Static is indicated by a value (or empty) and dynamic is indicated by the string DYNAMIC. The following rows correspond to one grid cell each. Below is a description of the columns:

- **X** First row contains X coordinate for left side of whole grid. The following lines contain the left side coordinate for that grid cell. This information must be specified.
- **Y** First row contains Y coordinate for lower side of whole grid. The following lines contain the lower side coordinate for that grid cell. This information must be specified.
- **NX** Number of grid cells on the X-axis. Only on first row.
- **NY** Number of grid cells on the Y-axis. Only on first row.
- **DX** Width of each grid cell. Only on first row.
- **DY** Height of each grid cell. Only on first row.
- **Name** String.
- **Info** String.
- **Info2** String.
- **Address** String.
- Post Address String.
- **Info. supp.** String.

- **Created Date.**
- **Changed Date.**
- **Misc String.**
- **Time var** References to **Time variariion** sub table.
- **S1 to S5** References to **Searchkey** sub tables.
- **Activity Code**
- **Geographical Code**

If an emission factor is not used, then the name of the substances follow in the header row. Any number of substances are allowed.

- **Sub grp.** Reference to **Emission factor** sub table.
- **Sub grp emission.** Here the activity for the emission factor is specified. It must be specified for each cell of the grid is referring emission factors.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	X	Y	Nx	Ny	Dx	Dy	Name	Info	Info2	Address	Postaddress	Info. Supp.	Created	Changed	Misc	Timevar	S1	S2	S3	S4	S5	Activity code	Geographical code	Sub grp	NOx
2	1230000	6245000	30	66	5000	5000	Test	DYNAMIC				Energidata				STANDARD									
3	1335000	6245000						X1381/N																	1.06211
4	1340000	6245000						X1381/N																	3.53231
5	1325000	6250000						X1381/N																	3.50698
6	1330000	6250000						X1381/N																	8.70191
7	1335000	6250000						X1381/N																	14.6385
8	1340000	6250000						X1381/N																	16.7574
9	1345000	6250000						X1381/N																	0.984515
10	1320000	6255000						X1381/N																	8.4358
11	1325000	6255000						X1381/N																	57.1107
12	1330000	6255000						X1381/N																	52.8527
13	1335000	6255000						X1381/N																	17.2177
14	1340000	6255000						X1381/N																	21.3651
15	1345000	6255000						X1381/N																	7.75927
16	1350000	6255000						X1381/N																	6.13652
17	1320000	6260000						X1381/N																	11.6059
18	1325000	6260000						X1381/N																	59.8357
19	1330000	6260000						X1381/N																	102.241
20	1335000	6260000						X1381/N																	47.5739
21	1340000	6260000						X1381/N																	28.0727
22	1345000	6260000						X1381/N																	8.70895
23	1350000	6260000						X1381/N																	1.22119
24	1325000	6265000						X1381/N																	70.774
25	1330000	6265000						X1381/N																	44.9148
26	1335000	6265000						X1381/N																	27.582
27	1340000	6265000						X1381/N																	3.95639
28	1345000	6265000						X1381/N																	39.9731
29	1350000	6265000						X1381/N																	21.145
30	1325000	6270000						X1381/N																	22.2027
31	1330000	6270000						X1381/N																	61.8916
32	1335000	6270000						X1381/N																	33.6586
33	1340000	6270000						X1381/N																	0.850215
34	1345000	6270000						X1381/N																	3.72117
35	1350000	6270000						X1381/N																	1.47912
36	1320000	6275000						X1380/N																	5.52396
37	1325000	6275000						X1380/N																	72.6968
38	1330000	6275000						X1381/N																	39.19
39	1335000	6275000						X1381/N																	17.7931

Figure D25. Sheet Grid.