



IAQEAssist

July 2007

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WELCOME

Welcome to IAQEAssist. IAQEAssist provides a documentation to help users familiarise capabilities and operations of the IAQE software.

The IAQE software is an environmental assessment tool for commercial buildings, developed by the Cooperative Research Centre (CRC) for Construction Innovation that includes research and industry partners: CSIRO, Department of Public Works QLD, RMIT University, Queensland University of Technology, University of Western Sydney, ABCB, Bovis Lend Lease, Building Commission VIC, Woods Bagot and Arup.

There are two parts in IAQEAssist:

- Part 1: Principles
- Part 2: Software overview
- Part 3: Installation and operation

PART 1: PRINCIPLES

Indoor air pollution

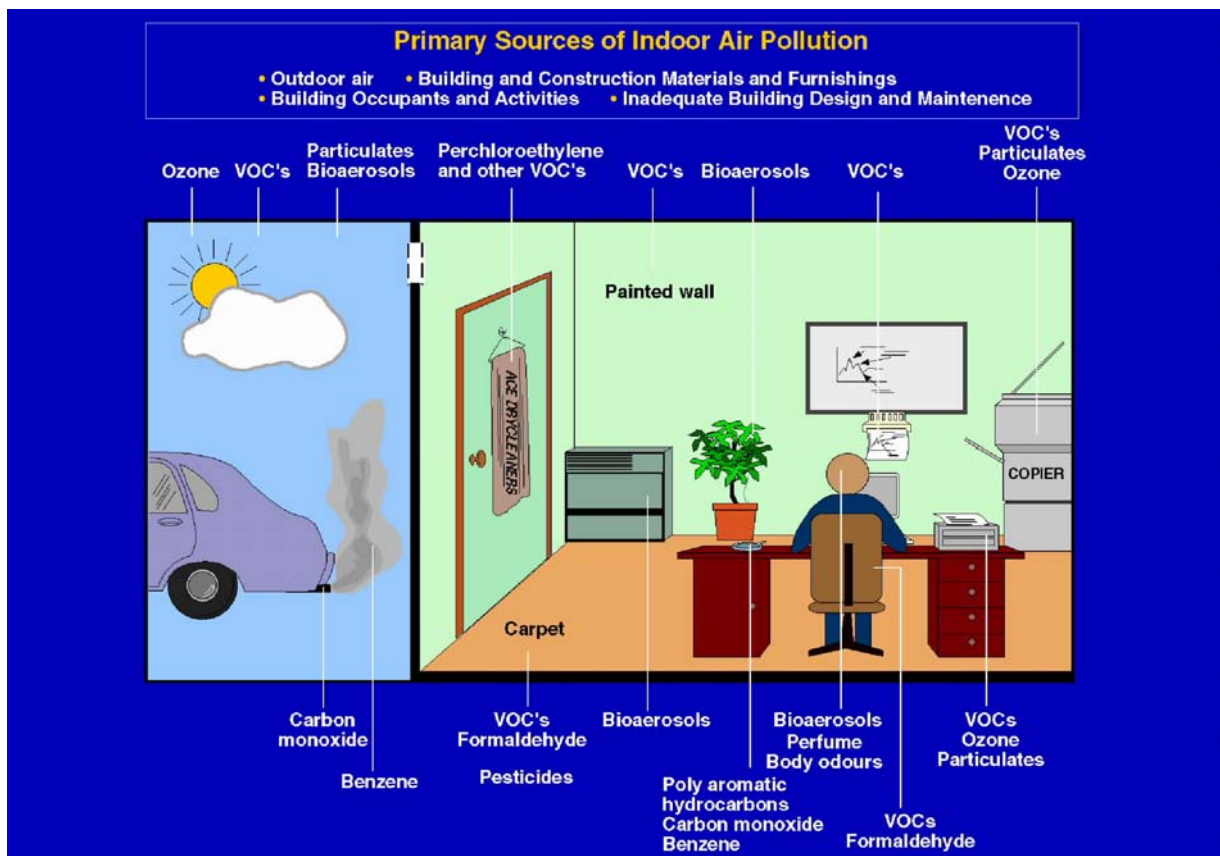


Figure 1 Primary sources of indoor air pollution

The primary sources of indoor air pollution in office buildings, as illustrated in Figure 1, are:

- Emissions from large area building products,
- Emissions from office furniture and equipment, and
- Pollutants from urban air introduced by ventilation.

Emissions from large-area building products are Volatile Organic Compounds (VOCs) from paints, floor covering systems, wall-boards (plasterboard and wood-based panels), and fixed furniture materials (structure and surfaces).

Emissions from office equipment are VOCs and fine particles from operating office equipment linked to the frequencies of operation of such sources in office buildings.

Emissions from office furniture are typical emissions of VOCs from office furniture such as work-stations.

Pollutants in ventilation air in mechanically ventilated office buildings are from outdoor urban fine particle pollution and are dependent on the ventilation flows in the enclosed space and efficiency of HVAC filtration.

Most HVAC systems are believed to pass the recirculated indoor air plus the outdoor air intake through a filter (i.e. the recirculated indoor air will have multiple passes through the filter). IAQ Estimator is based on a model that incorporates this general feature plus the added feature of a second filter for the outdoor air intake, as in Figure 2.

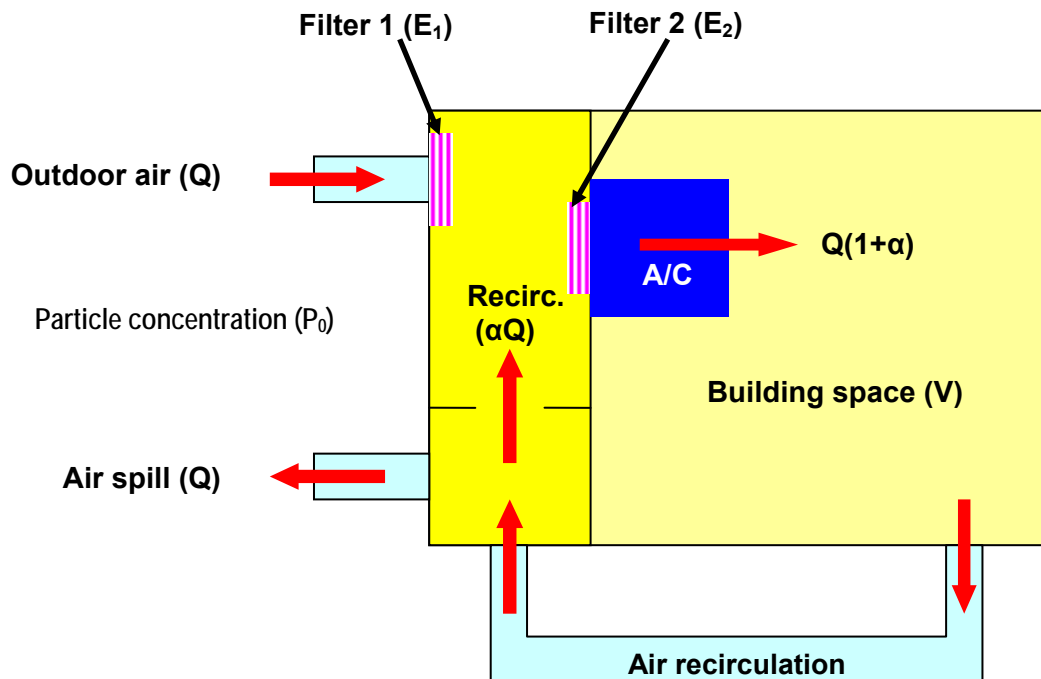


Figure 2 Schematic diagram of air circulation and filtering

IAQE principles

The basic principles followed during the development of the Indoor Air Quality estimator are;

- Indoor air pollutants arise from indoor materials and urban air.
- Major sources of indoor air pollution are identified.
- Key pollutants related to criteria for health significance are identified.
- The model is a simplified proof-of-concept.
- One indoor space (i.e. a building level) is assessed at a time.
- The whole building level is considered as one, fully mixed ventilated space.
- Quantities of indoor materials are obtained from a CAD model.
- The emissions of the materials are obtained from a CSIRO database of pollutant emissions from indoor materials.
- Outside air pollutants are dependent on the urban air pollutant load and filter efficiency.
- Indoor air pollutant levels are estimated from aggregated emissions/ventilation air in a simplified model.
- Indoor air emissions and particles are compared to health-based environmental exposure criteria to determine acceptability.
- Those pollutants which exceed the health criteria are identified.
- It is possible to “drill down: to the sources of pollutants in the building.
- Alternative lower polluting materials, equipment or higher performing filters can be selected to investigate the impacts.

Integrated model development

The Indoor Air Quality Estimator is an integrated proof-of-concept model development comprising:

- Acquiring dimensional data for the indoor spaces from a 3D CAD Building Information Model via IFC files.
- An application of Design View.
- A methodology for estimating indoor air pollutants over time from quantities and unit emissions from large area materials, office equipment and furniture and ventilation air sources, flow rates and filtration efficiency.
- An assessment approach based on health based criteria for indoor pollutants.
- An application of a standard reporting system (BIRT).

PART 2: SOFTWARE OVERVIEW

User input

IAQE user inputs were minimized so that users could focus on the task at hand – identifying high pollutant sources and testing the impact of alternative materials and ventilation scenarios. The inputs required (assuming that the 3D CAD model and the emissions databases exist) are restricted to tagging the building components and setting ventilation requirements.

3D CAD building

The dimensional (including marking of spaces) data is obtained from a 3D CAD model (Figure 3). Tagging of each emission component (e.g. identifying paint on wall, floor covering, furniture and office equipment) is done in IAQE using DesignView. Each piece of office equipment is specified by:

- name (from an available list),
- number of pieces in the room zone, and
- usage rate (e.g. number of copies per day).

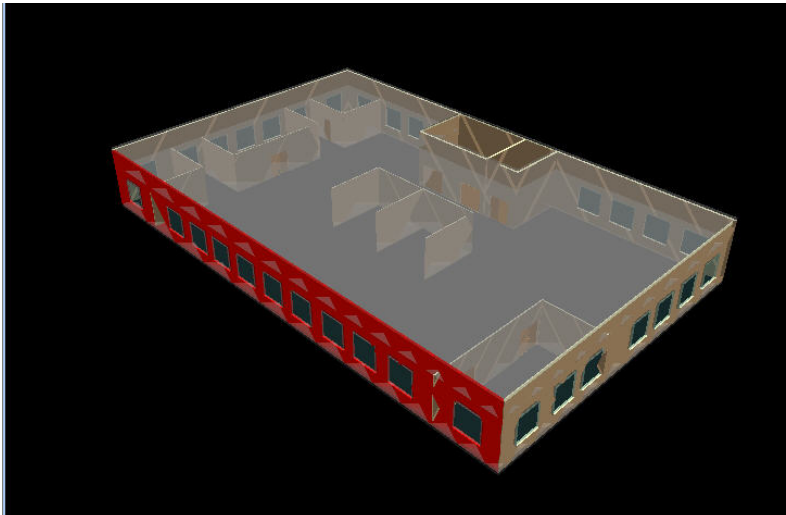


Figure 3 3D CAD image of a building

Ventilation

The characteristics for the building zone (level) are specified as follows:

- Location
- Outdoor air filter type
- Supply air filter type
- External flow rate
- Supply flow rate

Databases

There are four types of data stored in the IAQE database.

- Emissions from building materials,
- Office equipment emissions,
- Outdoor air pollutants (3 locations only, busy, urban and rural), and
- Health related limit criteria.

The databases for the materials are accessed automatically in the IAQE software when the materials, equipment and ventilation conditions are selected by the user. The databases are not editable by the user.

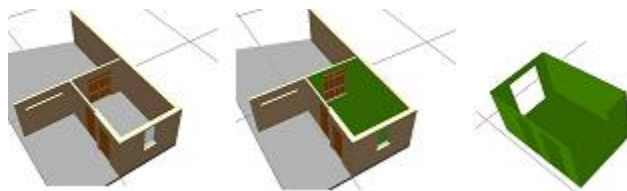
DesignView

DesignView provides powerful functions besides the ability to view IFC files in that it provides:

- A plug-in/perspective (view) architecture which allows multiple analysis applications to sit alongside DesignView and interact with it;
- A navigator panel which allows selection of a particular model for viewing;
- A “tree view” which allows the user to rapidly select sections of the building model to visualise and is synchronised with the viewing panel;
- A properties panel which displays tabular information which is attached to a selected building component in the viewer panel or the tree view;
- A problems list which displays a list of missing information that has been identified by DesignView on loading a building model; and
- A tasks list that allows people to enter “to do” lists to ensure that things are not forgotten during design development.

DesignView is the driving engine for the Indoor Air Quality Estimator.

The key feature of DesignView which was attractive to IAQE was the ability to add finishes to any building object in the 3D CAD model and see the object visually. The system was modified for IAQE to add paints and panels from a material emissions database and expanded to be able to add office furniture and equipment to the space. These finishes may be visually inspected in the 3D Viewer.



DesignView provides the Workbench Perspective as a default arrangement of views. The perspective is made up of the following views:

- 3D Viewer: This view displays the three dimensional visualisation of a building model.
- Model Outline: This view displays the outline of the building model in a tree structure.
- Viewer Palette: This view allows the user to adjust the appearance of building elements in the 3D Viewer.
- Problems & Tasks: These views display problems with the building model and user defined tasks.
- Properties: This view presents the properties of a selected building element to the user for inspection and modification.
- Navigator: This view allows the user to interact with project files, including the building model.

The key features most useful in IAQE are the 3D Viewer, the Model Outline and the Navigator.

The 3D viewer displays a real-time fully rendered 3D view of the active building model. The user may use the mouse and keyboard to explore and interact with the model. The camera can be panned, zoomed and orientated in any direction, and the user can select individual building elements using the mouse.

The Model Outline displays the hierarchy of the building model in a tree structure. The model may be traversed according to four different hierarchies; Building, Element Type, Space Type and Material Type. The Model Outline view is linked with the other views in the

Workbench perspective. Selecting elements in the Outline will highlight their visual representations in the 3D Viewer (if they are visible). Conversely, selections made in the 3D Viewer will be reflected in the Outline.

The Navigator view is used to display and navigate through the workspace. The workspace is a storage area on the user's computer. It contains a number of projects, which will typically contain a building model file and possibly other resources relevant to the project.

Calculations

The initial focus is on performing calculations for material emissions from example building components. The calculations provide:

- Total aggregated emissions by emission type.
- Aggregated emissions by building component and emission type.
- Indicators on whether the total aggregated emissions exceed the defined limits.
- All of the above for time points 1, 3, 7, 14, 28, 183, 365 days

Outputs

The outputs consist of:

- Table of pollutants with indicators showing whether total aggregated emissions exceed the health limit for each time point. For each emission, the reports contain
 - Emission name
 - Emission ID code
 - Maximum acceptable concentration (limit)
 - Indicators on whether the pollutant has exceeded the health limits or not - ✓ or ✕
- Pie charts of total pollutants broken down by pollutant for three time points.
- Table of finishes with pollutants at three time points.
- Pie charts of pollutants broken down by sources for three time points.

Other considerations

Validation is limited to comparing estimates against available background measured data from CSIRO and other Australian data for several examples of indoor environments.

The Indoor Air Quality Estimator **IS**:

- An office design tool for selection of materials, office equipment, ventilation filtration.
- Useful in design towards optimised Indoor Air Quality.
- A tool that allows control of indoor air pollutants
 - from new materials (aimed at first 6 months of construction),
 - from long term factors such as office equipment, filtration system and urban air.

The Indoor Air Quality Estimator **IS NOT**:

- A means of distinguishing a priori whether indoor environments present health risks.
- A means of predicting IAQ with precision.
- A means of dealing with all aspects of IAQ (e.g. provision/distribution of ventilation air, maintenance, indoor activities, other pollutants such as micro-organisms, combustion gases etc.).
- A tool for use in regulations.

PART 3: INSTALLATION AND OPERATION

Installing IAQE

The software is supplied as a large compressed (Zip) file (approx. 90MB). To install IAQE, unzip the file to the desired directory. A valid Design View licence file is also required to be in the desired IAQE directory.

To run the software, run the IAQE.exe file directly from the IAQE directory or from a shortcut on the desktop to the IAQE.exe file.

Perspectives

There are three views, work areas or perspectives in IAQE:

- Design View
- Emissions Data
- Reports

Each is opened from the menu under Window>Open perspective. The default is Design View.

Creating a new project

Design View is designed to be used in a project-orientated manner. The user may create a number of projects in a workspace, and each project may contain a number of different building models, along with other resources.

To create a project, select “File>New” as illustrated in Figure 4. On clicking on “New”, another window will ask to select a wizard (Figure 5) will appear. Choose “New CRC Project” and click “Next.”



Figure 4 Creating a new project



Figure 5 Selecting a wizard for a new project

A “New CRC Project” window (Figure 6) will appear. Specify the name of the project. The user may also specify where to store the project and its resources on the file system. A default workspace location is provided, and it is recommended that this is used. Then click the Finish button. A new empty project will be created and will be visible in the Navigator view.

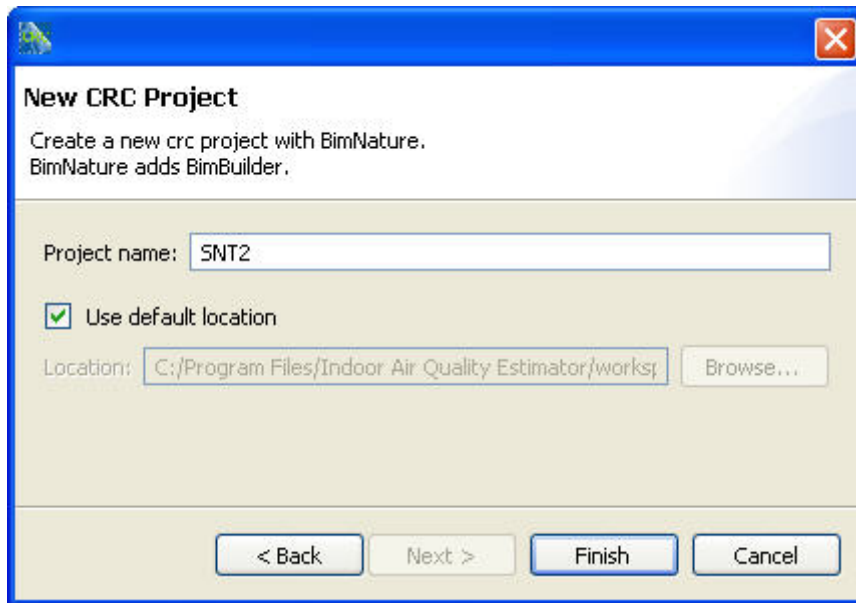


Figure 6 Naming new project

Loading building model data

After setting up the project, the next step is to enter data describing the physical dimensions of the indoor space. This can be done in either of two ways:

- From an IFC file of a 3D CAD building model, or
- By entering the dimensional data manually

Using the IFC file is the preferred approach as it enables the use of the 3D CAD viewer which links visual components to the names in a hierarchical list of components in the building model.

Importing a building model from an IFC file

Note: IFC files may only be imported if EDM 4.5 is installed. Use of the example in the supplied software is sufficient to become familiar with the Indoor Air Quality Estimator.

A building model can now be imported into the newly created empty project.

Only IFC2x2 building models can be imported into the Indoor Air Quality Estimator.

To import a model, first highlight the project into which the model is to be imported in the Navigator view. Then either choose “File>Import” (Figure 7), or alternatively you may right click the project in the Navigator view, and choose “Import>Other” from the context menu.

An “Import Wizard” (Figure 8) will appear. “IFC2x2 Building Model” must be selected and then click “Next”.

The next page of the wizard collects the model details (Figure 9). An IFC2x2 file may be imported in two ways. The simplest approach is to specify the IFC file directly.

When importing a model, the system needs to know into which project to import it. This can be specified in the drop down list “Into CRC Project”. By default, this will be whichever project has been selected before the “Import” menu was selected.

Click the “Finish” button to start the importation process. The system will then create an internal model, calculate geometry, and validate the model. Note that the length of time this process takes depends not only on the size of the model, but also the geometric complexity of the building elements. However this process only needs to be done once per model.



Figure 7 Importing a new model

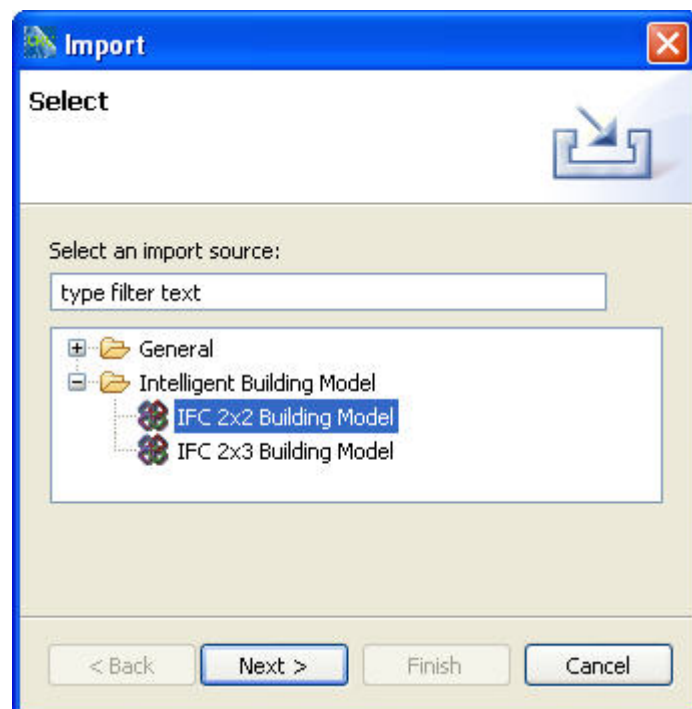


Figure 8 Selecting a new model type

EDM database connection details

Select to import IntelligentBuildingModel directly from Ifc2x2 file or model already stored in EDM database.

EDM Database Location: C:\edm45040\Db\crc.EDM Browse...

EDM Database Password: ●●●

☐ Import from Ifc2x2 model in EDM

☒ Import from Ifc2x2 file

File Name: E:\Selwyn\My Words\CSIRO\CSE\IAQE\5 Browse...

Into CRC project

SNT Building ▼ New...

< Back Next > Finish Cancel

Figure 9 Selecting the file containing the new model

Entering building data manually

To begin entering data manually into a model, choose “File>New” and select the “manual input” wizard under IAQE. A window similar to Figure 10 will appear. Alternatively, first highlight the project into which the model is to be entered in the Navigator view and right click on the model for which data is to be entered manually. Select “New>manual input” (Figure 11) and the same window as in Figure 10 will appear.

Click on the model name and enter a file name for the data. Then click on “Finish”.

The manual input window (Figure 12) will appear on the workbench. Click on “New” to add an entry to the required category (finish, furniture or equipment) and the window will expand to show a new line (Figure 13) for entering data on that component. Type in a name to identify the component, right click on the “<select xxxx>” to select from a drop down list of available finishes, furniture or equipment and then enter a value, area for finishes, and number of pieces of furniture or equipment. The values are automatically stored. Clicking on the red **X** deletes the complete entry.

The typical completed manual input window is shown in Figure 14.

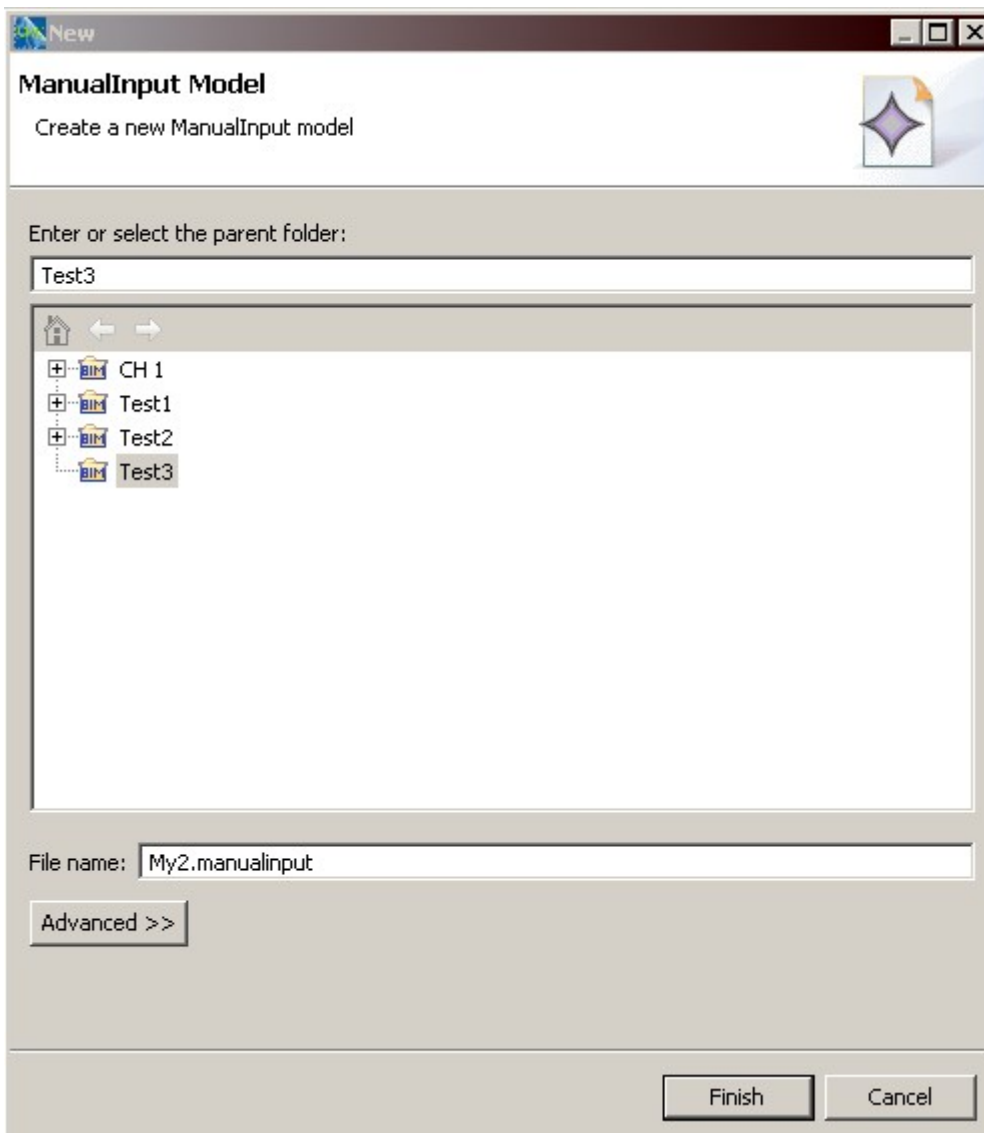


Figure 10 Selecting 3D CAD or manual input

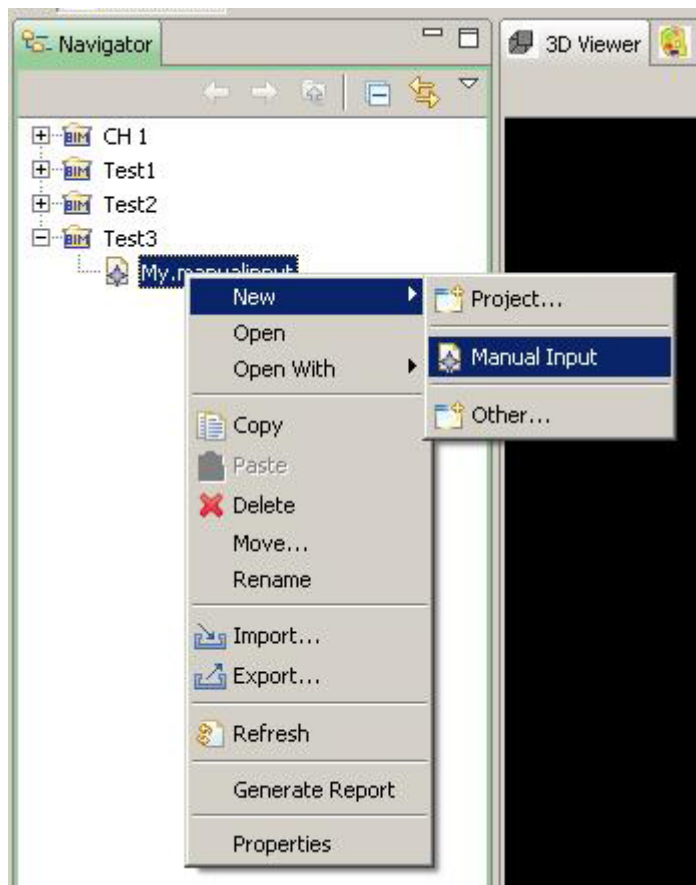


Figure 11 Selecting 3D CAD or manual input

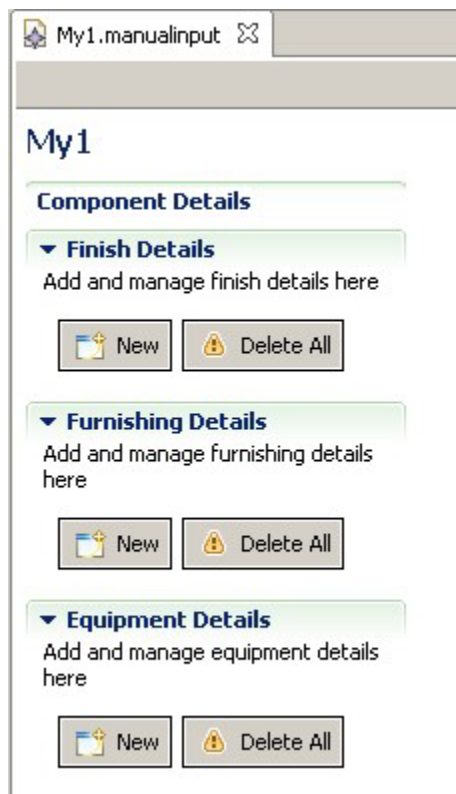


Figure 12 Blank manual input window

▼ Finish Details
Add and manage finish details here

[<Select Finish>](#)

Area (m2)

Figure 13 Blank new component input window

My

Component Details

▼ Finish Details
Add and manage finish details here

| | | | | |
|--------------------------------------|--|-----------|-----------------------------------|----------------------------------|
| <input type="text" value="Wall 1"/> | Dulux Full Gloss Enamel 1997 | Area (m2) | <input type="text" value="21.0"/> | <input type="button" value="X"/> |
| <input type="text" value="Wall 2"/> | Dulux Full Gloss Enamel 1997 | Area (m2) | <input type="text" value="15.0"/> | <input type="button" value="X"/> |
| <input type="text" value="Wall 3"/> | Dulux Full Gloss Enamel 1997 | Area (m2) | <input type="text" value="21.0"/> | <input type="button" value="X"/> |
| <input type="text" value="Wall 4"/> | Dulux Full Gloss Enamel 1997 | Area (m2) | <input type="text" value="15.0"/> | <input type="button" value="X"/> |
| <input type="text" value="Floor"/> | Dulux Full Gloss Enamel 1997 | Area (m2) | <input type="text" value="35.0"/> | <input type="button" value="X"/> |
| <input type="text" value="Ceiling"/> | Dulux Full Gloss Enamel 1997 | Area (m2) | <input type="text" value="35.0"/> | <input type="button" value="X"/> |

▼ Furnishing Details
Add and manage furnishing details here

| | | | | |
|--|---|----------|--------------------------------|----------------------------------|
| <input type="text" value="Furniture"/> | New items 5-12mth old L=0.6, 1998 | Quantity | <input type="text" value="3"/> | <input type="button" value="X"/> |
|--|---|----------|--------------------------------|----------------------------------|

▼ Equipment Details
Add and manage equipment details here

| | | | | |
|--|---|----------|--------------------------------|----------------------------------|
| <input type="text" value="Photocopier"/> | Xerox DocuCentre 506CP (equiv to CH2) | Quantity | <input type="text" value="1"/> | <input type="button" value="X"/> |
| <input type="text" value="Printer"/> | Texas Printer (early 1990s) | Quantity | <input type="text" value="1"/> | <input type="button" value="X"/> |

Figure 14 A typical completed manual input window

Design View

The Design View perspective contains eight windows (Figure 15).

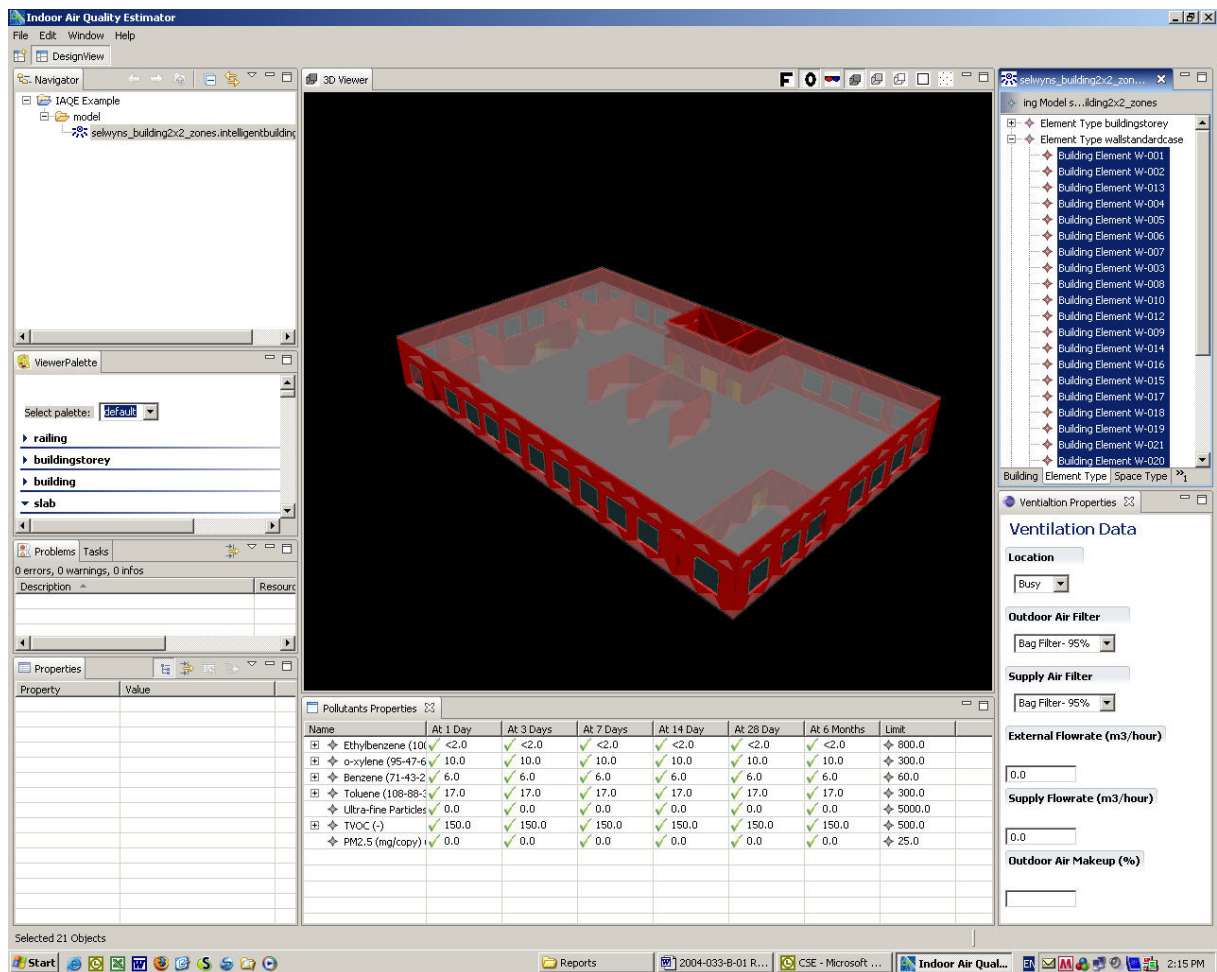


Figure 15 Design view perspective

This workbench serves as the master work area of IAQE. Double clicking on the top left most icon in the tab of each window displays a full screen view of that window. Double clicking again on the icon returns to the full workbench view from where the single window was activated.

The eight windows are:

- Navigator
- Properties
- 3D Viewer
- Viewer Palette
- Problems
- Building Model
- Pollutants Properties
- Ventilation Properties

Each is described below. The 3D Viewer is not available if building model data has been entered manually.

Navigator

The navigator (Figure 16) allows the user to select the building for analysis. The buildings are in a hierarchical structure. Click on + to display the level below and double click to select

the building. A 3D CAD image should appear in the 3D View window and a hierarchical list of components appear in the Building Model window.

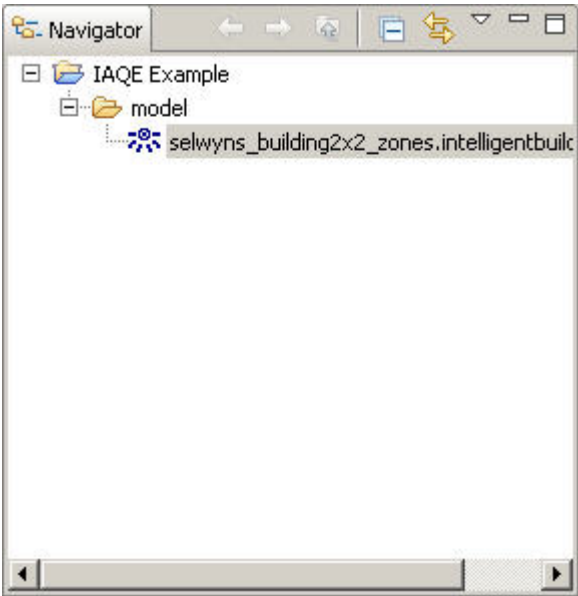


Figure 16 IAQE navigator window

3D Viewer

The 3D CAD Viewer window (Figure 17) displays a 3D CAD image of the current building model. The toolbar at the top right hand side of the window provides the following functions:

- First person control,
- Orbital control,
- Stereo rendering,
- Toggle smooth shading rendering model,
- Toggle flat shading rendering model,
- Toggle wire-frame rendering model,
- Toggle two dimensional rendering model, and
- Toggle point rendering mode.

The orbital control is the most useful viewing mode as the 3D CAD view can be rotated in any direction by pointing to the model and holding down the left mouse key while moving the mouse.

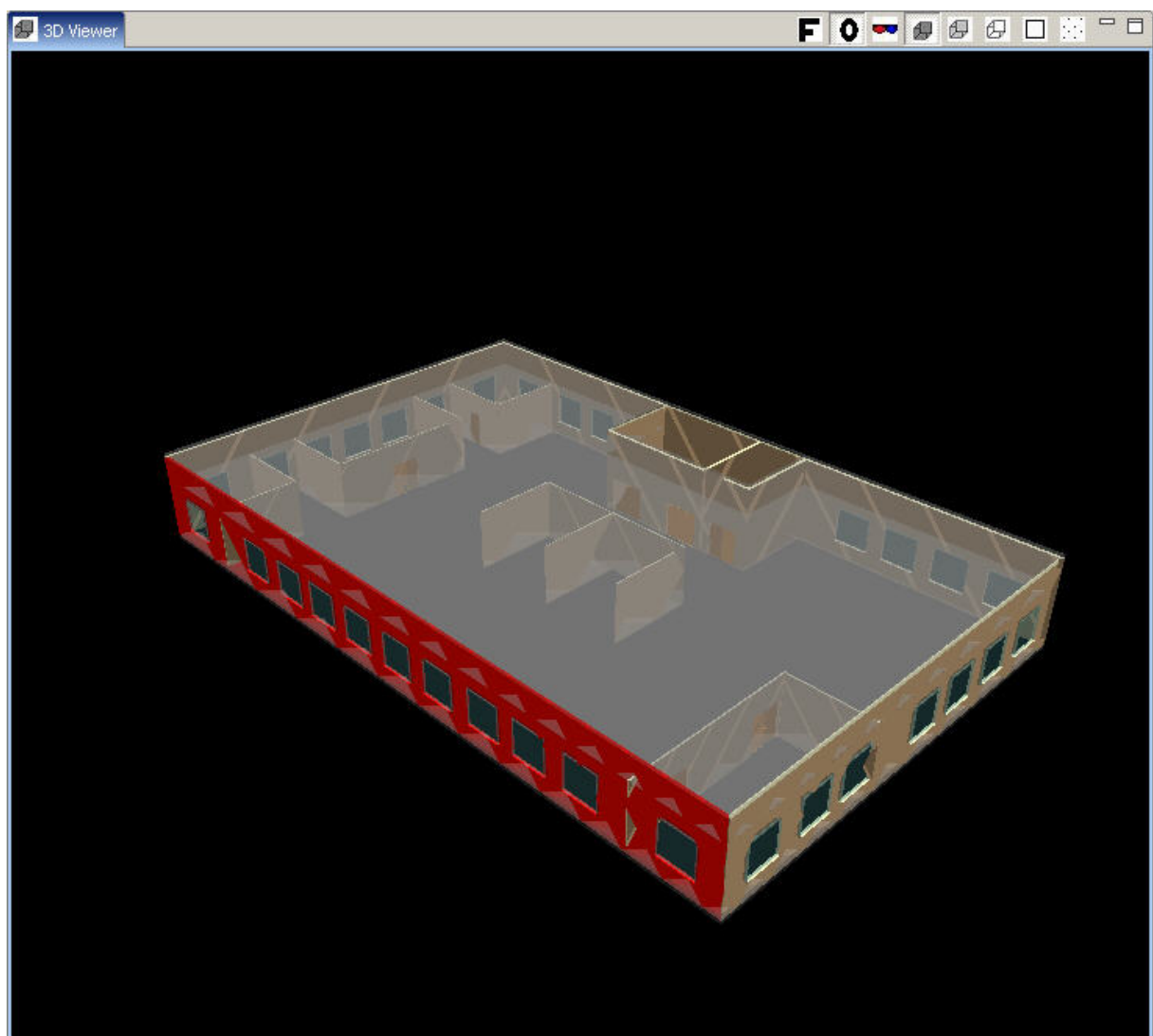


Figure 17 IAQE 3D Viewer window

Selection of components

Individual components of the building can be selected and highlighted either by clicking on the 3D component or on the building model hierarchical view.

Viewer Palette

The Viewer Palette view may be used to adjust the display properties of elements based on element types. Elements can be shown or hidden and have their opacity and colour adjusted. The Viewer Palette window (Figure 18) lists all the possible components with the option of setting

- Whether it is displayed,
- Its colour, and
- its opacity.

It is useful to set the opacity of the slabs to about 25% to be able to see inside the building in the 3D model.

Different Viewer Palette configurations can be saved by scrolling down to the bottom of the list and clicking the “Save” or “Save As” buttons. The configuration can later be retrieved using the drop down list at the top of the view.

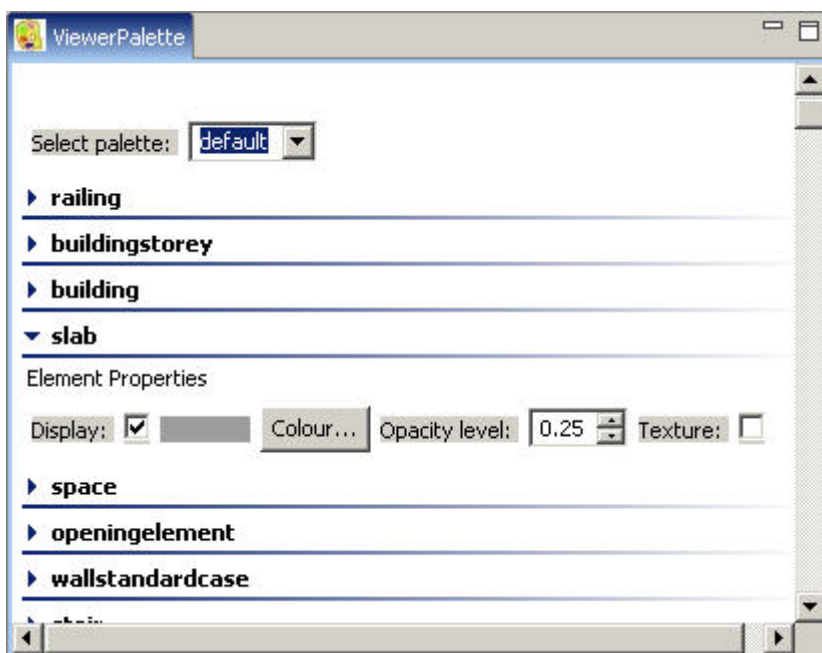


Figure 18 IAQE Viewer Palette

Building Model

The Building Model window (Figure 19) displays a hierarchical list of components of the building. Clicking on any component highlights it in the 3D view window and calculates the pollutants for it in the Pollutants Properties window and various properties in the Properties window. Clicking one of the tabs on the bottom of the window shows one of the different hierarchies of the building:

- Building
- Element type,
- Space type, and
- Material type.

The last item in any branch of the lists is the finish.

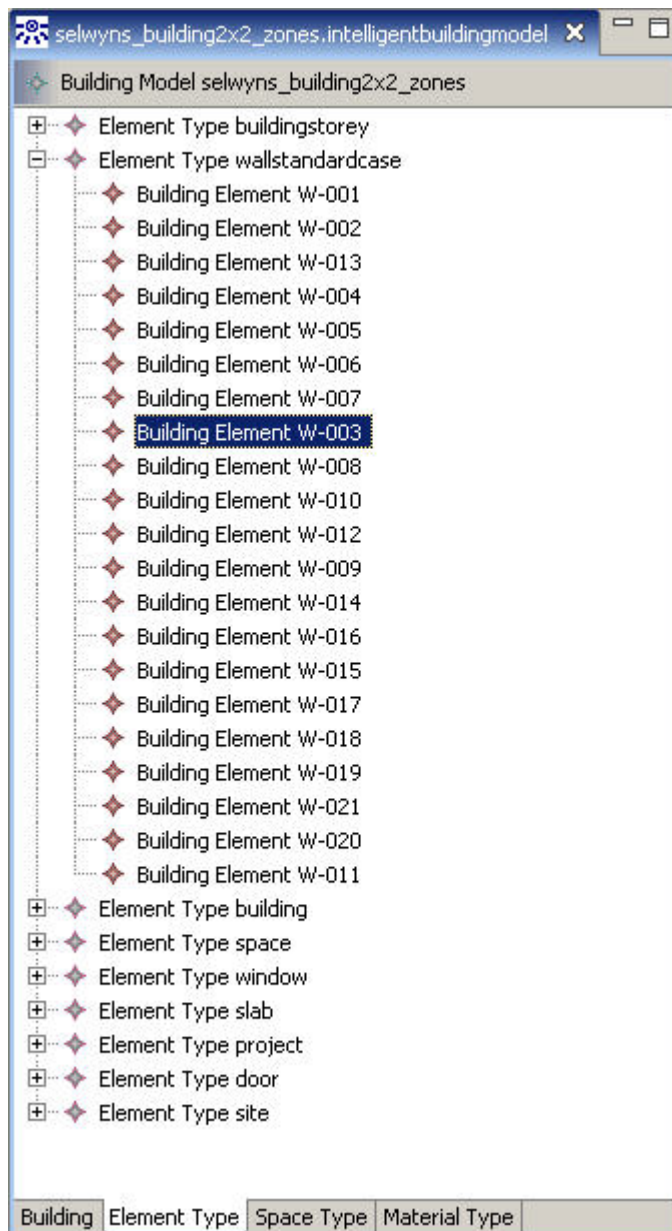


Figure 19 IAQE Building Model window

The 3D model may be navigated using the keyboard and mouse, and building elements may be selected by clicking them in the 3D Viewer or the Model Outline. Elements may be Drag 'n' Dropped from the Model Outline to the 3D Viewer to view them in isolation. To view the entire model again, simply Drag 'n' Drop the model's "Site" element (top level node in the "Building Hierarchy" mode).

Adding finishes, furniture and office equipment

Finishes, furniture and office equipment can be added to a component by clicking on the required component in the model hierarchy and right clicking. Select "Add finish" and another pop-up window shows a choice of coatings, panels and floor coverings. By clicking on the + signs, the list can be expanded until the required product appears. After clicking on the required finish, a value from 0 to 1 inclusive must be entered to indicate what proportion of the component is to be covered by the selected finish. Click "Next" to select which space the component is in from the list (one or more may be selected) and click "Finish". The finish has been added and the results for the selected component appear in the Pollutant Properties window.

Pollutants Properties

The Pollutants Properties window (Figure 20) displays the pollutants generated by the building components selected in the Building model window. If the emissions are below the accepted level, a green tick is displayed and if not, a red cross is displayed for time periods up to 6 months.

Clicking on a pollutant displays its properties in the Properties window.

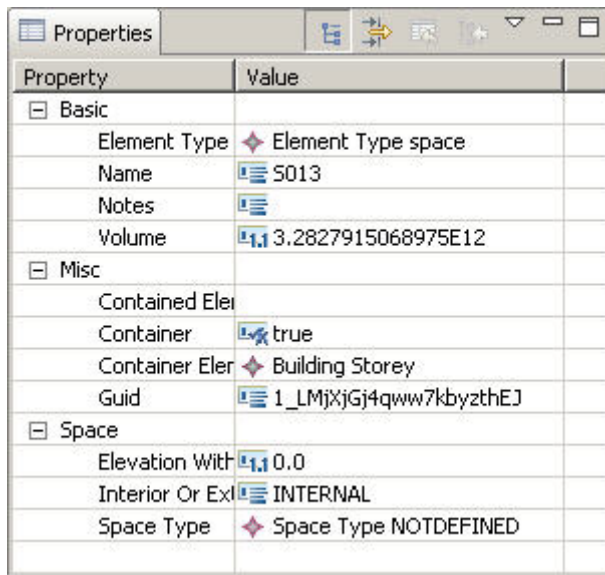
Clicking on the + signs enables drilling down in great detail and provides additional detail such as the percentages of the total emissions of a pollutant by the different materials contributing to the particular pollutant.

| Pollutants Properties | | | | | | | |
|-----------------------|-------------|-------------|-------------|-------------|-------------|-------------|--------|
| Name | At 1 Day | At 3 Days | At 7 Days | At 14 Day | At 28 Day | At 6 Months | Limit |
| 4-Phenyl cyclohex | 2.116714... | 2.116714... | 1.058357... | <1.0583... | <1.0583... | <1.0583... | 10.0 |
| Benzene (71-43-2) | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 60.0 |
| 2,2,4-Trimethyl-1, | 158.7300... | 28.86000... | 8.898500... | 2.645500... | <0.0240... | <0.0240... | 5000.0 |
| Toluene (108-88-3) | 24.57303... | 23.65586... | 23.65586... | 23.65586... | 23.65586... | 23.65586... | 300.0 |
| TVOC (-) | 6371.075... | 1335.332... | 935.1397... | 270.2802... | 174.6557... | 173.1271... | 500.0 |
| 4-Vinyl cyclohexer | <0.0635... | <0.0635... | <0.0635... | <0.0635... | <0.0635... | <0.0635... | 10.0 |
| PM2.5 (mg/copy) | 1.856060... | 1.856060... | 1.856060... | 1.856060... | 1.856060... | 1.856060... | 25.0 |
| Ethylbenzene (106 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | 800.0 |
| o-xylene (95-47-6) | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 300.0 |
| Ultra-fine Particles | 7.424242... | 7.424242... | 7.424242... | 7.424242... | 7.424242... | 7.424242... | 5000.0 |
| Styrene (100-42-5) | 3.386742... | <3.3867... | <3.3867... | <3.3867... | <3.3867... | <3.3867... | 500.0 |
| Hexanal (66-25-1) | 856.0274... | 107.0034... | 61.14482... | 0.917172... | 0.412727... | <0.3821... | 100.0 |
| | | | | | | | |
| | | | | | | | |

Figure 20 IAQE Pollutant Properties window

Properties

The Properties window displays details of selected building elements and further details of the pollutant selected in the Pollutant Properties window (Figure 21).



The screenshot shows a software window titled 'Properties' with a standard toolbar. Below the toolbar is a table with two columns: 'Property' and 'Value'. The table is organized into three expandable sections: 'Basic', 'Misc', and 'Space'. The 'Basic' section contains 'Element Type' (Element Type space), 'Name' (S013), 'Notes' (empty), and 'Volume' (3.2827915068975E12). The 'Misc' section contains 'Contained Element' (empty), 'Container' (true), 'Container Element' (Building Storey), and 'Guid' (1_LMjXjGj4qww7kbyzthEJ). The 'Space' section contains 'Elevation With' (0.0), 'Interior Or Exterior' (INTERNAL), and 'Space Type' (Space Type NOTDEFINED).

| Property | Value |
|----------------------|------------------------|
| Basic | |
| Element Type | Element Type space |
| Name | S013 |
| Notes | |
| Volume | 3.2827915068975E12 |
| Misc | |
| Contained Element | |
| Container | true |
| Container Element | Building Storey |
| Guid | 1_LMjXjGj4qww7kbyzthEJ |
| Space | |
| Elevation With | 0.0 |
| Interior Or Exterior | INTERNAL |
| Space Type | Space Type NOTDEFINED |

Figure 21 IAQE Properties window

Ventilation Properties

The Ventilation Properties window (Figure 22) allows the user to set the ventilation parameters of:

- Location – a choice of Busy, Urban or Rural
- Outdoor air filter – a choice of Bag Filter 95%, Bag Filter 85%, Bag Filter 65%, pleated or none
- Recirculation supply air filter - a choice of Bag Filter 95%, Bag Filter 85%, Bag Filter 65%, pleated or none
- External flow rate – m^3/h
- Recirculation supply flow rate – m^3/h

The screenshot shows a software window titled "Ventilation Properties". Inside, there is a section titled "Ventilation Data". This section contains five expandable categories, each with a dropdown menu:

- Location:** The dropdown menu is set to "Busy".
- Outdoor Air Filter:** The dropdown menu is set to "Bag Filter - 95%".
- Supply Air Filter:** The dropdown menu is set to "Bag Filter - 95%".
- External Flowrate (m3/hour):** The text input field contains "0.0".
- Supply Flowrate (m3/hour):** The text input field contains "0.0".

Figure 22 IAQE Ventilation Properties window

Problems

The Problems window (Figure 23) displays error messages.

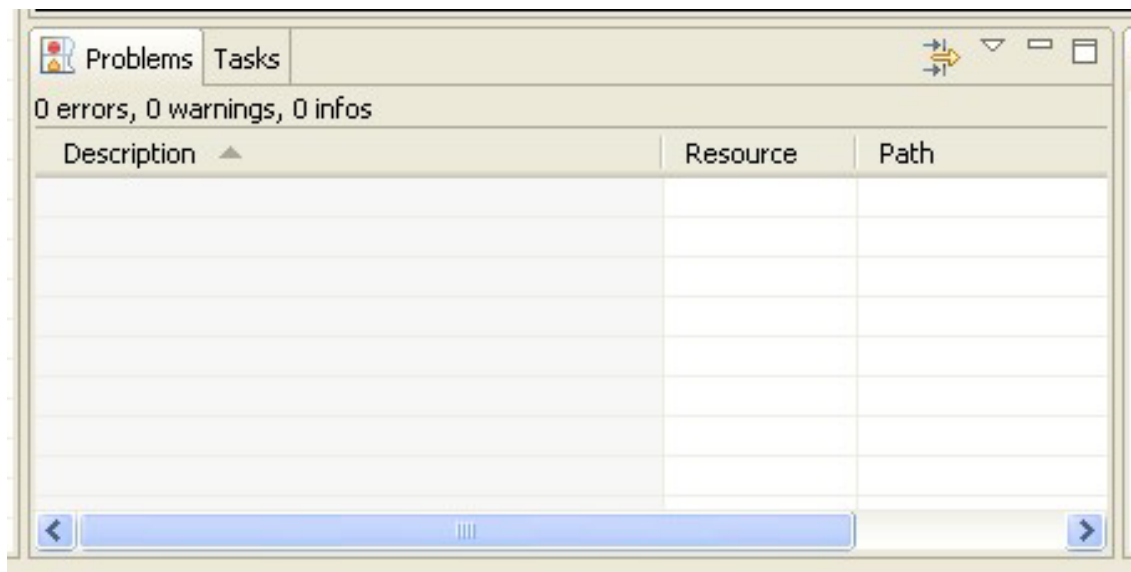


Figure 23 IAQE Problems window

Emissions data

The Emission Data perspective (Figure 24) displays the emissions data in a hierarchical table for browsing or checking on values used. The user cannot change any data in the emissions database.

| Name | Pollutant | 1 Day | 3 Days | 7 Days | 14 Days | 28 Days | 6 Months |
|--|-----------------------------------|---------|---------|---------|---------|---------|----------|
| Component Class Interior Coatings | | | | | | | |
| Component Type Low Emission Paints | | | | | | | |
| Component Type Conventional Acrylic Paints | | | | | | | |
| Component Dulux Wash&Wear Interior | | | | | | | |
| | 1,2,4-TRIMETHYL BENZENE (95-... | 0.012 | 0.0020 | <0.0010 | <0.0010 | <0.0010 | <0.0010 |
| | 2,2,4-Trimethyl-1,3-pentanedol... | 13.2 | 2.4 | 0.74 | 0.22 | <0.0020 | <0.0020 |
| | DI-N-BUTYL ETHER (142-96-1) | 0.036 | <0.0040 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| | ETHYL BENZENE (100-41-4) | <0.0080 | <0.0020 | <0.0010 | <0.0010 | <0.0010 | <0.0010 |
| | ETHYLENE GLYCOL MONOBUTYL... | <0.06 | <0.0040 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| | M-P-XYLENE (108-38-3/106-42-3) | <0.012 | <0.0020 | <0.0010 | <0.0010 | <0.0010 | <0.0010 |
| | PROPYLENE GLYCOL MONOBUT... | 48.0 | 4.0 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| | TVOC (-) | 32.0 | 2.0 | 0.5 | 0.4 | 0.3 | <0.3 |
| Component Solver Luxury Flat Acrylic | | | | | | | |
| | 1,2-PROPANEDIOL (57-55-6) | 9.0 | <0.6 | <0.6 | <0.6 | <0.6 | <0.6 |
| | 2,2,4-Trimethyl-1,3-pentanedol... | 3.6 | 1.8 | 0.62 | 0.16 | 0.05 | <0.05 |
| | ACETONE + N-PENTANE (n.a.) | 0.056 | 0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| | FORMALDEHYDE (8005-38-7) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | ISOBUTYRALDEHYDE (78-84-2) | 0.08 | 0.06 | 0.03 | 0.01 | <0.0040 | <0.0040 |
| | TVOC (-) | 4.4 | 1.4 | 0.54 | 0.15 | <0.02 | <0.02 |
| Component Taubmans Living Proof Sil | | | | | | | |
| | 1,2-PROPANEDIOL (57-55-6) | 5.0 | <1.0 | <0.6 | <0.6 | <0.6 | <0.6 |
| | ACETONE + N-PENTANE (n.a.) | 0.3 | 0.082 | 0.04 | 0.02 | <0.02 | <0.02 |
| | DIETHYLENE GLYCOL MONOBUT... | 2.6 | 0.44 | 0.12 | 0.0080 | <0.0080 | <0.0080 |
| | FORMALDEHYDE (8005-38-7) | 0.056 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | ISOBUTYRALDEHYDE (78-84-2) | 0.054 | <0.0060 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| | TVOC (-) | 2.2 | 0.2 | 0.06 | <0.02 | <0.02 | <0.02 |
| Component Watty Flat Acrylic (wash | | | | | | | |
| | 1,2-PROPANEDIOL (57-55-6) | 3.0 | 0.14 | 0.026 | 0.01 | 0.0030 | <0.0030 |
| | 2,2,4-Trimethyl-1,3-pentanedol... | 10.0 | 2.0 | 0.42 | 0.034 | 0.016 | <0.016 |
| | FORMALDEHYDE (8005-38-7) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | ISOBUTANAL (78-84-2) | 0.9 | 0.12 | 0.02 | <0.0040 | <0.0040 | <0.0040 |
| | TVOC (-) | 7.4 | 1.5 | 0.26 | 0.054 | <0.02 | <0.02 |
| Component Watty Interior Acrylic Lo | | | | | | | |
| | 1,2-PROPANEDIOL (57-55-6) | 11.0 | 0.6 | <0.02 | <0.01 | <0.01 | <0.01 |
| | 2,2,4-Trimethyl-1,3-pentanedol... | 4.6 | 2.0 | 1.0 | 0.5 | 0.25 | <0.25 |
| | 2-ETHYL-1-HEXANOL (104-76-7) | 0.03 | <0.01 | <0.0060 | <0.0020 | <0.0020 | <0.0020 |
| | FORMALDEHYDE (8005-38-7) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | OCTYL ACETATE (112-14-1) | 0.042 | 0.012 | <0.0040 | <0.0040 | <0.0040 | <0.0040 |
| | TVOC (-) | 5.8 | 1.5 | 0.72 | <0.4 | <0.4 | <0.4 |
| Component Type Solvent Based Paints | | | | | | | |
| Component Type Natural Paints | | | | | | | |
| Component Class Wood Based Panels | | | | | | | |
| Component Class Floor Coverings | | | | | | | |
| Component Class Office Furniture | | | | | | | |
| Component Type Ikea office layout | | | | | | | |
| Component Type Criterion office layout | | | | | | | |
| Component Class Office Equipment | | | | | | | |

| Pollutant | Limit |
|---------------------------------------|--------|
| Ultra-fine Particles (100,000,000 ... | 5000.0 |
| TVOC (-) | 500.0 |
| Trichloroethylene (79-01-6) | 150.0 |
| TOTAL ISOCYANATES (n.a.) | 0.0 |
| Toluene (108-88-3) | 300.0 |
| Tetrachloroethylene (127-18-4) | 100.0 |
| Styrene (100-42-5) | 500.0 |
| STYRENE/O-XYLENE (n.a.) | 0.0 |
| STYRENE/NONANE/O-XYLENE (n.a.) | 0.0 |
| PROPYLENE GLYCOL MONOBUTYL... | 0.0 |
| PROPYL BENZENE (103-65-1) | 0.0 |
| PM2.5 (mg/copy) (-) | 25.0 |
| PHENYL BUTENE (768-56-9) | 0.0 |
| Phenol (108-95-2) | 300.0 |
| PENTANAL (110-62-3) | 0.0 |
| OZONE (10028-15-6) | 0.0 |
| o-xylene (95-47-6) | 300.0 |
| OTHER VOCs (n.a.) | 0.0 |
| OCTYL ACETATE (112-14-1) | 0.0 |
| OCTANAL (124-13-0) | 0.0 |
| O-M-P-XYLENE (130-20-7) | 0.0 |
| N-UNDECANE (1120-21-4) | 0.0 |
| N-PROPYLBENZENE (103-65-1) | 0.0 |
| N-PENTADECANE (629-62-9) | 0.0 |
| NONANAL (124-19-6) | 0.0 |
| N-NONANE (111-84-2) | 0.0 |
| n-Hexane (110-54-3) | 1600.0 |
| N-HEXADECANE (544-76-3) | 0.0 |
| N-DODECANE (112-40-3) | 0.0 |
| N-DECANE (124-18-5) | 0.0 |
| N-BUTYL ACETATE (123-86-4) | 0.0 |
| Naphthalene (91-20-3) | 30.0 |
| METHYL FORMATE (107-31-3) | 0.0 |
| METHOXY ETHYLBENZENE (n.a.) | 0.0 |
| METHANOL (67-56-1) | 0.0 |
| m,p-Xylene (108-38-3/106-42-3) ... | 300.0 |
| M-P-XYLENE (108-38-3/106-42-3) | 0.0 |
| LIMONENE (9969-27-5) | 0.0 |
| LIMONENE (138-86-3) | 0.0 |
| ISOPROPYLENE BENZENE (98-82-8) | 0.0 |
| ISO-CARYOPHYLLENE (87-44-5) | 0.0 |
| ISOBUTYRALDEHYDE (78-84-2) | 0.0 |
| Isobutyl methyl ketone (108-10-1) | 500.0 |
| ISOBUTANAL (78-84-2) | 0.0 |
| ISOBORNEOL (507-70-0) | 0.0 |
| HEXANOIC ACID (142-62-1) | 0.0 |
| Hexanal (66-25-1) | 100.0 |
| HEPTANAL (111-71-7) | 0.0 |
| Freon 22 (75-45-6) | 0.0 |
| FORMIC ACID (BY LC) (64-19-7) | 0.0 |

Figure 24 Emissions data perspective

Reports

The Report perspective provides a comprehensive report. The whole report may be saved or exported as a CSV or pdf file.

To create the report, go to the Report Perspective, highlight the required model in the Navigator window, right click to bring up a menu and click on “Generate report”.

In the Report View, there are four buttons at the top left (Figure 25):

- Toggle table of contents
- Run report (only way to refresh already open report after making changes to inputs)
- Export to CSV file (to copy to Excel)
- Print to pdf

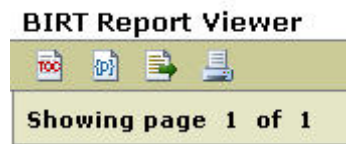


Figure 25 Report buttons

The report consists of several sections covering the emissions for the whole building or element thereof indicating whether the specific emission is above or below the acceptable limit (Figure 26), the contributions of each pollutant at three points in time (Figure 27), and the proportion of sources of a particular pollutant at three points in time (Figure 28).

| Pollutant | IAQE Goal (ug/m3) | 1 day | 3 days | 7 days | 2 weeks | 4 weeks | 6 months |
|--|-------------------|----------|---------|----------|---------|---------|----------|
| Naphthalene (91-20-3) | 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| PM2.5 (ug/copy) (-) | 25 | 2.311 | 2.311 | 2.311 | 2.311 | 2.311 | 2.311 |
| | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Phenol (108-95-2) | 300 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Styrene (100-42-5) | 500 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| TVOC (-) | 500 | 6866.523 | 1475.63 | 1033.753 | 273.725 | 169.443 | 167.675 |
| | | ✗✗ | ✗✗ | ✗✗ | ✓ | ✓ | ✓ |
| Tetrachloroethylene (127-18-4) | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Toluene (108-88-3) | 300 | 18.414 | 17.354 | 17.354 | 17.354 | 17.354 | 17.354 |
| | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Trichloroethylene (79-01-6) | 150 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ultra-fine Particles (10,000,000 P/COPY) (-) | 5000 | 9.245 | 9.245 | 9.245 | 9.245 | 9.245 | 9.245 |

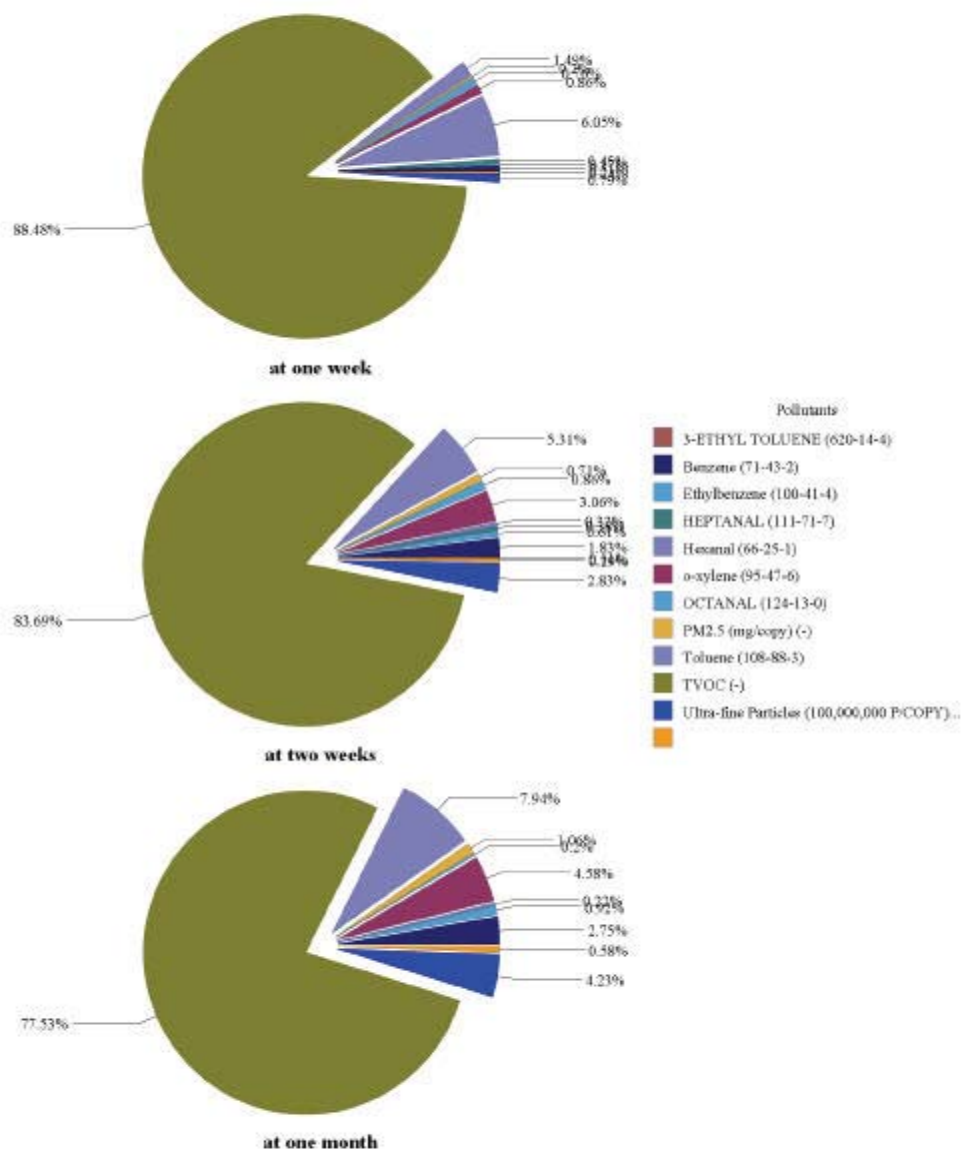
Created on: 22-05-2007

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Figure 26 Emissions acceptability at six time intervals



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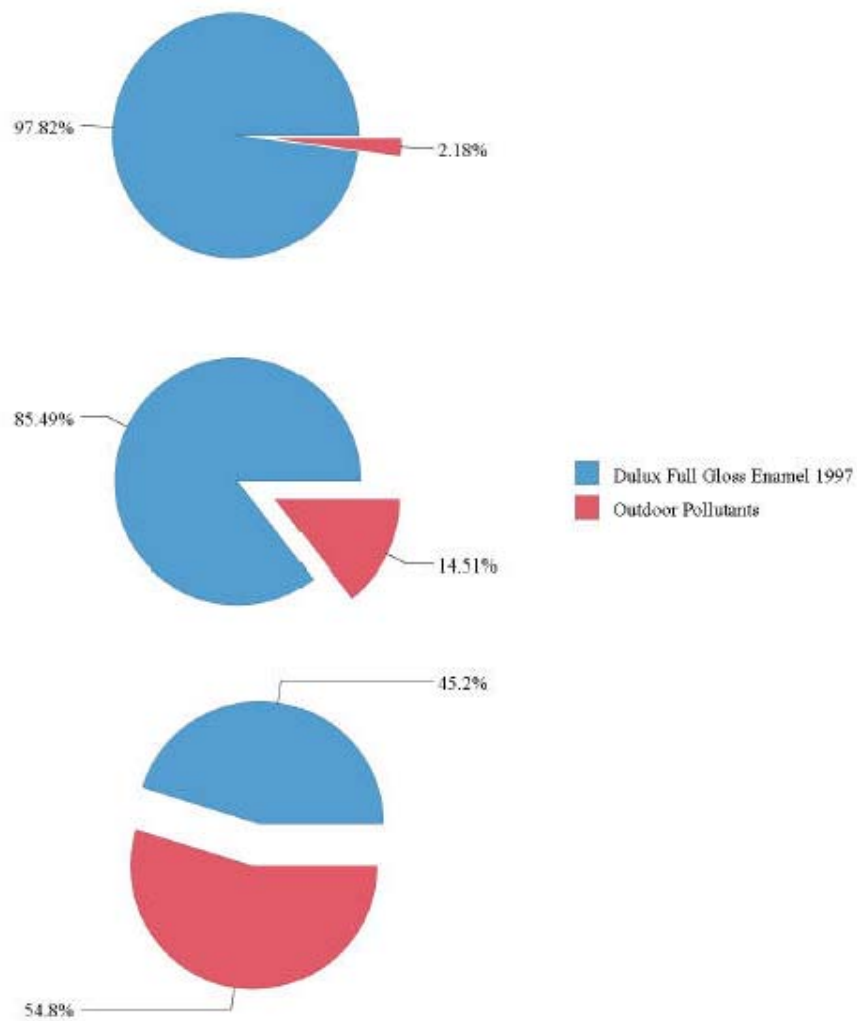
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Figure 27 Proportional contribution from pollutants at three points in time

TVOC (-)



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Figure 28 Proportional contribution from sources at three points in time for a particular pollutant