

Users' Guide to the Health Effects Model

The *Health Effects Model* consists of the following worksheets:

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About This Model

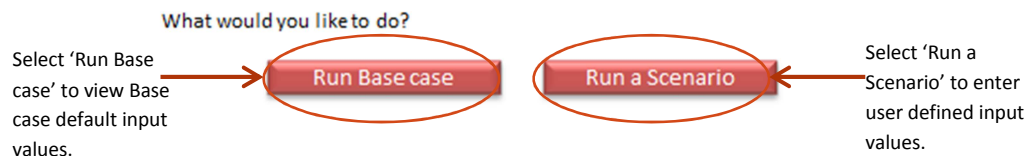
The *Health Effects Model* opens with an 'About This Model' page. This page lists the organisations who commissioned and funded the project, those who assisted in providing the base data, and the project team members who developed the model.

Click on the 'Next' button to proceed to the Introduction page.



1 Introduction

The Introduction page provides a brief background and outline of the structure of the model and allows users to select whether to run base case analysis or select a scenario by requesting a response to:



Select 'Run Base case' to view the base case inputs (this proceeds to **2 Base case Input**) and then run the model or 'Run a Scenario' to select user-defined inputs and then run the model (proceeds to **3 Scenario Input**).

2 Base case Input

All base case input values used to run a base case analysis are displayed and **input values cannot be changed** by the user. An error message is displayed if a value is entered on this page.

A rectangular button with a gradient from orange to yellow, containing the text "Run Base case".

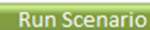
Input values for PM_{10} and population are multipliers but are set to a default value of 1.00 for the base case analysis (as the base case analysis is for the set year of 2006 with set PM_{10} data).

Click on 'Run Base case' to run the model. When the run is complete, the model will go to **4 Base case Output** and display the results.

3 Scenario Input

In this sheet, a user can define the input values to run their own scenarios. For example, this function could be used by Councils to assess the likely change in health costs resulting from emission reduction scenarios¹.

As with the Base case Input, input values for PM_{10} and population are multipliers and the user can set different values for the scenario. For example, if a PM_{10} value of 1.20 is set, this will increase the PM_{10} concentrations by 20 per cent. Similarly, if a high population scenario is to be assessed, the user can set a value of 2.00 for population which will double the 2006 base population.

A rectangular button with a gradient from green to yellow, containing the text "Run Scenario".

Click on 'Run Scenario' to run the model. When the run is complete, the model will go to **5 Scenario Output** and display the results.

4 Base case Output

This sheet displays the summary base case output table. The default results presented are the national results. Results can be selected by region, TLA, airshed or urban area (as defined by Stats NZ).

¹ It is important to note that the *Health Effects Model* is based on annual average PM_{10} concentrations. The model does not directly allow users to estimate the effect of changes in 24 hour average concentrations (e.g., to meet the requirements of the National Environmental Standard for PM_{10}). However, this could be undertaken in locations where the relationship between peak 24 hour average concentrations and annual average concentration has been estimated.

To select by specific area, click in the desired box and select area from the drop down menu. Note: a dropdown menu does not appear automatically. The cell must be selected first.



A dependent selection is not available in this model, so **only one area type can be selected at a time**. For example, if the user has viewed results for the Auckland Urban airshed, and wants to view results for the Auckland region, the airshed field must be cleared (set to blank).

The blank option for each area selection is the first option in the drop down menu (the text 'blank' does not actually appear).

Health Effects	Health effects (cases)					Total	
	Domestic fires	Motor vehicles	Industry	Open burning	Natural		
Mortality Adults 30+ yrs	103	121	18	30	292	5	
Mortality Adults Maori 30+ yrs	17	19	3	5	45	3	
Mortality Babies 0-1 yrs	0.5	0.6	0.1	0.2	1.4	2.8	0.8
CHA All ages	23.7	26.9	3.4	6.9	64.4	125.3	0.8
RHA All ages	47.6	55.2	7.0	14.5	130.8	255.2	1.2
RHA Children 1-4 yrs	17.1	19.9	2.6	5.3	47.4	92.3	0.4
RHA Children 5-14 yrs	9.9	11.1	1.4	3.0	27.3	52.8	0.2
RADs	178,381	206,483	27,997	53,410	496,442	982,713	59.7
TOTAL POPULATION	1,156,105	380.0	446.4	67.8	110.5	1,077.6	2,082.3

Options are also provided to view detailed base case results by specific source as indicated above.

Note: Some airsheds have been combined together due to the size of the underlying census area unit (CAU) with two exceptions:

- Te Awamutu & Kihikihi - is actually one airshed in reality
- Dunedin - is not an airshed but is named as such in this model and includes the actual airsheds of North Dunedin, Central Dunedin, South Dunedin, Green Island and Port Chalmers.

5 Scenario Output

This sheet displays the summary scenario output table. Functionality and conditions are the same as those presented in **4 Base case Output**.

If no scenario is selected, then the base case results are presented by default.

6 Comparison

This sheet presents both the summary base case and scenario output tables on the same page for comparison. Results displayed here are the same as those displayed in **4 Base case Output** and **5 Scenario Output**.

Note: To compare results the user must ensure that the areas selected in the Base case Output table and the Scenario Output table are the same.

7 Base case Results

This sheet presents the results and calculations performed in the model for the base case analysis by CAU. Health effects and costs are also broken down by source contribution on this page.

Note: Results are presented by CAU but the detail shown (e.g., decimal places) implies a level of accuracy which is not necessarily justifiable and therefore must be treated with caution. Data are imported from the *Exposure Model*, which uses ambient monitoring, source apportionment studies and emission inventories to estimate PM₁₀ concentrations by source by CAU. The exposure data are then multiplied by population information, exposure-response functions and costs estimates in the *Health Effects Model* to determine air pollution health impacts by source by CAU.

Results can be filtered by region, TLA, airshed or urban centre to view the each CAU's result for the selection. A 'filtered total' and 'national total' summary is provided at the bottom of the sheet to compare summary results between the selection and national results.

8 Scenario Results

This sheet presents the results and calculations performed in the model for the scenario analysis. Health effects and costs are also broken down by source contribution on this page as per the **7 Base case Results**.

Note: Results are presented by CAU and the same caution as with **7 Base case Results** applies.

Note: Results can be filtered using the same parameters as indicated in **7 Base case Results**.

9 All Base Data

All base data used for all calculations are presented on this page.

- Population data obtained from Census 2006, Statistics New Zealand.
- Health data and base incidence rates are the three year average of data provided by Ministry of Health.
- PM₁₀ concentrations are from the *Exposure Model*

Note: Statistics New Zealand do not supply data for CAUs where confidentiality may be breached. Data for these CAUs are represented with a '..C'. For the purposes of the model calculations, when this occurs, the data are assumed to be zero.

Note: For the premature mortality cases related to babies, information on the total cases is only available as a national total. To get estimates by CAU, the national total has been pro-rated by the number of babies in each CAU over the total number of babies nationally. These numbers have been multiplied by the population weighted annual average concentrations but only for the 0-1 year population.

Report Tables - Base case

This page contains all the tables for the base case presented in the *Updated Health and Air Pollution in New Zealand Study Volume 1 - Summary Report*. These tables are only provided as a reference and **cannot be changed**.

Maps

The following section outlines the steps required to create a map using the data from the *Health Effects Model* (from sheets '7 Base case Results' and '8 Scenario Results').

1. Obtain the spatial file of the 2006 Census from Statistics New Zealand, or from your organisation's GIS team.

Prepare the Excel table

1. Tidy up data in sheets '7 Base case Results' or '8 Scenario Results' from the *Health Effects Model* by deleting all the extra information from the table that is not required.

Tip: Copy and paste into a new Excel workbook the Base case or Scenario Output sheets. Ensure to paste special as 'values' in the new workbook so that none of the original data is lost and the formulas are not embedded into this sheet.

2. Remove any blank rows or columns, including any between the heading and data.
3. Ensure each column has a heading. This will correspond as the *field name* in GIS. Headings cannot have spaces, cannot start with a number and must be 10 characters or less.

4. Do NOT delete the Census Area Unit Code (2006 Areas) column. These numbers will be needed to match the data in the Excel file with the GIS spatial file. Sort the numbers in ascending order.
5. Remove all formatting in the table and save the file (.xls or .xlsx).

Adding the Excel Table to ArcMap

1. In ArcMap, click the **Add Data** button, browse to the location of the Excel file and double click the name.
2. Choose the data sheet to add (usually the first sheet on the list) and click **Add**.
3. **Open the attribute table** for both the Excel file and the 2006 Census spatial layer.
4. Check that the CAU number column in the data table matches the content a column in the spatial layer. The heading names do not need to match, but the content in each column does need to match. The data in the table will be joined using this common column.

Join the Excel Table to the Spatial Layer

1. **Right-click** on the 2006 Census spatial data.
2. From the menu, in **Joins and Relates**, click **Join**.
3. The **Join Data** dialog box appears.
4. At '**What do you want to join to this layer?**' Select **Join attributes from a table** from the drop down menu.
5. Select the following at:
 - '1. Choose the field this layer that the join will be based on:'
Select the field name of the data in the 2006 Census spatial layer that matches the data in the Excel table.
 - '2. Choose the table to join to this layer, or load the table from disk:'
Select the sheet of the Excel file (usually Sheet 1 which will appear as Sheet1\$)
 - '3. Choose the field in the table to base the join on:'
Select the column name from the Excel table which matches that of the 2006 Census spatial layer.
6. Under **Join Options**, select the **Keep all records** option.

Verify that the Join worked

1. Right click the 2006 Census spatial data.
2. Click **Open Attribute Table**
3. Scroll to the right of the attribute table to check if the columns from the Excel file have been added.

Creating a map

1. Right click on the spatial layer in ArcMap.
2. Select **Properties** from the drop down menu.
3. In the **Symbology** tab, under **Show**, click **Quantities** then click **Graduated colors**.
4. In the 'Fields' section, at 'Value', choose a field from the 2006 Census spatial file to be displayed on the map from the drop down menu. Leave the normalization field blank.
5. This will display the data in five classification breaks using 'Natural Breaks (Jenks)' classification as the default. This can be changed by clicking on **Classify** and selecting another classification option.
6. Click **OK**.

The data should be displayed by CAU in ArcMap. Additional data can be added to the map in Map Layout (such as legend, scale, map title etc.).

Range of Values for Sensitivity Analysis

A list of the range of values available to the user in the Scenario Input page, and those used in the Sensitivity Analysis are listed below.

Table A3-1: Default values and typical ranges for the parameters used in the Health Effects Model

PM ₁₀ Data		Default Value	Typical Range
1	Data as supplied by councils and corrected for HiVol equivalency	1.00	(0.85-1.15)
2	Population data as per 2006 Census	1.00	(1.00-1.00)
Health Outcomes		Default Value	Typical Range
3	Premature mortality, all adults (30 yrs +) per 10 µg/m ³ annual PM ₁₀	0.07	(0.03-0.10)
3a	Premature mortality, Maori adults (30 yrs +) per 10 µg/m ³ annual PM ₁₀	0.20	(0.07-0.33)
4	Premature mortality, all children (0-1 yrs) per 10 µg/m ³ annual PM ₁₀	0.05	(0.02-0.08)
5	Cardiac hospital admissions, all ages per 10 µg/m ³ daily PM ₁₀	0.006	(0.003-0.009)
6	Respiratory hospital admissions, all ages per 10 µg/m ³ daily PM ₁₀	0.01	(0.006-0.017)
6a	Respiratory hospital admissions, all children (1-4 yrs) per 10 µg/m ³ daily PM ₁₀	0.02	(0.01-0.04)
6b	Respiratory hospital admissions, all children (5-14 yrs) per 10 µg/m ³ daily PM ₁₀	0.03	(0.00-0.05)
7	Restricted activity days, all ages per 10 µg/m ³ daily PM _{2.5}	0.9	(0.5-1.7)
Social Costs (in NZ\$ as at June 2011)		Default Value	Typical Range
8	Premature mortality, all adults (30 yrs +) per 10 µg/m ³ annual PM ₁₀	\$3.56M	(\$3.56M-\$7.12M)
8a	Premature mortality, Maori adults (30 yrs +) per 10 µg/m ³ annual PM ₁₀	\$3.56M	(\$3.56M-\$7.12M)
9	Premature mortality, all children (0-1 yrs) per 10 µg/m ³ annual PM ₁₀	\$3.56M	(\$3.56M-\$7.12M)
10	Cardiac hospital admissions, all ages per 10 µg/m ³ daily PM ₁₀	\$6,350	(\$6,350-\$356,000)
11	Respiratory hospital admissions, all ages per 10 µg/m ³ daily PM ₁₀	\$4,535	(\$4,535-\$356,000)
11a	Respiratory hospital admissions, all children (1-4 yrs) per 10 µg/m ³ daily PM ₁₀	\$4,535	(\$4,535-\$356,000)
11b	Respiratory hospital admissions, all children (5-14 yrs) per 10 µg/m ³ daily PM ₁₀	\$4,535	(\$4,535-\$356,000)
12	Restricted activity days, all ages per 10 µg/m ³ daily PM _{2.5}	\$62	(\$34-\$87)