

Quick Start Guide

(For International Use)

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Introduction

This Quick Start Guide (hereafter referred to as “the Guide”) aims to provide instructions to persons who are unfamiliar with the BenMAP software and who wish to conduct environmental benefit analyses in places where non-US data are required. The Guide includes a step-by-step tutorial for using BenMAP with sample data from China. In addition, it provides information on the data format for BenMAP-required inputs (e.g., population, incidence rate, health impact functions, etc.), so that the users can create their own BenMAP inputs for their future analyses.

The BenMAP Flow Diagram on the next page provides an overview of BenMAP analysis. This figure shows the types of choices that you make regarding the modeling of population exposure, the types of health effects to model, and how to place an economic value on these health effects. Please note that BenMAP does not have air quality modeling capabilities, and instead relies on externally created air quality modeling and monitoring data.

Before you start using this Guide, you need to:

- have BenMAP installed on your computer (BenMAP software and installation instruction are available at <http://www.epa.gov/air/benmap/download.html>)¹
- have the BenMAP User’s Manual (hereafter referred to as “the Manual”) in hand (available at <http://www.epa.gov/air/benmap/docs.html>)²
- Save the China data files at a proper location on your computer (The data files should be included in the zip file you obtained from <http://www.epa.gov/air/benmap/docs.html>).

As you use this Guide, keep in mind that the Frequently Asked Questions section at the end may be useful in answering your questions and helping you with troubleshooting.

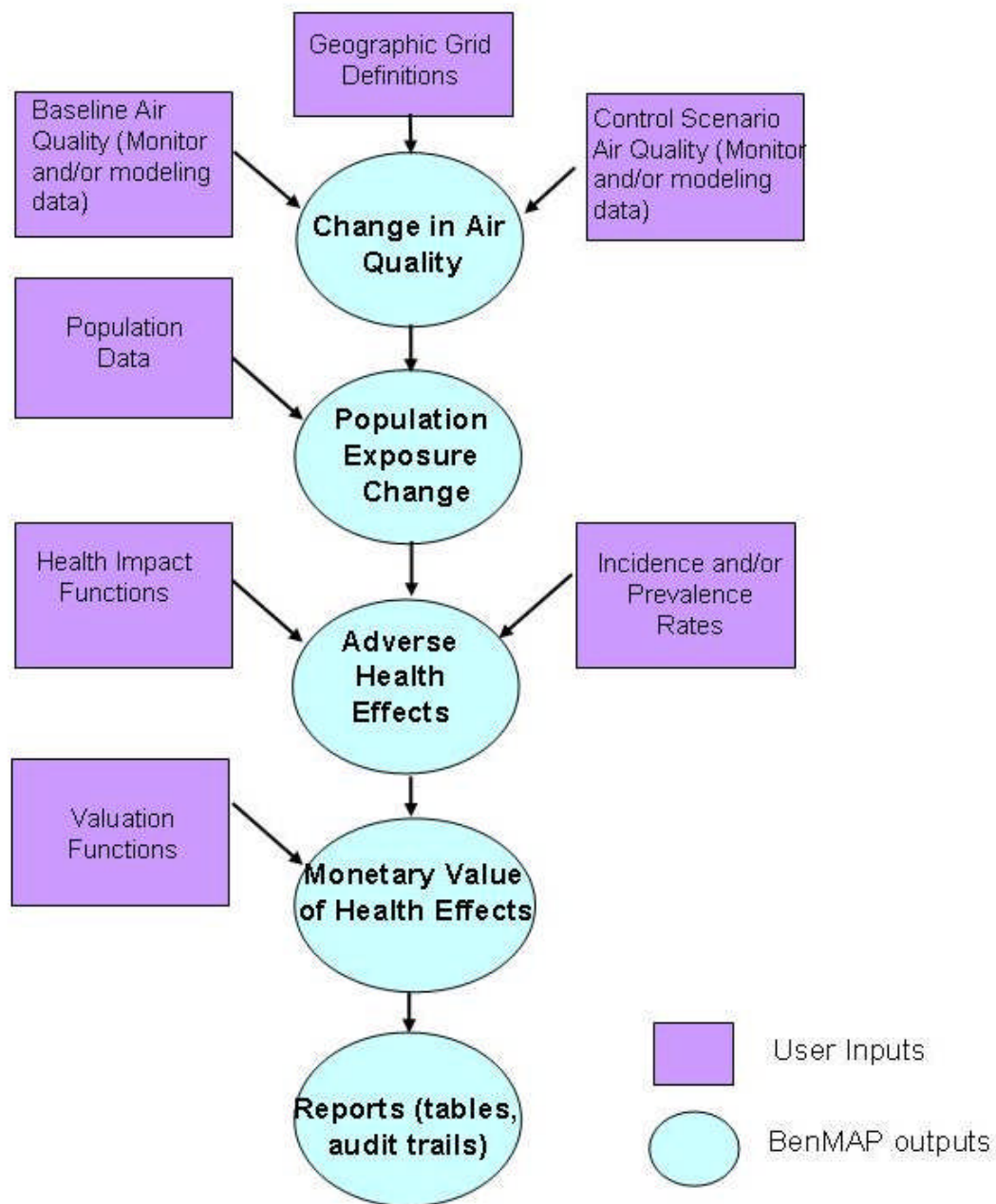
After you finish this Guide, you are expected to:

- be able to run BenMAP to conduct simply benefit analyses
- be familiar with BenMAP-required datasets and data formats.

¹ This Quick Start Guide is developed based on BenMAP 4.0.30, but should apply to other versions of BenMAP.

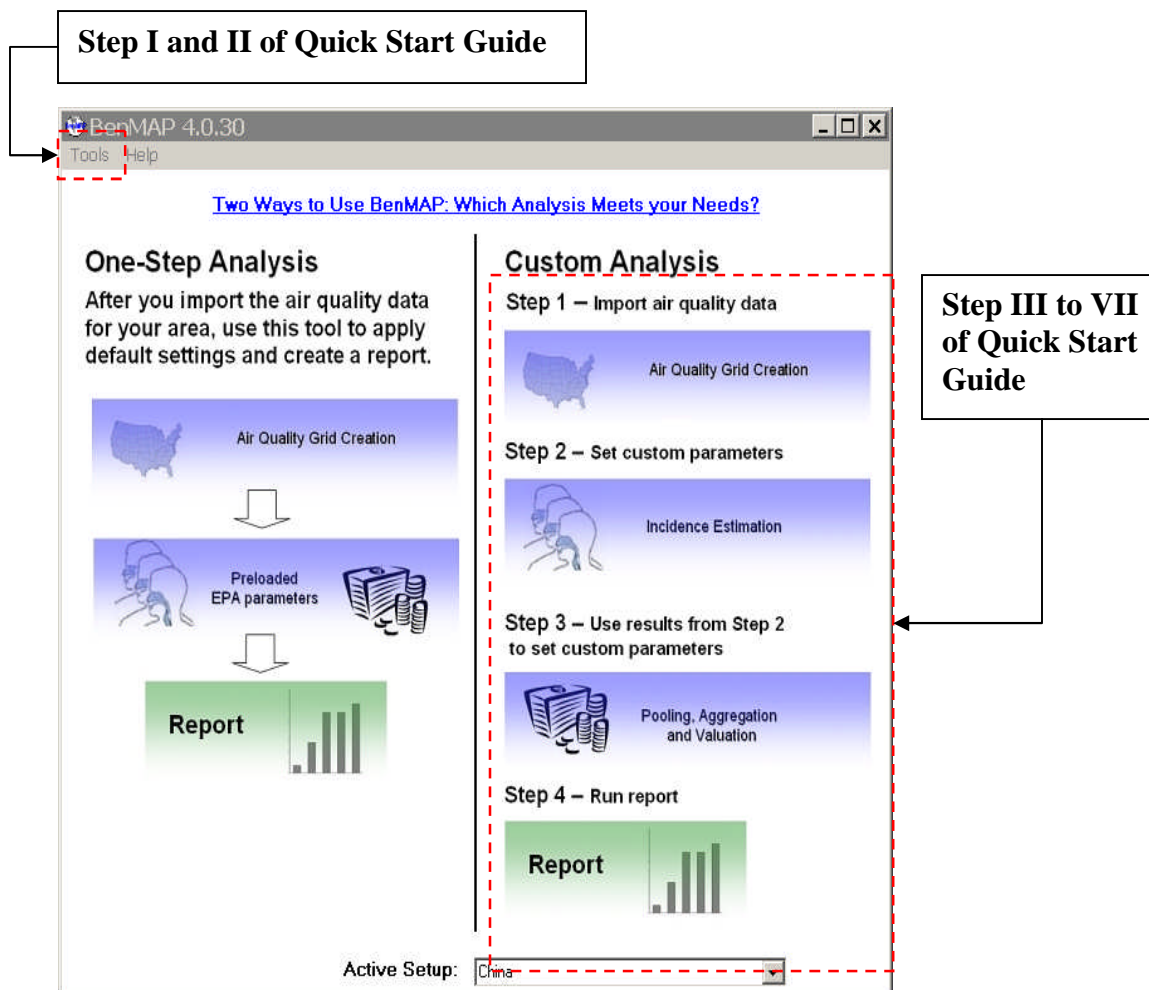
² The BenMAP User’s Manual mentioned in this document was published in September 2008 and is the current version posted on EPA’s website as of July 2010.

BenMAP Flow Diagram



BenMAP Main Window

This screenshot shows the BenMAP main window and the relevant BenMAP options you will be using in this Guide.




Step I. Add a China Setup and Load Data

A “setup” is a collection of databases that work together when you conduct an analysis. To add a new setup for China:

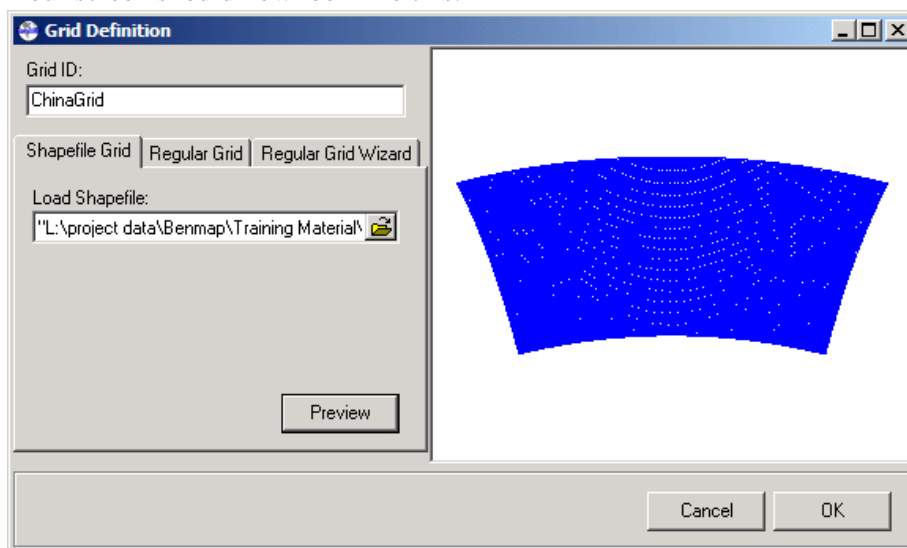
- Start BenMAP.
- Click *Tools* and then *Modify Setup*. This will bring up the *Manage Setup* window.
- Click the *Add* button next to the *Available Setups* box.
- Type *China* into the *Available Setups* box and click the *OK* button.

Step II. Load Data into BenMAP

Shapefile Grid Definitions: They are used to identify the geographic resolution (e.g., county, region or the whole nation).

- Make sure you have the *Manage Setup* window open and *China* is selected as the *Available Setups*. Click the *Edit* button under the *Grid Definitions* box. This will bring up the *Manage Grid Definitions* window.
- Click the *Add* button, which will bring up the *Grid Definition* window.
- In the *Grid ID* box, type *ChinaGrid*. This will be the name of the new Grid Definition.
- Click the *Shapefile Grid* tab.
- Click the  icon in the *Load Shapefile* box to browse for a shapefile (*.shp).
- In the data files you downloaded, locate the *Grid_region.shp* and open it.
- Click the *Preview* button to see what the new Grid Definition looks like.

Your screen should now look like this:

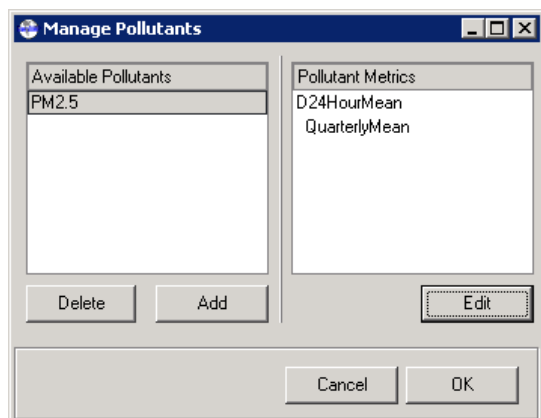


- Click the *OK* button to return to the *Manage Grid Definitions* window.
- Using the same steps as above, add *China_boundary.shp* and *bou2_4p_region_simplified.shp* shapefiles and give them the Grid ID *ChinaBoundary* and *ChinaRegions* respectively.
- When you are done, click the *OK* button to return to the *Manage Setup* window and the three Grid IDs should appear in the *Grid Definitions* box.

Pollutant(s): Name your pollutant(s) and define the measures or metrics BenMAP will use in the analysis (You are NOT importing air pollution data at this step!). Here we take PM_{2.5} for an example.

- In the *Manage Setup* window, click the *Edit* button under the *Pollutants* box. This will bring up the *Manage Pollutants* window.
- Click the *Add* button under the *Available Pollutants* box. This will bring up the *Pollutant Definition* window.
- In the *Pollutant ID* box, type *PM2.5*. This will be the name of the new pollutant. (Note: It is very important that this name be spelled properly, as the name of the pollutant is linked to Health Impact functions, Model Data, etc.)
- For the *Observation Type*, select *Daily* from the drop-down list.
- Click the *Add* button under the *Metrics* box. You will see *Metric 0* shown in the *Metrics* box. Click on *Metric 0* and type *D24HourMean*.
- Click the *Edit* button under the *Seasonal Metrics* box. This will bring up the *Manage Seasonal Metrics* window.
- Click the *Add* button under the *Seasonal Metrics* box. This will add a Seasonal Metric to the Metric named *Seasonal Metric 0*. Rename this Seasonal Metric by clicking where it says *Seasonal Metric 0* and typing *QuarterlyMean*.
- Click the *Add* button under the *Seasonal Metric Seasons* box. This will add a season to the Seasonal Metric. Change the *End Date* value to *March 31*. To change the date, highlight either the month or the day and use the up and down arrows to increase or decrease the highlighted value. Leave the *Start Date* at its current value, *January 1*; and leave the *Statistic* at its current value, *Mean*.
- Click the *Add* button under the *Seasonal Metric Seasons* list again. This will add a second season to the Seasonal Metric. Note that the *Start Date* value is automatically set to one day after the previous seasons *End Date* value. Change the *End Date* value for this second season to *June 30*.
- Click the *Add* button under the *Seasonal Metric Seasons* list again, and change the *End Date* value for this third season to *September 30*.
- Add the 4th and final season. Note that there is no need to modify date values.
- Click the *OK* button in the *Manage Seasonal Metrics* window to return to the *Pollutant Definition* window.
- Click the *OK* button to return to the *Manage Pollutants* window.

Your screen should now look like this:



- Click the *OK* button one final time to return to the *Manage Setup* window. You will see *PM2.5* shown in the *Pollutants* box.

Optional: You can go through the similar steps as above to add other pollutants as needed (you may find it helpful to check the pollutants defined in the United States Setup, which covers a wide range of pollutants). Note that you can use other observation type (e.g., hourly) and metrics (e.g., D1HourMax, D8HourMax, seasonal metrics). Refer to p.66-69 of the Manual for details about hourly metrics and p.70-72 for seasonal metrics.

Monitor Data: (1) If you don't have nor use monitoring air quality data for your analysis (i.e., you only use modeling data), you could skip adding monitor data. (2) The monitor data we use for demonstration here are not real-world China monitor values, however, the data format and the methods for loading the data should be the same no matter what monitor data you use. The China data files you downloaded from the BenMAP website include sample monitor data in all three formats, which you could use for practice. (3) Monitor data may be formatted in three different ways: *Database Rows*, *Database Columns*, and *Text File*. We discuss the most often used one, *Database Rows* here. Refer to p.76-79 of the Manual for details about the other two formats and p.73-76 for loading data of other formats.

Note: Air pollution data that can be used in BenMAP are of two types - point source monitoring data and grid-definition-based modeling data. Whichever data you use, they must be associated with a particular pollutant that you have defined. Only the point source monitoring data are stored in the setup database. The modeling data are loaded into BenMAP when you conduct the analysis.

In the data files you downloaded, locate *Mocked China Monitor Data PM2.5 Daily 2003.xls* and open it in Excel. You will see eight variables in the file: Monitor Name, Description, Latitude, Longitude, Metric, Seasonal Metric, Annual Metric, and Values. Four variables (i.e., Monitor Name, Latitude, Longitude and Values) are required to be filled in. The "Values" variable contains comma separated values with missing values signified with a period ('.'). For more details about these variables, refer to Table 4-5a (p.78) in the Manual.

Now you can close the excel file and begin adding it to BenMAP. Make sure you are at the *Manage Setup* window and *China* is selected in the *Available Setups* list.

- Click the *Edit* button under the *Monitor DataSets* box. This will bring up the *Manage Monitor DataSets* window.
- Click the *Add* button under the *Available DataSets* box. This will bring up the *Monitor DataSet Definition* window.
- In the *DataSet Name* box, type *China Monitors*.
- In the *Pollutant* box (on the right hand side of the *DataSet Name* box), click the drop down arrow and select *PM2.5* (the pollutant you just added).
- In the *Year* box, type *2003* (i.e., the *PM_{2.5}* monitor data you are adding are for the year 2003).
- Click on the *Database, Rows* tab and then click the *Browse* button next to the *Monitor Data File* box.
- Select *Excel Files* from the drop down menu for *Files of Type* and then highlight the *Mocked China Monitor Data PM2.5 Daily 2003.xls* file. Click *Open*.
- Click the *Load Monitor Data* button.

Your screen should look like the following:

Monitor DataSet Definition

DataSet Name: China Monitors

Pollutant: PM2.5 Year: 2003

DataSet Contents (Number of Monitors by Pollutant by Year)

Pollutant	Year	Count
* PM2.5	2003	9

Database, Columns Database, Rows Text File

Monitor Data File: H:\ERD\BenMAP\Design\BenMAP China 12 Browse

Load Monitor Data

Cancel OK

- Click the *OK* button to return to the *Manage Monitor DataSets* window. Click *OK* button again to return to the *Manage Setup* window and you will see *China Monitors* appearing in the *Monitor DataSets* box.

Note: If the purpose of your analysis is to examine air quality data, you can directly go to Step III now to create and map air quality grids. If you want to estimate health benefits, you will need to continue adding a few more datasets.

Incidence Data: The incidence rate is the number of health effects (e.g., lung cancer mortality) per person in the population per unit of time. Locate and open *Incidence_mortality.xls* from the China data files you downloaded. Note the format of the data and refer to Table 4-6a (p.83) in the Manual for details about incidence dataset variables.

Now you can close the excel file and begin adding it to BenMAP. Make sure you are at the *Manage Setup* window and *China* is selected in the *Available Setups* box.

- Click the *Edit* button under the *Incidence/Prevalence DataSets* box. This will bring up the *Manage Incidence DataSets* window.
- Click the *Add* button under the *Available DataSets* box. This will bring up the *Incidence DataSet Definition* window.
- In the *DataSet Name* box, type *ChinaMortalityIncidence*.³ This will be the name of the new incidence dataset.
- Set the Grid Definition to *ChinaGrid*. Click the *Load from Database* button. Locate the incidence dataset, entitled *Incidence_mortality.xls*. (Make sure that *File of Type* located at the bottom of the window is set to *Excel Files*.)
- Click the *OK* button to load the incidence dataset (this may take some time). When BenMAP finishes loading the data, click the *OK* button in the *Incidence DataSet Definition* window to return to the *Manage Incidence DataSets* window.

³ The dataset names can include blanks between words so you can use other names like *China Mortality Incidence*. You just need to be consistent.

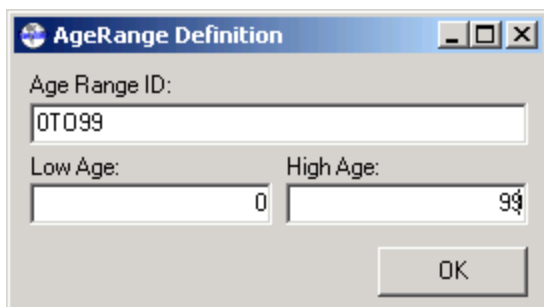
- Repeat the above steps to add the morbidity dataset, *Incidence_morbidity.xls* and give this dataset a name “*ChinaMorbidityIncidence*”. The Grid Definition is also *ChinaGrid*.
- When you are done with adding both incidence datasets, click the *OK* button in the *Manage Incidence DataSets* window to return to the *Manage Setup* window.

Population Data: You will be adding population data from an Excel file. First view the population dataset entitled *population_2005.xls* in your China data files. Note the format of the data and refer to Table 4-7 (p.91) in the Manual for details about population dataset variables.

Close *population_2005.xls* and begin adding it to BenMAP. Make sure you are at the *Manage Setup* window and *China* is selected in the *Available Setups* box.

- Click the *Edit* button under the *Population DataSets* box. This will bring up the *Manage Population DataSets* window.
- Click the *Add* button under the *Available DataSets* box. This will bring up the *Load Population DataSets* window.
- In the *Population DataSet Name* box, type *ChinaPopulation2005*. This will be the name of the new population dataset.
- Next, you need to define the population data that you are loading into BenMAP by adding a population configuration.⁴ Normally you will need to create the population configuration only once for your population data files of different years. Click the *Add* button under the *Population Configuration* box. This will bring up the *Population Configuration Definition* window. In the box for the *Population Configuration Name*, type *ChinaPopulation*.
- From *Available Races* box, drag *ALL* to the *Races* box on the left hand side.
- From the *Available Genders* box, drag *ALL* to the *Genders* box.
- From the *Available Ethnicity* box, drag *ALL* to the *Ethnicities* box.
- The next step is to add the age groups to your population configuration. Click the *Add* button under *Age Ranges* box. This will bring up the *AgeRange Definition* window.
- Type *OTO99* (the number “0”, the letter “TO” and the number “99”) in the *Age Range ID* box, *0* in the *Low Age* box, and *99* in the *High Age* box.

Your screen should now look like this:



Tip: Be very careful to spell the Age Range ID values correctly (it’s case sensitive!), i.e., the Age Range ID must match the values for the AgeRange variable in the population dataset you will be loading into BenMAP.

- Click *OK*. This will take you back to *Population Configuration Definition* window.

⁴ BenMAP displays all of the existing population configurations in BenMAP. The drop-down menu allows you to choose from existing population configurations. For example, choose the *United States Census population* configuration and then click the *View* button. The existing configurations do not match the population definition of your China population, so you will need to generate your own.

- For this example, the China population dataset only has one age group, 0T099 and therefore you only need to define one age range. In cases where more age groups are included in the population dataset, you would repeat the above *AgeRange Definition* process to define all required age groups.

Your screen should now look like this:

Population Configuration Definition

Population Configuration Name: ChinaPopulation

Races
ALL
Remove New

Available Races
ASIAN
BLACK
NATAMER
WHITE
ALL

Genders
ALL
Remove New

Available Genders
FEMALE
MALE
ALL

Ethnicities
ALL
Remove New

Available Ethnicity
NON-HISPANIC
HISPANIC
ALL

Age Ranges

Low Age	High Age
0T099	99

Delete Add

Cancel OK

- Click the *OK* button to return to the *Load Population Dataset* window.
- In the *Grid Definition* box, use the drop-down arrow to select *ChinaGrid*.
- Click the *Browse* button next to the *Database* box.
- Locate the China population file for 2005, *population_2005.xls*, and click *Open*.
- Click the *OK* button to load the *population_2005.xls* and this will take you back to the *Manage Population DataSets* window. This may take some time.
- Repeat the above steps to load population data for 2010, 2020, and 2030. Note: you don't need to create the population configuration again. Use the one you just created.
- After you complete loading the population data for all four years, click the *OK* button to return to the *Manage Setup* window. You should see four population datasets in the *Population Datasets* box.

Health Impact Functions: Health impact functions in BenMAP rely on data from peer-reviewed epidemiology studies to mathematically define the relationship between pollutant exposure and adverse health impacts. The functions can be quite complicated; nevertheless, there are four basic components: change in air pollution, an effects estimate (beta),⁵ an incidence rate,

⁵ In case epidemiology studies report relative risk (RR) or odds ratio, you need to convert the RR or odds

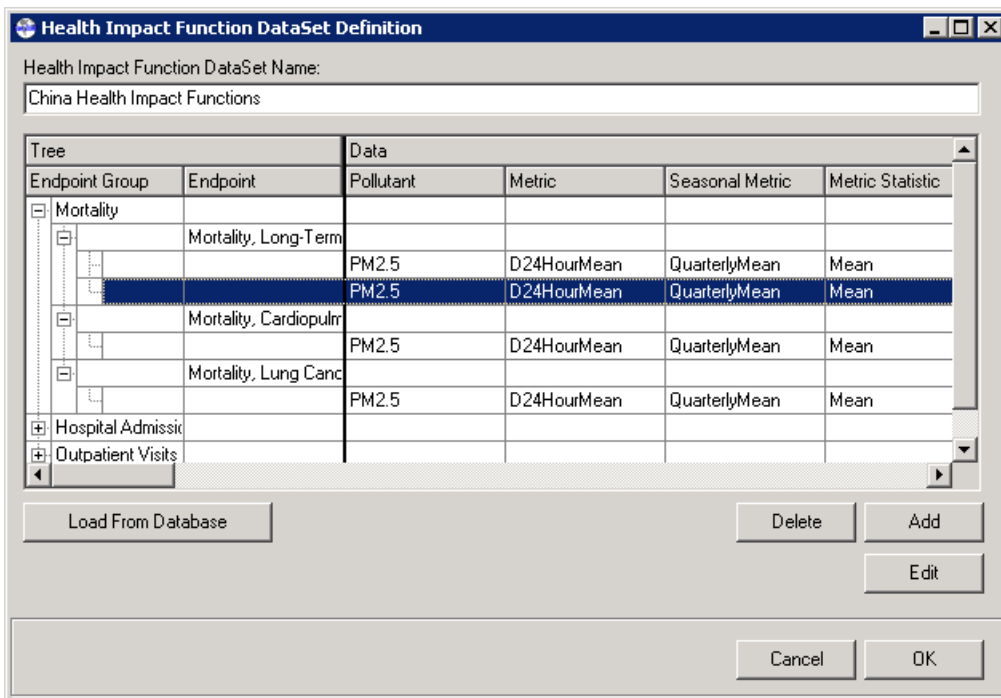
$$\text{ratio to beta: } \beta = \frac{\ln(RR)}{\Delta PM} = \frac{\ln(odds)}{\Delta PM}$$

and a population dataset. Here you will be adding health impact functions from an Excel file. First view the data format using *China Health Impact Functions.xls* in your China data files. Table 4-8 (p.96) in the Manual lists the details about the required and optional variables in the BenMAP health impact function dataset.

Close *China Health Impact Functions.xls* and begin adding it to BenMAP. Make sure you are at the *Manage Setup* window and *China* is selected in the *Available Setups* box.

- Click the *Edit* button under the *Health Impact DataSets* box. This will bring up the *Manage Health Impact Function DataSets* window.
- Click the *Add* button under the *Available DataSets* box. This will bring up the *Health Impact Function DataSet Definition* window.
- In the *Health Impact Function DataSet Name* box, type *China Health Impact Functions*.
- Click the *Load From Database* button in the lower left corner. This will bring up the *Load a Health Impact Function Database* window.
- Locate the *China Health Impact Functions.xls* file. After locating the file, click *Open*. This will bring up the *Select a Table* window.
- In the drop-down list, select the *Final Functions BenMAP\$*.
- Click *OK*. This will bring you back to the *Health Impact Function DataSet Definition* window.
- Click on the “+” next to *Mortality*. Continue clicking the “+” until the *Mortality* tree is fully expanded. Use the scrollbar to view the entries for individual health impact function. You could also try expanding *Hospital Admissions* and *Outpatient Visits* for more practice.

Your screen should now look like this:



- Click the *OK* button twice to return to the *Manage Setup* window.

Note: If the purpose of your analysis is to generate incidence results only (i.e., you don't want to attach dollar values to the incidence results), you can go to Step III directly now. If you do want to conduct valuation, you will need to continue adding variable dataset and a valuation function dataset.

Variable Data: The variable data file allows you to add data that are not typically used in an analysis, such as income data. In the particular analysis you are doing in this training, you will not need any additional data. Nevertheless, due to the current model structure of BenMAP, a variable data file is required regardless of whether you need additional data or not. So, you will be adding a variable file with “dummy” data, *China Variables.xls*. Table 4-9a (p.103) in the Manual shows the format of variable dataset.

Now let's add *China Variables.xls* to BenMAP. Make sure you are at the *Manage Setup* window and *China* is selected in the *Available Setups* box.

- Click the *Edit* button under the *Variable DataSets* box. This will bring up the *Manage Setup Variable DataSets* window.
- Click the *Add* button under the *Available DataSets* box. This will bring up the *Setup Variable DataSet Definition* window.
- In the *DataSet Name* box, type *ChinaVariables*. This will be the name of the new Variable DataSet.
- Click the *Load from Database* button. This will bring up the *Load Variable Database* window. Set the Grid Definition to *ChinaBoundary* and locate *China Variables.xls* to open it. This will bring up the *Select a Table* window. Use the drop-down arrow to select *Sheet1\$* and click *OK*. This will bring you back to the *Load Variable Database* window.
- Click the *OK* button to return to the *Setup Variable DataSet Definition* window.
- Click the *OK* button to return to the *Manage Setup Variable DataSets* window.
- Click the *OK* button to return to the *Manage Setup* window.

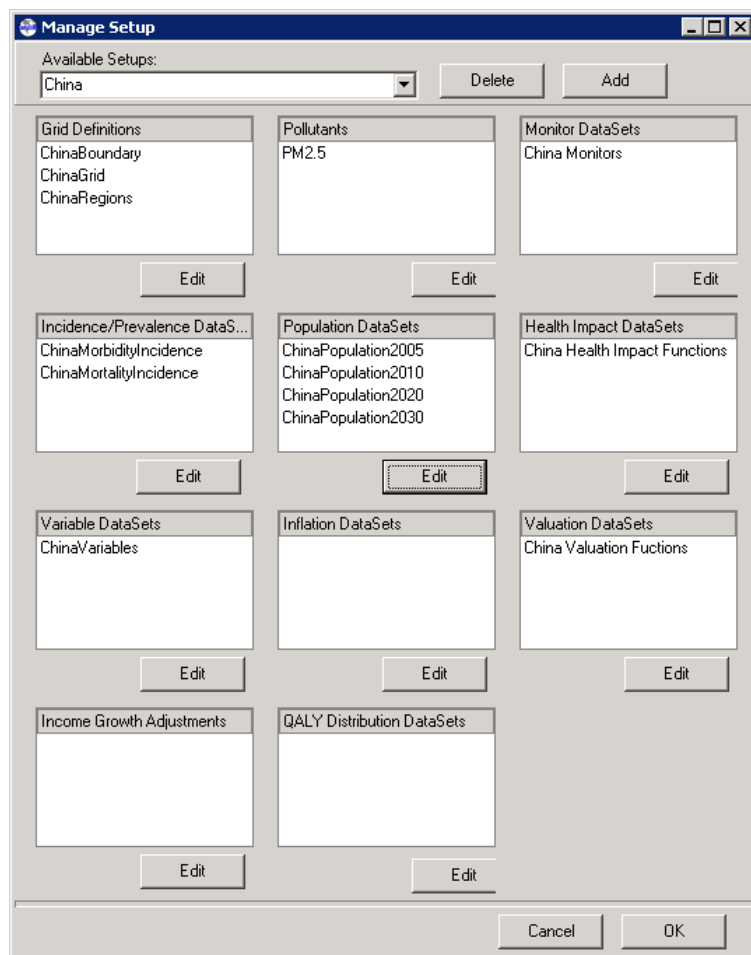
Valuation Functions: You will be adding valuation functions from an Excel file. First view the data format using *China Valuation Functions.xls* in your downloaded data files. Table 4-11 (p.109) in the Manual lists the details about valuation dataset variables.

Close *China Valuation Functions.xls* and begin adding it to BenMAP. Make sure you are at the *Manage Setup* window and *China* is selected in the *Available Setups* box.

- Click the *Edit* button under the *Valuation DataSets* box in the *Modify Setup* screen. This will bring up the *Manage Valuation Function DataSets* window.
- Click the *Add* button under the *Available DataSets* box. This will bring up the *Valuation Function DataSet Definition* window.
- In the *Valuation Function DataSet Name* box, type *China Valuation Functions*. This will be the name of the new Valuation Function DataSet.
- Click the *Load From Database* button, locate the *China Valuation Functions.xls* file, and click *Open*.
- Click the *OK* button and this will return you to the *Manage Valuation Function DataSets* window.

- Click the *OK* button to return to the *Manage Setup* window.⁶

Your screen should now look like this:



Congratulations! You have completed adding all datasets you will need for this training course. Your screen should look like the above. **Click the *OK* button at the bottom of the *Manage Setup* window to return to BenMAP main window.** You can now conduct BenMAP analyses.

⁶ The boxes for Inflation DataSets, Income Growth Adjustments, and QALY Distribution DataSets are empty. For more advanced users, the Manual has detailed information on inflation data (p.104-105), income growth data (p.110-115), and QALY data (p.115-118).

Step III. Create Air Quality Grids

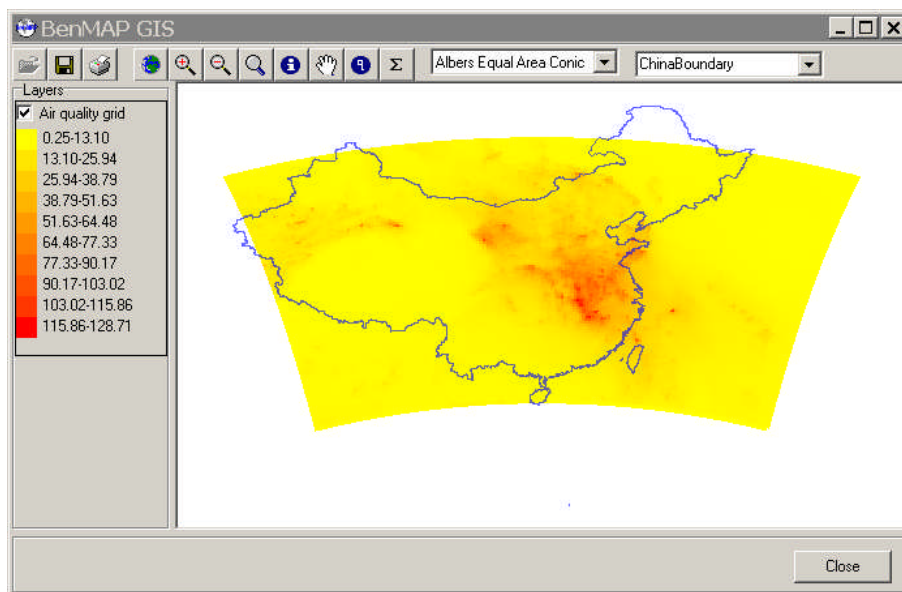
BenMAP is not an air quality model, nor can it generate air quality data independently. Instead it relies on the air quality inputs given to it. To estimate population exposure to air pollution, BenMAP generates air quality grids using user-input air quality data (modeling and/or monitoring data).⁷ BenMAP provides four options for creating air quality grids: Model Direct, Monitor Direct, Monitor and Model Relative, and Monitor Rollback. Here you will be inputting China PM_{2.5} air quality modeling data and use Model Direct method to generate a baseline air quality grid and a control-scenario air quality grid. For other air quality grid creation methods, Section 5.2 in the Manual (p.128) describes *Monitor Direct*; Section 5.3 (p.138) discusses *Monitor and Model Relative*; and Section 5.4 (p.143) states *Monitor Rollback*.

Open *CMAQ36km_China_Baseline_PM2.5_2005.xls* to view the format of modeling air quality data. Table 5-1 (p.126) in the Manual lists the details about each variable. Note that the variable name “Annual Metric” used in the Manual is equivalent to “Statistics” shown in the data file.

Now close *CMAQ36km_China_Baseline_PM2.5_2005.xls* and begin using it to create an air quality grid.

- Start BenMAP. Make sure that the *Active Setup* drop-down list is set to *China*.
- In the *Custom Analysis* side of the BenMAP main window, click the *Air Quality Grid Creation* button under *Step 1*. This will bring up the *Air Quality Grid Creation Method* window.
- Select *Model Direct* as your grid creation method, and click the *Go!* button. This will bring up the *Model Direct Settings* window.
- Select *ChinaGrid* in the *Grid Type* list.
- Select *PM2.5* in the *Pollutant* list.
- Click the *Browse* button next to the *Generic Model Database* textbox, locate *CMAQ36km_China_Baseline_PM2.5_2005.xls*, and click *Open*.
- Before you click *OK* to save your air quality grid, click the *Map* button to view the air quality grid in the *BenMAP GIS* window.
 - In the *BenMAP GIS* window, double click the text *Air quality grid* in the *Layers* panel on the left side of the window. This will bring up the *Display Options* window.
 - Select the value *QuarterlyMean* from the *Variable* list. [Note that if you choose *D24HourMean*, you will just get -345. This happens because you did not load in daily data.]
 - Uncheck the box next to “Grid Outline”. Keeping the Grid Outline checked can obscure the view – you might just see grid outlines and not the color in the interior. Try it both ways to see what happens.
 - Click *OK* to return to the *BenMAP GIS* window.
 - In the *BenMAP GIS* window, select *ChinaBoundary* from the *Reference Layer* drop-down list.
 - Your screen should now look like this:

⁷ For distinction between modeling and monitoring data, see p.5 of this Quick Start Guide (i.e., the section on loading the monitoring data).



- When done, click the *Close* button to return to the *Model Direct Settings* window.
- Click the *OK* button to save the Air Quality Grid to file [BenMAP will automatically choose the folder for saving the file].
 - Name the file *PM2.5_ModeledCMAQ36km_China_Baseline_2005*. (Tip: Consistent naming conventions can be a quick way to remember the assumptions you made in your analysis.)
 - Click the *Save* button.
- Repeat the process for the control-scenario model data --- *CMAQ36km_China_Control_PM2.5.xls*. Map the air quality grid in the same way you did and save it as *PM2.5_ModeledCMAQ36km_China_Control*.
- After BenMAP finishes saving your air quality grids, it will return to the main window automatically.

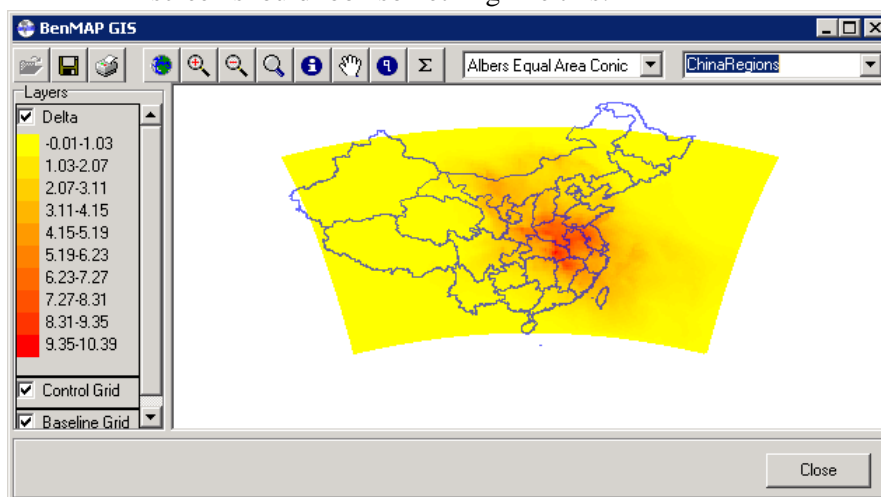
Note: If the purpose of your analysis is to examine air quality data only, you are done! You can then save the maps you generated and create an audit trail report for your analysis (Go to Step VII to generate an audit trail report). For most BenMAP users, however, the goal may be to estimate health benefits and/or value them. If so, go to the next step now.

Step IV. Estimate Health Benefits

To estimate the health benefits, you will need to generate and run a BenMAP configuration file (*.cfg). A configuration is a reusable file that specifies the air quality grids, health impact functions, population data, and other parameters necessary for an analysis. The results obtained from running a configuration are the estimated health benefits associated with a specific emissions reduction scenario. In the case of this example the health benefits generated are attributed to the control scenario. Here you will create a configuration for an analysis of the

effect of PM_{2.5} on premature mortality, cardiovascular and respiratory hospital admissions, and outpatient visits.

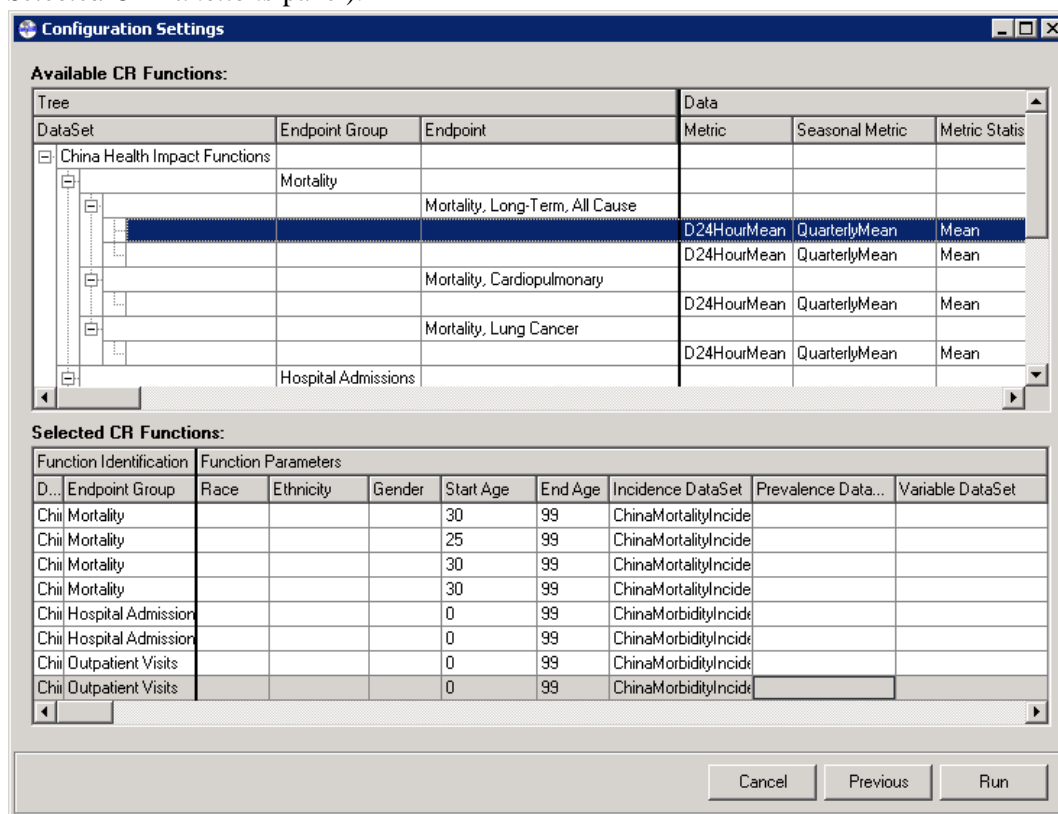
- Make sure *China* is selected as the *Active Setup* in BenMAP main window.
- Click the *Incidence Estimation* button under *Step 2*. This will bring up the *Configuration Creation Method* window.
- Select *Create New Configuration* and click the *Go!* button. This will bring up the *Configuration Settings* window.
- Click the *Open* button next to the *Baseline File* box, locate the previously created baseline air quality grid, *PM2.5_ModeledCMAQ36km_China_Baseline_2005.aqq* file, and click *Open*. (Note: AQQ is the filename extension created by BenMAP for air quality grids)
- Click the *Open* button next to the *Control File* box, locate the previously created control-scenario air quality grid, *PM2.5_ModeledCMAQ36km_China_Control.aqq* file, and click *Open*.
- Before you make other settings, you can map the air quality difference between the baseline and control scenario (See Appendix A for more mapping options).
 - Click the *Map Grids* button. This will bring up the *BenMAP GIS* window.
 - Double click the *Delta* in the *Layers* panel, which will open the *Display Options* window. Select *QuarterlyMean* in the Variable drop-down box and uncheck *Grid Outline*. Then click *OK*.
 - Select *ChinaRegions* in the *Reference Layer* drop-down box. This will allow you to view the change between the *Baseline* and *Control* modeled scenarios. Your screen should look something like this:



- Click the *Close* after you have examined the maps. This will take you back to the *Configuration Settings* window.
- Select the value *10* in the *Latin Hypercube Points* list.
 - Latin Hypercube points are used to capture the uncertainty in the health impact estimate. They capture evenly-spaced points along distributions of coefficient values used in health impact functions. For example, if you choose 10 Latin Hypercube points, you get the 5th, 15th, 25th, ..., 95th percentiles.
- Select the value *population2005* in the *Population DataSet* list.
- Select the value *2005* in the *Population Year* list.

- Leave *Run In Point Mode* unchecked. Note that this is an alternative to choosing Latin Hypercube points. If you check *Run In Point Mode*, you just get the estimate based on the mean of the health impact coefficient.
- Leave *Threshold* blank. Note that the *Threshold* option works by preventing estimated pollution levels from falling below the value at which the threshold is set. This applies to all health impact functions. For details about *Threshold* option, see p.156 in the Manual.
- Click the *Next* button to move on to selecting health impact functions.⁸ This may take a moment as BenMAP loads the appropriate functions.
- In the *Configuration Settings* window, expand the *China Health Impact Functions* node by clicking on the “+” symbol next to it and continue clicking the “+” until the tree is fully expanded. [Note: you can use the scrollbar to better view the entries for each health impact function. You can also adjust the column width]. Click on each health impact function, and drag it down to the *Selected CR Functions* panel.
 - You can save time by dragging a node (rather than individual functions).
 - If you accidentally drag the same function twice, highlight the duplicate in the *Selected CR Functions* panel, and hit *Delete* on your keyboard.

Your screen should now look like this (there should be totally eight C-R functions in your *Selected CR Functions* panel):



- Click the *Run* button. This will bring up the *Save Configuration* window.
- Click the *Save* button to save the configuration to file (*.cfg) – this will store the various choices you just made: the baseline and control air quality grids, the number of Latin

⁸ “Health impact function” is used interchangeably with “Concentration Response Function” (C-R functions) here.

hypercube points, the population dataset and year, and the selected C-R functions. Name the configuration *PM2.5 China CFG* and click *Save*. The *Save Configuration* window will re-appear.

- Click the *OK* button in the *Save Configuration* window to save the configuration results to file (*.cfgr) – this is not configuration but the results from running your configuration! Name the configuration results *PM2.5 Modeled China CFGR 2005* and click *Save*. This may take some time, as BenMAP loads all of the relevant data and then runs each of the health impact functions for each cell in the analysis.
- When BenMAP finishes generating results, you will be returned to BenMAP main window.

Note: Using the CFGR file you just created, you could now go to Step VII to generate tabular reports to show the endpoint-specific health benefits due to air pollution reduction if:

- You don't want to pool your incidence results --- for many of the health endpoints (e.g., mortality), BenMAP contains several different health impact functions from different studies that you could choose to include in your configuration. Pooling refers to combining the results of two or more health impact functions into single results, and
- You don't want to monetize the health benefits.

If you would like to conduct either of the above two analyses, go to the next step now.

Step V. Aggregate and Pool Incidence Results

You will be creating an Aggregation, Pooling and Valuation (APV) Configuration in this step. APV is a reusable file that records the aggregation, pooling, and valuation choices necessary for an analysis. Aggregation refers to spatial aggregation – typically summing results up from smaller areas (e.g. China grid cells) to larger ones (e.g. China regions).⁹ Pooling refers to combining the results of two or more health impact functions into single results. Finally, valuation refers to applying unit values to incidence results to get monetized benefits (You will do valuation in Step VI).

To create an APV file, BenMAP works by first aggregating results to the level that you have specified. It then pools the aggregated incidence results. Finally it values the aggregated and pooled incidence. Here you will change the aggregation level from grid-level to the national level, and then generate a single estimate of outpatient visits for individuals of all ages by pooling two health impact functions.

- **Create APV Configuration.** Click the *Pooling, Aggregation, and Valuation* button under *Step 3* in BenMAP main window. This will bring up the *APV Configuration Creation Method* window.

⁹ If you only want to aggregate your incidence results but not to pool them, you can skip the Step 5 and do the aggregation when you generate the report (see Step 7).

- Select *Create New Configuration for Aggregation, Pooling, and Valuation* and click the *Go!* button. Locate the previously generated configuration results file (CFGR), *PM2.5 Modeled China CFGR 2005.cfgr* and click *Open*. This will bring up the *Incidence Pooling and Aggregation* window.
- **Aggregate From China Grid to the Region Level.** Click the *Advanced* button in the lower-left corner. This will bring up the *APV Configuration Advanced Settings* window.
- Select *ChinaRegions* from the *Incidence Aggregation* list. This tells BenMAP to spatially aggregate the incidence estimates from the *China Grid* level to the *region* level before pooling them. Keep the rest of options unchanged.
- Click *OK* to return to the *Incidence Pooling and Aggregation* window.
- **Pooling.** Click the “+” next to *PM2.5* in the *Available Incidence Results* window on the left hand side. Drag all available functions to *Pooling Window 1*, on the right hand side.

Your screen should now look like this:

Incidence Pooling and Aggregation

Available Incidence Results: PM2.5

- Mortality
- Hospital Admissions
- Outpatient Visits

Select Pooling Methods

Pooling Window Name: Pooling Window 1

Endpoint Group	Endpoint	Author	Qualifier	Location	Start Age	Pooling Method
Mortality	Mortality, Long-Term					None
		Pope et al.	51 cities	51 cities	30	
		Laden et al.	No threshold	6 cities	25	
	Mortality, Cardiopulm	Pope et al.	51 cities	51 cities	30	
	Mortality, Lung Canc	Pope et al.	51 cities	51 cities	30	
Hospital Admissions						None
	Hospital Admissions, Wong et al.	PM10 Function		Hong Kong	0	
	Hospital Admissions, Wong et al.	PM10 Function		Hong Kong	0	
Outpatient Visits	Outpatient Visits, All	Xu et al.				None
		Nonsurgery		Beijing	0	
		Nonsurgery, Co-pc		Beijing	0	

-- Window to Delete -- [Delete] [Add]

Target Grid Type: ChinaGrid

Configuration Results File Name(s): C:\Program Files\BenMAP 4.0\Configuration Results\JES Modeled PM2.5 2005.cfgr [Browse]

[Advanced] [Cancel] [Next]

- You can sort the pooling tree by moving the columns around. For example, let's sort the pooling tree by *Endpoint*, *Start Age*, *End Age*, and finally by *Author*.
 - Locate the *Start Age* column and drag it to the right of the *Endpoint* column.
 - Locate the *End Age* column and drag it to the position immediately after *Start Age*.
- Click on *None* in the *Pooling Method* column for the *Outpatient Visits* Endpoint node and select the *Subjective Weights* from the drop down menu. Note that you should leave *None* selected next to all other Endpoint Group nodes (i.e., *Mortality* and *Hospital Admissions*). For explanation about pooling methods, refer to Table 7-1 (p.176) in the Manual.

Your screen should now look something like this:

Incidence Pooling and Aggregation

Available Incidence Results

- PM2.5
 - Mortality
 - Hospital Admissions
 - Outpatient Visits

Select Pooling Methods

Pooling Window Name:

Endpoint Group	Endpoint	Start Age	End Age	Pooling Method
Mortality				None
	Mortality, Long-Term			None
		30	99	
		25	99	
	Mortality, Cardiopulm	30	99	
	Mortality, Lung Canc	30	99	
Hospital Admissions				None
	Hospital Admissions, 0		99	
	Hospital Admissions, 0		99	
Outpatient Visits	Outpatient Visits, All	0	99	Subjective Weights

-- Window to Delete --

Target Grid Type:

Configuration Results File Name(s):

- **Save and Run APV Configuration.** Click the *Next* button. This will bring up the *Select Subjective Weights* window. Leave the default weights in place (0.50) and click the *OK* button. This will bring up the *Select Valuation Methods, Pooling, and Aggregation* window.
- We will be valuing our results later. For now, select *ChinaVariable* in the *Variable DataSet* list at the top of the window, and click *Next*. This will bring up the *Save Aggregation, Pooling, and Valuation Configuration* window. [Note: BenMAP will refuse to proceed if you do not select a variable dataset, even if you are not using any variables in your analysis.]
- Click the *Save* button to save the APV Configuration to file – this will store the various choices we just made: the pooling options, and the national aggregation. When the *Save As* window appears, name the APV Configuration *PM2.5 China APV* and click *Save*. This will take you back to the *Save Aggregation, Pooling, and Valuation Configuration* window.
- Click the *OK* button to save the APV Configuration Results (APVR) to file – this will store the aggregated and pooled health impact estimates generated by the various choices we just made. Name the configuration results *PM2.5 Modeled China APVR 2005* and click *Save*. Again, this process may take some time.
- When BenMAP finishes pooling and aggregating results, you will be returned to BenMAP main window.

Note: If you don't want to monetize the health benefits, go to Step VII now to generate reports for the incidence results from the APVR file you just created. If you would like to do valuation, go the next step now.

Step VI. Valuation

As described above, APV Configuration is a reusable file that records the aggregation, pooling, and valuation choices necessary for an analysis. In this section, you will add the valuation component of the APV file, which applies unit values to incidence results to get monetized benefits. You will then generate a new APVR file by running the modified APV file.

- **Open APV Configuration.** Click the *Pooling, Aggregation, and Valuation* button in BenMAP main window. This will bring up the *APV Configuration Creation Method* window.
- Select *Open Existing file for Aggregation, Pooling, and Valuation (*.apv file)* and click *Go!*. Locate the previously generated *PM 2.5 China APV.apv* file and click *Open*. This will bring up the *Incidence Pooling and Aggregation* window.
- Click the *Next* button. This will bring up the *Select Valuation Methods, Pooling, and Aggregation* window.
- **View Valuation Functions.** Click the + symbol next to the text *China Valuation Functions* in the *Valuation Methods* tree on the left side of the window. Continue clicking the “+” until the *Valuation Methods* tree is fully expanded.
- **Add Valuation Functions.** Highlight *Wang & Mullahy (2005)/ 0-99* under *Mortality; Mortality, Long-Term, All Cause* and drag it to the *Valuation Method* column on top of the --Select-- for the first *Mortality, Long-Term, All Cause* entry in *Pooling Window 1*. Release it there.

Your screen should now look something like this:

Endpoint Group	Endpoint	Start Age	Valuation Method	Pooling Method
Mortality				None
	Mortality, Long-Term			None
		30		
		25	Wang & Mullahy (2005)	
			--Select--	
	Mortality, Cardiopulm	0	--Select--	
	Mortality, Lung Canc	0	--Select--	
Hospital Admissions				None
	Hospital Admissions,	0	--Select--	
	Hospital Admissions,	0	--Select--	
Outpatient Visits		0	--Select--	

- Repeat this procedure for the other *Mortality, Long-Term, All Cause* entry in *Pooling Window 1*.
- Highlight and drag corresponding valuation functions for other health endpoints (be careful to match the name of the endpoint).

- **Add Valuation Aggregation.** Click the *Advanced* button. This will bring up the *APV Configuration Advanced Settings* window.
- Select *ChinaRegions* from the *Valuation Aggregation* list. This tells BenMAP to spatially aggregate the valuation estimates from the *Grid Cell* level to the *region* level before pooling them.
- Click the *OK* button to return to the *Select Valuation Methods, Pooling, and Aggregation* window.
- **Pool Valuation Results.** Note that *None* has appeared in the *Pooling Method* column. This is because we now have multiple valuation results that can be pooled together, just as our incidence results can be pooled together in the *Incidence Pooling and Aggregation* window. Table 7-1 (p.176) in the Manual lists various pooling methods.
- Pool the two *Mortality, Long-Term, All Cause* valuation results together using the *Subjective Weights* method.
- Note that we still do not want to pool the *Hospital Admissions* endpoints together.

Your screen should now look something like this:

Select Valuation Methods, Pooling, and Aggregation

Variable DataSet: ChinaVariables

Pooling Window Name: Pooling Window 1

Endpoint Group	Endpoint	Start Age	Valuation Method	Pooling Method
Mortality				None
	Mortality, Long-Term			Subjective Weights
		30	Wang & Mullahy (20	
		25	Wang & Mullahy (20	
	Mortality, Cardiopulm	0	Wang & Mullahy (20	
	Mortality, Lung Canc	0	Wang & Mullahy (20	
Hospital Admissions				None
	Hospital Admissions, 0		National Health Sur	
	Hospital Admissions, 0		National Health Sur	
Outpatient Visits		0		
			National Health Sur	

Advanced ☒ Skip QALY Weights Cancel Previous Next

- **Subjective Weights.** Click the *Next* button. The *Select Subjective Weights* window will appear with default weights (0.50) assigning equal weight to each valuation study.
- Click *OK*. This will bring up the *Save Aggregation, Pooling, and Valuation Configuration* window.
- **Save & Run Revised APV Configuration.** Click the *Save* button to save the APV Configuration as *PM2.5 China APV_Valuation*.
- Click the *OK* button in the *Save Aggregation, Pooling, and Valuation Configuration* window to save the APV Configuration Results (APVR) as *PM2.5 Modeled China APVR Valuation 2005*. Click the *Save* button. This process may take some time.

- When BenMAP is done generating results, you will be returned to BenMAP main window.

Step VII. Generate Reports

Generate Tabular Reports from Configuration Results (CFGR)

- Click the *Report* button in BenMAP main window under *Step 4*. This will bring up the *Select Report Type* window.
- Select *Raw Incidence Results*. (Created from *.cfgr files) and click *OK*.
- Locate the previously generated *PM2.5 Modeled China CFGR 2005.cfgr* file and click *Open*. This will bring up the *Configuration Results Report* window.
- Set *Digits After Decimal Point* to “0.”
- Check the *Endpoint Group*, *Endpoint*, *Author*, *Qualifier*, *Start Age* and *End Age* boxes in the *Health Impact Function Fields* panel – these fields should uniquely identify the various studies.
- Uncheck the *Column* and *Row* boxes in the *Grid Fields* panel.
- Recall that the configuration results are at the level of model grid cells. BenMAP allows you to change the aggregation level in this report window by using the *Aggregation Level* list in the *Advanced Options* panel. Select *ChinaBoundary* (you could also try *ChinaRegions*). This process may take some time.

Your screen should now look something like this:

Configuration Results Report

Column Selection

Grid Fields:

- ☐ Column
- ☐ Row

Health Impact Function Fields:

- ☐ DataSet
- ☒ Endpoint Group
- ☒ Endpoint
- ☐ Pollutant
- ☐ Metric
- ☐ Seasonal Metric
- ☐ Metric Statistic
- ☒ Author
- ☐ Year
- ☐ Location
- ☐ Other Pollutants
- ☒ Qualifier
- ☐ Reference
- ☐ Race
- ☐ Ethnicity
- ☐ Gender
- ☒ Start Age
- ☒ End Age
- ☐ Function
- ☐ Incidence DataSet
- ☐ Prevalence DataSet
- ☐ Beta
- ☐ DistBeta
- ☐ P1Beta
- ☐ P2Beta
- ☐ A
- ☐ NameA
- ☐ B
- ☐ NameB
- ☐ C
- ☐ NameC

Result Fields:

- ☒ Point Estimate
- ☒ Population
- ☒ Delta
- ☒ Mean
- ☒ Baseline
- ☒ Percent of Baseline
- ☒ Standard Deviation
- ☒ Variance
- ☒ Latin Hypercube Points

Grouping Options

- ☒ Group by Gridcell, then by Health Impact function.
- ☐ Group by Health Impact function, then by Gridcell.

Display Options

Digits After Decimal Point: 0

Elements in Preview: 25

Advanced Options

Population Weighted Deltas: ☐

Aggregation Level: ChinaBoundary

Preview

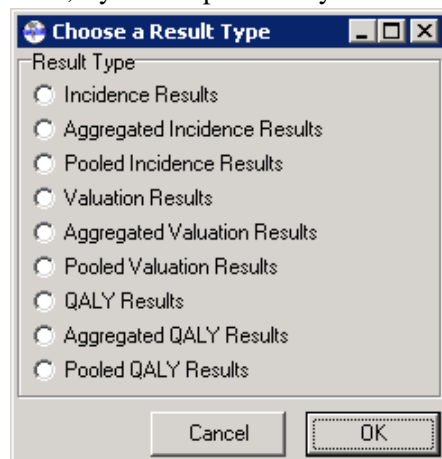
Endpoint Group	Endpoint	Author	Qualifier	Start Age	End Age	Point Estimate	Population
Mortality	Mortality, Long-Term	Pope et al.	51 cities	30	99	68.951	1,186,270,016
Mortality	Mortality, Long-Term	Laden et al.	No threshold	25	99	185,017	1,271,003,612
Mortality	Mortality, Cardiopulm	Pope et al.	51 cities	30	99	56,397	1,186,270,016
Mortality	Mortality, Lung Canc	Pope et al.	51 cities	30	99	7,390	1,186,270,016
Hospital Admissions	Hospital Admissions	Wong et al.	PM10 Function	0	99	5,707,903	1,694,671,483
Hospital Admissions	Hospital Admissions	Wong et al.	PM10 Function	0	99	10,240,765	1,694,671,483
Outpatient Visits	Outpatient Visits, All	Xu et al.	Nonsurgery	0	99	2,793,037,337	1,694,671,483
Outpatient Visits	Outpatient Visits, All	Xu et al.	Nonsurgery, Co-poll	0	99	2,001,945,881	1,694,671,483

Done

- Look at all of the results.
 - Do the numbers seem plausible?
 - If not, what do you think the problem might be?
- Try out the various options – *Grouping Options*, *Display Options*, and *Advanced Options*.
- Include any additional fields you wish to be displayed.
- When ready, press *Ctrl+S*, or click *File* then *Save*. Save the report as *PM2.5 Modeled China 2005 Incidence Boundary*. (It will be saved as a “csv” file and the default save location is in C:\Program Files\BenMAP 4.0\Reports)
- Locate the file in which you saved your report and open it up in Microsoft Excel.
- Create a second report. This time leave checked *Column* and *Row* (these are the identifiers for each of the squares in the China Grid). In addition, leave the *Aggregation Level* blank (this will keep the results at the grid level).

Generate Tabular Reports from APVR File

An APVR file can be used to generate different type of reports as shown in the following *Choose a Result Type* window.¹⁰ In the following exercise, you will be using the two previously generated APVR files to generate *Pooled Incidence Results* and *Pooled Valuation Results*. For more practices, try other options on your own later.



Pooled Incidence Results

- Click the *Report* button in BenMAP main window under *Step 4*. This will bring up the *Select Report Type* window.
- Select *Incidence*, *Valuation*, *QALY Results: Raw*, *Aggregated*, and *Pooled (Created from *.apvr files)* and click *OK*.
- Locate the previously generated *PM2.5 Modeled China APVR 2005.apvr* file and click *Open*. This will bring up the above *Choose a Result Type* window.
- Select *Pooled Incidence Results* and click *OK*. The values displayed are the pooled incidence estimates by region (the aggregation level you set).

¹⁰ The *Incidence Results* option gives the same results as those from *Raw Incidence Results*. (Created from *.cfgr files). QALY is not covered in this user guide. Advanced users should refer to the Manual for details about the use of QALY weights in the valuation.

- Check the *Endpoint Group* and *Endpoint* boxes in the *Pooled Health Impact Function Fields* panel.

Your screen should now look something like this:

Column	Row	Endpoint Group	Endpoint	Point Estimate	Mean	Standard Deviation
1	11	Mortality	Mortality, Long-Term	275.3407	275.2025	95.2079
1	11	Mortality	Mortality, Long-Term	746.5986	746.0654	192.3336
1	11	Mortality	Mortality, Cardiovascular	225.9466	225.7953	74.1088

- Try out the various options – *Grouping Options*, and *Display Options*.
- When ready, press *Ctrl+S*, or click *File* then *Save*. Save the report as *PM2.5 Modeled China 2005 – Pooled Incidence*. The default save location is in *C:\Program Files\BenMAP 4.0\Reports*
- Locate the file in which you saved your report and open it up in Microsoft Excel.

Pooled Valuation Results

- Click the *Report* button. This will bring up the *Select Report Type* window.
- Select *Incidence, Valuation, QALY Results: Raw, Aggregated, and Pooled (Created from *.apvr files)* and click *OK*.
- Locate the previously generated *PM2.5 Modeled China APVR Valuation 2005.apvr* file and click *Open*.
- Select *Pooled Valuation Results* and click *OK*.
- Uncheck the *Column* and *Row* boxes in the *Grid Fields* panel.
- Check the *Endpoint Group* and *Endpoint* boxes in the *Pooled Valuation Method Fields* panel.

Your screen should now look something like this:

APV Configuration Results Report

File

Column Selection

Grid Fields:

- ☒ Column
- ☒ Row

Pooled Valuation Method Fields:

- ☒ Endpoint Group
- ☒ Endpoint
- ☐ Start Age
- ☐ ValuationMethod
- ☐ Pooling Window

Result Fields:

- ☒ Point Estimate
- ☒ Mean
- ☒ Standard Deviation
- ☒ Variance
- ☒ Latin Hypercube Points

Add Sums

Grouping Options:

- ☒ Group by Gridcell, then by Pooled Valuation Method.
- ☐ Group by Pooled Valuation Method, then by Gridcell.

Display Options:

Digits After Decimal Point: 0

Elements in Preview: 25

Preview

Column	Row	Endpoint Group	Endpoint	Point Estimate	Mean	Standard Dev
1	11	Mortality	Mortality, Long-Term	415,787,104	415,486,176	229,404,256
1	11	Mortality	Mortality, Cardiopulm	183,857,616	183,719,520	61,229,248
1	11	Mortality	Mortality, Lung Canc	24,217,410	24,194,162	7,482,322

Done

- Examine your results; try out the various options, and save your results to a file for viewing in Microsoft Excel. Be consistent and give a file name (e.g., *PM2.5 Modeled China 2005 – Pooled Valuation.csv*).

Generate Audit Trail Reports (Optional)

Audit Trail Reports provide a summary of the assumptions underlying each of five types of files generated by BenMAP: Air Quality Grids (with the “.aqg” extension), Incidence Configurations (with the “.cfg” extension), Configuration Results (with the “.cfgr” extension), Aggregation, Pooling, and Valuation Configurations (with the “.apv” extension), and Aggregation, Pooling, and Valuation Results (with the “.apvr” extension). Audit Trail is a useful tool to check the choices you made in the BenMAP analysis.


- Click the Report button and select Audit Trail Reports. Click the OK button.
- Locate the PM_{2.5} air quality grids you created previously. (They should be in the Air Quality Grids folder.) Choose one and click Open.
- This will bring up an Audit Trail Report. Expand the tree, browse through the report and confirm that it contains the choices you made for data file and grid definition. After you are done, you can choose to export this audit trail report as a tab-delimited text file.
- Repeat the above procedure to generate and examine the audit trail for the configuration result file *PM2.5 Modeled China CFGR 2005.cfgr*. This will let you check the assumptions underlying your analysis.

- What assumptions did you make in creating your air quality grids?
- Which studies did you use?
- What are the parameters in a particular health impact function?
- What additional information does an audit trail from a CFGR file have compared to an audit trail of an air quality grid?

Appendix A. Map Your Results/Data

Mapping can be quite useful to check the quality of your work, and, of course, mapping provides a useful platform for presenting your results. BenMAP features powerful, integrated mapping capabilities which you can access at several points in the model. In Step III (Create Air Quality Grids) of this quick start guide, you learned to map air quality grids. In Step IV (Estimate Health Benefits), you learned to map the difference (“delta”) between the baseline and control air quality grids when creating an incidence configuration file.

This appendix introduces the main Mapping / GIS tool in BenMAP, available via the *Tools* drop-down menu in the main window. This mapping tool allows you to map various types of files and data associated with an analysis, including air quality grid files,¹¹ monitor data, population data, incidence results, and valuation results. We use the incidence results (CFGR file) for demonstration purpose here. The method is similar for mapping other files/data.

- Click *Tools* and then *GIS / Mapping* to open the *BenMAP GIS* window.
- Click on the  icon and select *Configuration Results (*.cfgr)*. Locate the previously generated *PM2.5 Modeled China CFGR 2005.cfgr* and click *Open*. This will bring up the *Edit GIS Field Names* window. Click twice (one at a time) on the entries of *Gis Field Name* column to rename the variable.
 - Select easy-to-remember names – no longer than 10 characters – for each of the estimated health impact changes that you wish to map. BenMAP assigns them default names of the form *ResultX*, which may not be easy to remember.
 - For example, rename *Result0* as *MortPope* (short for premature mortality based on the Pope et al. (2002) function).

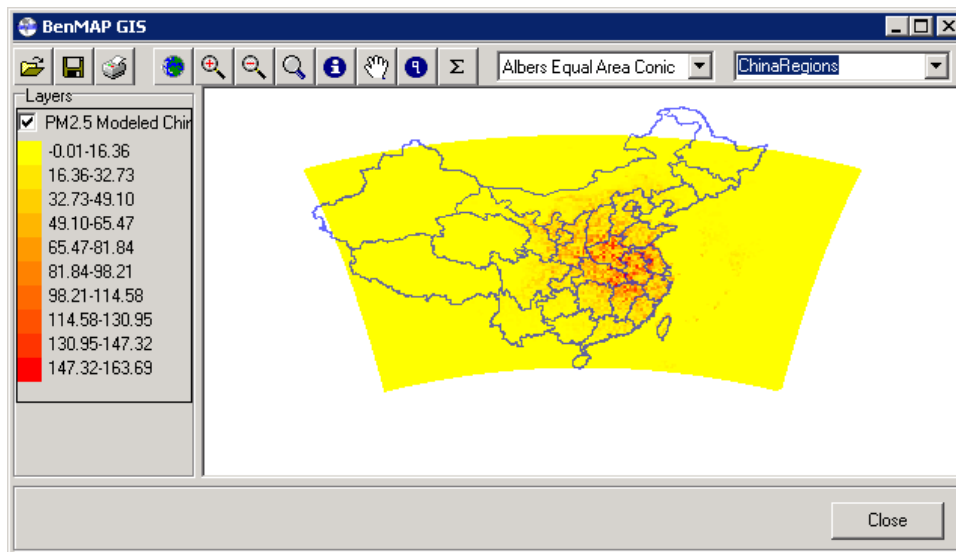
Your screen should look something like this:

Edit GIS Field Names									
DataSet	Endpoint Gr...	Endpoint	Pollut...	Metric	Seas...	Metric ...	Author	Year	Gis Field Name
China Health	Mortality	Mortality, Long-Term, All Cause	PM2.5	D24Hou	Quarter	Mean	Pope et al.	2002	MortPope
China Health	Mortality	Mortality, Long-Term, All Cause	PM2.5	D24Hou	Quarter	Mean	Laden et al.	2006	MortLaden
China Health	Mortality	Mortality, Cardiopulmonary	PM2.5	D24Hou	Quarter	Mean	Pope et al.	2002	CardioPope
China Health	Mortality	Mortality, Lung Cancer	PM2.5	D24Hou	Quarter	Mean	Pope et al.	2002	LCPOpe
China Health	Hospital Admis	Hospital Admissions, Cardiovas	PM2.5	D24Hou		None	Wong et al.	1999	HACardio
China Health	Hospital Admis	Hospital Admissions, Respirator	PM2.5	D24Hou		None	Wong et al.	1999	HAResp
China Health	Outpatient Vis	Outpatient Visits, All cause	PM2.5	D24Hou		None	Xu et al.	1995	OVSingl
China Health	Outpatient Vis	Outpatient Visits, All cause	PM2.5	D24Hou		None	Xu et al.	1995	OVCo

¹¹ Note that mapping of the “delta” is not available from the *Tools* menu. The only way to map the “delta” is through creating the incidence configuration file as described in the previous paragraph.

- When you have finished renaming the variable, click the *OK* button. This will bring up the *BenMAP GIS* window.
- Double click the text *PM2.5 Modeled China CFGR 2005.cfgr*. This will bring up the *Display Options* window, which you should be familiar with.
- Select *MortPope* from the *Variable* list.
- Uncheck the *Grid Outline* box.
- Click the *OK* button to return to the *BenMAP GIS* window.
- Select *ChinaRegions* from the *Reference Layer* list.

Your screen should now look like this:



- To view statistics for the active layer, click on the “Σ” button in the panel at the top of the window. Select the variable you want to view from the *Fields* box and you will then be able to see the *Mean*, *Min*, *Max*... To quickly determine the total number of premature deaths in China, look at the *Sum*. When done, click the *OK* button to return to the *BenMAP GIS* window.
- When done, click the *Close* button to return to BenMAP main window.

Appendix B. Health Impact Function Editor

In Step II, you learned to add a health impact function dataset to BenMAP. The dataset generally contains multiple health impact functions. BenMAP also allows you to add and edit a single health impact function at a time.

- Start BenMAP.
- Click *Tools* and then *Modify Setup*. This will bring up the *Manage Setup* window.
- Choose the *China* setup.
- Click the *Edit* button under the *Health Impact DataSets* box. This will bring up the *Manage Health Impact Function DataSets* window.
- Click the *Edit* button. This will bring up the *Health Impact Function DataSet Definition* window.

- Click the *Add* button. This will bring up the *Health Impact Function Definition* window.
- Fill in the lists and boxes on the left-hand side of the window (you can use the drop-down menu):

Endpoint Group: Mortality
Endpoint: Mortality, Long-Term, All Cause
Pollutant: PM2.5
Metric: D24HourMean
Seasonal Metric: QuarterlyMean
Race: ALL
Ethnicity: ALL
Gender: ALL
Start Age: 0
End Age: 99
Author: Health Effects Institute
Year: 2004
Location: Asian Cities
Qualifier: Linearized-Random effects estimate

- Click on the *Edit* button below the *Function* box. This will bring up the *Edit Function* window.
- Choose the *Select Existing Function* tab.
- In the *Available Compiled Functions* list, choose the following function: “ $(1-(1/\text{EXP}(\text{Beta}*\text{DELTAQ})))^{\text{Incidence}}*\text{POP}$ ”. After choosing this function from the list, make sure that you click the *Select* button. The function will then appear in the *Function* box. Your screen should look as follows:

- Click *OK* to return to the *Health Impact Function Definition* window.
- Choose *Normal* from the *Beta Distribution* list. The *Edit Distribution Values* window will appear.
- Enter the value 0.00011 in the *Mean Value* box. Also, enter the value 0.00005 for the *Beta Std Error* in the *sigma* box.
- Click *OK*. This will bring you back to the *Health Impact Function Definition* window.

Your screen should now look like this:

Health Impact Function Definition

DataSet Name:

Endpoint Group: Endpoint:

Pollutant: Metric: Metric Statistic:

Seasonal Metric:

Race: Ethnicity: Gender: Start Age: End Age:

Author: Year: Location:

Qualifier: Other Pollutants:

Reference:

Function:

Baseline Incidence Function:

Beta Distribution: Beta:

Beta Parameter 1: Beta Parameter 2:

Constant Description: Constant Value:

A: B: C:

Incidence DataSet: Prevalence DataSet:

Variable DataSet:

- Click **OK**. This will take you back to the *Health Impact Function DataSet Definition* window.
- In the tree, find the function that you just created by expanding *Mortality* and then expanding *Mortality, Long-Term, All Cause*. After using the scrollbar under the Tree, your screen should appear as follows (the highlighted row seen here in the screen shot shows the new function you just added):

Health Impact Function DataSet Definition

Health Impact Function DataSet Name:

Tree	Endpoint Group	Endpoint	c	Metric Statistic	Author	Year	Location
[-] Mortality							
[-] Mortality, Long-Term							
				Mean	Pope et al.	2002	51 cities
				Mean	Laden et al.	2006	6 cities
				None	Health Effects Institute	2004	Asian Cities
[+] Mortality, Cardiopulm							
[+] Mortality, Lung Canc							
[+] Hospital Admissi							
[+] Outpatient Visits							

- Click *OK*. Continue clicking *OK* until you reach BenMAP main window. You are now ready to use the function that you just created. You just need to add this new function to the CFG file you previously created in Step IV (recall that CFG file is reusable).
- Click *Incidence Estimation* under *Step 2* in BenMAP main window and open the previously-created *PM2.5 China CFG .cfg*. Add the newly-created Mortality function by dragging it to the *Selected CR Function* panel. Your new configuration settings window should look something like the following. Re-run this new configuration and save your results under a different file name.

Configuration Settings

Available CR Functions:

Tree	DataSet	Endpoint Group	Endpoint	Metric Statistic	Author	Year	Location
[-] China Health Imp							
[-] Mortality							
[-] Mortality, Long-Term							
				Mean	Pope et al.	2002	51 cities
				Mean	Laden et al.	2006	6 cities
				None	Health Effects Institu	2004	Asian Cities
			Mortality, Cardiopulm				
			Mortality, Lung Canc				
			Hospital Admissions				
			Outpatient Visits				

Selected CR Functions:

Function Identificati		Function Parameters							
DataSet	Endpo	Race	Ethnicity	Gender	Start Age	End Age	Incidence Data	Prevalence Data...	Variable Data
China Health	Mortal				30	99	ChinaMortalityIncid		
China Health	Mortal				30	99	ChinaMortalityIncid		
China Health	Hospit				0	99	ChinaMorbidityIncid		
China Health	Hospit				0	99	ChinaMorbidityIncid		
China Health	Outpat				0	99	ChinaMorbidityIncid		
China Health	Outpat				0	99	ChinaMorbidityIncid		
China Health	Mortal	ALL	ALL	ALL	0	99	ChinaMortalityIncid		

Cancel Previous Run

Frequently Asked Questions

1. What are the file types commonly used in BenMAP?

The following table lists BenMAP file types, the corresponding descriptions and the default folder location (You can also find this table in Table 2-1 in the Manual).

File Extension	Description	Default Folder Location
*.aqq	Air quality grid.	Air Quality Grids
*.cfg	Configuration specifying the health impact functions and other options used to generate incidence estimates.	Configurations
*.cfgr	Configuration results, containing incidence results at the grid cell level.	Configuration Results
*.apv	Aggregation, Pooling, and Valuation configuration specifying the aggregation levels, pooling options, and valuation methods used to generate aggregated incidence estimates, pooled incidence estimates, valuation estimates, aggregated valuation estimates, and pooled valuation estimates.	Configurations
*.apvr	Aggregation, Pooling, and Valuation configuration results, containing incidence results at the grid cell level, aggregated incidence results, valuation results, aggregated valuation results, and pooled valuation results.	Configuration Results
*.shp	Shape files generated by BenMAP's mapping capabilities. These files can be viewed within BenMAP or within shape file viewers, such as ArcView.	Maps
*.csv	Reports are exported as *.csv files, which may be viewed in a text editor, or in programs such as Excel.	Reports

2. What should I do when encountering error messages in BenMAP?

There are generally two types of error messages BenMAP could generate: user's error and system error. The user's error can be solved if the user operates BenMAP correctly. When you encounter an error message, try to take a step back (e.g., remove the dataset you just added) and then re-do that step. Sometimes it is helpful to exit BenMAP and re-start it. If you think it is a system error, you can report to <http://bugz.unc.edu>

3. I added one or more datasets to BenMAP and then exited BenMAP to do something else. When I came back to continue my training, the datasets I added were gone.

You probably didn't save your work properly before you exited BenMAP. Make sure you click the *OK* button in the *Manage Setup* window (in the lower-right corner of the window) to save the datasets you added before you exit BenMAP.

4. I don't see the *OK* button (or other buttons I am supposed to click on).

This doesn't happen very often but in case you encounter this situation, try to expand the window to view all parts of the window.

5. I've loaded new baseline incidence data, but BenMAP won't let me select it in the configuration stage.

When formatting these data for importation to BenMAP, take special care to ensure that you have specified the health endpoints correctly. The baseline incidence rate must be associated with a specific health endpoint and endpoint group in BenMAP. Be sure that you have recorded the endpoint group and endpoint exactly as it is recorded in BenMAP. For example, if the baseline incidence rate is for asthma-related hospital admissions, be sure you have recorded the endpoint group as "Hospital Admissions, Asthma" and the endpoint as "HA, Asthma".

6. Can I use air quality grids based on different Grid Types in the baseline and control scenarios?

No. In any given analysis, you need to use the same Grid Type in the baseline and control scenarios.

7. How do I know which health impact functions to use? Which functions does EPA use?

One option regarding the choice of health impact functions is to work with someone, say another BenMAP user, who is familiar with the epidemiological literature and develop your own set of health impact functions. Reviewing the epidemiological literature can be time-consuming, though in some situations, this might be the best option, such as if you want to estimate the health impacts of carbon monoxide exposure, for which BenMAP does not have pre-installed health impact functions.

Another option is to use the ozone and PM_{2.5} configurations used by EPA that come installed with BenMAP. You will find them in the Configurations folder. If desired you can edit this configuration and then save it under a different file name -- it is always a good idea to keep the original version, so you can go back to it if needed!

8. I am at the BenMAP valuation window and cannot proceed. What should I do?

In order to proceed to the next step, you must select a *Variable DataSet* from the drop-down menu in the *Select Valuation Methods, Pooling, and Aggregation* window. The files in the *Variable DataSet* can include a variety of data, such as income and poverty data that might be used in health or valuation functions. For the default EPA health and valuation functions, you just need to select the EPA Standard Variables.

If you have developed your own setup, then you need to make sure that you also load a *Variable DataSet*. This is necessary even if you do not need the extra variables that can be included in this dataset.

9. How do I know what year dollars were used?

You can find the answer in the Audit trail for the APVR file that you generated.

10. When creating reports from *.cfgr and *.apvr files, why do some of the variables that I have checked appear as blanks?

When results are pooled together, some of the identifying information for individual health impact functions gets lost. For example, when pooling together endpoints within the same endpoint group, such as “HA, Pneumonia” and “HA, Chronic Lung Disease” (both within “Hospital Admissions, Respiratory”), there is no longer a unique endpoint name for the pooled result. So, BenMAP would leave the endpoint name blank.

11. Who should I contact if I have other questions?

You can send email to benmap@epa.gov.