

# Control Strategy Tool (CoST) and Advanced EMF Training Outline

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## **Introduction to CoST**

This course introduces participants to the Control Strategy Tool (CoST) of the Emissions Modeling Framework (EMF). CoST can be used to estimate the cost and emissions reductions that result from applying additional emission control measures to point, nonpoint, nonroad, and mobile emissions sources.

This hands-on training covers:

- Managing, viewing, and editing control measures
- Creating, editing, and reviewing the results of control strategies to see the levels of cost and emissions reductions that would be achieved
- Limiting a control strategy to a specified geographic region
- Setting control strategy constraints/limits
- Setting up custom quality assurance steps

### **A. Control Measure Manager**

This section demonstrates the features of the EMF Control Measure Manager. Control measures contain information about control technologies and practices that are available to reduce emissions, the source categories to which they apply, the control efficiencies achieved, and their estimated costs. The Control Measure Manager allows measure data to be entered, viewed, and edited. The measures can also be imported from files that are provided in a specific CSV format. The Control Measure Manager has the following major features:

- Facilitates storing and maintaining control measure data within the EMF database;
- Shows minimum, maximum, and average values of control efficiency, cost per ton (based on the year 1999 values), and average rule effectiveness and rule penetration information;
- Displays other control measure attributes (e.g., abbreviation, major pollutant, source group, equipment life, sectors, class);
- Allows import of control measure information into the system from CSV files;
- Enables export of control measure to CSV files;

#### **A.1. Examine the *Control Measure Manager Window***

In this section, you will learn how to:

- View, sort, and filter a list of control measures from the *Control Measure Manager Window*
- Filter and display cost and control efficiency information for major and cobenefit pollutants of the measures
- See cost per ton information for different cost years

Let's begin by exploring the Control Measure Manager:

1. On the Main Menu, **Click Manage -> Control Measures**. This will open the *Control Measure Manager Window*.

#	Select	Name	Abbreviation	Pollutant	Avg CPT	Avg CE	Min CE	Max CE
9	<input type="checkbox"/>	LOWRVP; Motorcycles (MC); Urban Local	LRVPGMCLU	VOC	5700.00	19.89	5.36	56.60
10	<input type="checkbox"/>	LOWRVP; Motorcycles (MC); Urban Minor Arterial	LRVPGMCAU	VOC	5700.00	21.30	5.36	56.60
11	<input type="checkbox"/>	LOWRVP; Motorcycles (MC); Urban Other Expressways	LRVPGMCFU	VOC	5700.00	18.69	6.50	55.05
12	<input type="checkbox"/>	LOWRVP; Motorcycles (MC); Urban Other Principal Arterial	LRVPGMCPU	VOC	5700.00	21.94	5.36	56.60
13	<input type="checkbox"/>	ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Other Principal Arterial	ONRTHHDVPU	NOX		50.19	31.63	58.59
14	<input type="checkbox"/>	ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Other Expressways	ONRTHHDVU	NOX		50.82	36.51	55.00
15	<input type="checkbox"/>	ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Minor Arterial	ONRTHHDVU	NOX		50.26	31.63	57.67
16	<input type="checkbox"/>	ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Local	ONRTHHDVLU	NOX		50.53	31.61	58.59
17	<input type="checkbox"/>	ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Interstate	ONRTHHDVLU	NOX		49.00	31.63	57.67


132 rows : 24 columns[ Filter: Empty, Sort: Max CPT(desc) ]

View Edit Copy New Pollutant: MAJOR Cost Year: 1999 Import Export Close

2. Control Measures are organized within CoST by major pollutant (i.e., the pollutant that is most controlled by the control measure). Thus, to see a list of Control Measures, you must first specify a major pollutant. To see all the measures, change the **“Major Pollutant:” pull-down menu** to **“ALL”**. The interface will pause momentarily while the Client accesses the control measure list from the EMF Server. [Note: For the training, the laptops are each running both the Client and the Server). When you choose a different Major Pollutant than **“ALL”**, only the information for that major pollutant's measures will be transferred from the server and displayed in the window.
3. Using the control measure list that appears, **scroll through the list of control measures** that have been pre-loaded for this training and review the columns available in the list by using the left-right scroll bar. You will be shown how to edit this information later.

The following are brief descriptions of the columns in the *Control Measure Manager Window*.

- Select: This column will allow the user to view, edit, or copy the measure by clicking the corresponding button at the bottom of the manager window. These features will be discussed later in the training.
- Name: Unique measure name.
- Abbreviation: Unique measure abbreviation.
- Pollutant: The pollutant that is selected in the Pollutant menu at the bottom of the control measure manager, or the major pollutant for the measure if Major is selected. The cost per ton, control efficiency, rule effectiveness, and rule penetration columns show the values for the pollutant shown in the Pollutant column.
- Max, Min, and Avg CE: Maximum, minimum, and average control efficiencies aggregated for all locales.

- Max, Min, and Avg CPT: Maximum, minimum, and average cost per ton aggregated across all efficiency records.
  - Avg Rule Eff.: Average rule effectiveness aggregated across all efficiency records.
  - Avg Rule Pen.: Average rule penetration aggregated across all efficiency records.
  - Control Technology: The control technology that is used for the measure (e.g. Low NOx burner, Onroad Retrofit).
  - Source Group: The group of sources to which the measure applies (e.g. Fabricated Metal Products – Welding).
  - Equipment Life: Expected lifetime (in years) of the equipment used for the measure.
  - NEI Device Code: the device code for the measure that would be found in the NEI.
  - Sectors: A sector or set of emission sectors to which the measure applies. Typically, these are one or more sectors emissions modeling team’s list of sectors for the 2002 platform.
  - Class: The class of the measure. Possible options are Known (i.e., already in use), Emerging (i.e., realistic, but in an experimental phase), Hypothetical (i.e., the specified data is hypothetical), or Obsolete (i.e., no longer in use).
  - Last Modified Time: The date and time on which the information about the measure was last modified in the editor or imported from a file.
  - Last Modified By: The last EMF user to modify the measure.
  - Date Reviewed: The date on which the data for the measure was last reviewed.
  - Creator: The EMF User that created the measure (either from the import process or by adding it via the “New” button).
  - Data Source: A description of the sources or references from which the values were derived. Temporarily, this is a list of numbers that correspond to references listed in the References Sheet from when the control measures were imported.
  - Description: A textual description of the applicability of the measure and any other relevant information.
4. Next sort the control measures by average control efficiency by **clicking on the Avg CE column**. Try sorting on some other columns.
5. Now, you will use a filter to limit the list of Measures. **Click on the filter**  **button**. This will open the *Filter Rows Window*. **Click the “Add Criteria” button**, to add one criterion to the table. For the new criterion, **change the “Column Name” field to “Name” and enter “ONRetrofit” in the Value field**. [Once you **Click OK**, you will then see only the measures that are onroad-retrofits.] The dialog should look as follows:

**Filter Rows**

☒ Apply Filter?    Match using: ☒ ALL criteria    ☐ ANY criteria

**Add Criteria**    **Delete Criteria**

Column Name	Operation	Value
Name	starts with	ONRetrofit

**OK**    **Cancel**

6. Select NO<sub>x</sub> from the **“Pollutant:” pull-down list** located **at the bottom of the window**. This will cause the values for control efficiency, cost per ton, rule penetration, and rule effectiveness to be shown for **NO<sub>x</sub>**, regardless of whether NO<sub>x</sub> is the major pollutant. Next **choose VOC** to see the VOC related data for the measures. If you change the **“Pollutant:” pull-down list** to “MAJOR” the control efficiency, cost per ton, rule penetration, and rule effectiveness values for the measure’s major pollutant will be shown.

Note—if the measure does not have any data for the selected pollutant, then no values will be shown for cost per ton, control efficiency, etc.

7. Next view the adjusted cost per ton for different years by **changing the “Cost Year:” pull-down list**. By default, the costs are shown for the reference year 1999, so if you choose a year greater than 1999, the cost will be more, likewise if you choose a year before 1999 the cost will be less. Cost is converted based on tables of GDPs. To see this more clearly, you may want to do a descending sort on cost-per-ton before and after changing the year.

## A.2. Edit/view an existing control measure

The purpose of this section is to learn about editing/viewing a Control Measure.

### A.2.a. Open a measure for editing

1. From the *Control Measure Manager*, **set the major pollutant to NO<sub>x</sub>**, then select the control measure named **“ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Other Principal Arterial”** by **scrolling down in the table or filtering** and then **click the checkbox** next to the control measure. Then, **click the “Edit” button** on the *Control Measure Manager Window*. After a short time, you will then see the Control Measure Editor.

**Edit Control Measure: ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Other Principal Arterial**

**Summary** | Efficiencies | SCCs

**Name:** Diesel Vehicles 8A & 8B; Urban Other Principal Arterial

**Description:**

**Abbreviation:** ONRTHHDVPU

**Creator:** Alison Eyth

**Last Modified Time:** 2007/05/06 21:18

**Last Modified By:** Alison Eyth

**Major Pollutant:** NOX

**Class:** Known

**Control Technology:** ONRetrofit

**NEI Device code:** 0

**Source Group:** HD Diesel Vehicles 8A & 8B

**Equipment life (yrs):** 0.0

**Date Reviewed:**

**Data Sources:** 2nd Run Controls to EPA.mdb

**Sectors:** Onroad

**Add** **Remove**

**Save** **Close**

**The Summary tab** of the Control Measure Editor will be shown by default. This tab contains high level summary information about the measure. Below are brief descriptions of the fields on this tab.

**Name:** A unique name that summarizes the control technology and the sources to which it applies.

**Description:** A longer description of the applicability of the measure and any other relevant information.

**Abbreviation:** A 10 character unique string that is used to assign the control measure to sources in the inventory. Ideally, the abbreviation should be somewhat readable so that the user has some idea of what type of measure it is when reading the abbreviation.

**Creator:** The name of the user who imported or created the measure.

**Last Modified Time:** The date and time on which the information about the measure was last modified in the editor, or imported from a file.

**Last Modified By:** The last EMF user to modify the measure.

**Major Pollutant:** The pollutant most controlled by the measure. This is used to group the measures only, and has no impact on how the measure is assigned to sources.

**Control Technology:** The control technology that is used by the measure (e.g. ONRetrofit, short for 'On-road retrofit'). You can type a new entry into this field and choose it from the pull down menu in the future.

Source Group: The group of sources to which the measure applies (e.g., Motorcycles (MC)). You can type a new entry into this field and choose it from the pull down menu in the future.

Sectors: A modeling sector or set of modeling sectors to which the measure applies. Typically, these correspond to the emissions modeling team's list of sectors for the 2002 platform.

Class: The class of the measure. Possible options are Known (i.e., already in use), Emerging (i.e., expected to be used), Hypothetical (i.e., the specified data is hypothetical), or Obsolete (i.e., no longer in use).

NEI Device Code: The numeric code used in the NEI to indicate that the measure has been applied to a source. A cross-reference table to match the CMAbbreviations and NEI Device Codes to one another may be created.

Equipment Life: The expected life of the control measure equipment, in years.

Date Reviewed: The date at which the data for the measure was last reviewed.

Date Sources: A description of the sources or references from which the values were derived. Temporarily, this is a list of numbers that correspond to references listed in the References Sheet from when the control measures were imported.

2. **Change a couple of the fields** so you can see how to edit a measure. For example, **type values into the fields as defined below:**
  - a. **Equipment Life = 10**
  - b. **Date Reviewed = 5/03/2007**
3. Save the measure changes you have made so far by **clicking the “Save” button** at the left bottom of the *Edit Control Measure Window*. When the measure is saved, it automatically closes the editor window. To see the changes in the *Control Measure Manager Window*, **click the “Refresh” button**. To edit the measure you will again need to **click the “Edit” button**.
4. **Pull-down the menus for Control Technology, Source Group, and Class** to see what types of choices there are. **Click Add Sector** to see how you would specify the inventory sector(s) to which the measure applies.

#### **A.2.b. Examine the *Efficiencies Tab***

1. If you have not yet reopened the measure, **click Edit to reopen it**.

If the measure was no longer selected, you may need to **click the Select checkbox** for the control measure **“ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Other Principal Arterial”** and then **click the “Edit” button** on the *Control Measure Manager Window*.
2. Next, **click on the Efficiencies tab** to see the data that is available from this tab. You will see a table of efficiency records with many columns. Each row in the table corresponds to a different record in the database. In this example, the data varies by county and pollutant and the FIPS county code appears in the Locale column.

Edit Control Measure: ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Other Principal Arterial

Summary **Efficiencies** SCCs

Row Limit: 100 Row Filter:

Apply

#	Select	Pollutant	Locale	Effective Date	Cost Year	Cost Per Ton	Ref Yr Cost Per Ton	Control Effi
1	<input type="checkbox"/>	CO	37001		1999			
2	<input type="checkbox"/>	CO	37013		1999			
3	<input type="checkbox"/>	CO	37019		1999			
4	<input type="checkbox"/>	CO	37021		1999			
5	<input type="checkbox"/>	CO	37023		1999			
6	<input type="checkbox"/>	CO	37025		1999			
7	<input type="checkbox"/>	CO	37027		1999			
8	<input type="checkbox"/>	CO	37031		1999			
9	<input type="checkbox"/>	CO	37035		1999			

100 rows : 18 columns [Filter: None, Sort: None]

Add Edit Copy Remove

Save Close

Here are some notes on the measure efficiency records.

Each efficiency record contains cost and control efficiency information about the control measure *for a particular pollutant, locale, and effective date*. This tab contains a table of all information relevant to each efficiency record including the pollutant that is controlled, its control efficiency, cost per ton for control, and other information.

Different records would be specified to provide data for different pollutants. If the cost or control efficiency varies over region or time, it is possible to specify different records in the table for each Locale or Effective Dates.

A **Locale** is a **two digit FIPS state code**, or a **five digit FIPS county code**. When the efficiency records are matched with sources for a strategy, the Locale and Effective Date are considered when determining the most specific efficiency record that applies to that source based on its FIPS code and the date of the strategy run. Note that any records without a locale specified are assumed to be applicable to all areas, and any records with no Effective date will be assumed to apply for all dates.

The following are descriptions of the efficiency record fields in the table:

**Pollutant:** The pollutant for which this record applies (emissions are either decreased or increased).

**Locale:** A two digit FIPS state code, or a five digit FIPS county code to denote that the information on the row is only relevant for a particular state or county. If left blank, it is assumed to apply to all locales.



Effective Date: The month, day, and year on which the record becomes effective. The system will find the record with the closest effective date that is less than or equal to the date of the analysis. If this is left blank, it is assumed to apply to any date.

Cost Year: The year for which the cost data is provided.

Cost Per Ton: The cost to reduce each ton of the specified pollutant.

Ref Yr Cost Per Ton: The cost per ton to reduce the pollutant in 1999 dollars.

Control Efficiency: The [median] control efficiency (in units of percent reduction) that is achieved when the measure is applied to the source, exclusive of rule effectiveness and rule penetration. Eventually, statistical distributions for percent reduction may be provided to facilitate uncertainty analysis. *Note that there are sometimes disbenefits for certain pollutants as a result of the control device, so control efficiency can be negative to indicate that the amount of a pollutant actually increased.*

Rule Effectiveness: The rule effectiveness of the measure, which could be expected to vary by locale. Rule effectiveness is defined as “the ability of a regulatory program to achieve all the emissions reductions that could have been achieved by full compliance with the applicable regulations at all sources at all times”. Therefore a rule effectiveness of 100% means that all sources are fully complying at all times.

Rule Penetration: The rule penetration of the measure, which could be expected to vary by locale. Rule penetration is the percent of sources that are required to implement the control measure. Rule penetration might vary over time as a new rule is “phased-in” over time.

Equation Type: The type of cost equation to use. The only currently supported type is cpton, for “cost per ton”. Additional types will be added later, in particular those which correspond to the equation types used by AirControlNET. Many of the cost equations rely on stack flow and boiler capacity values that are derived from the inventory. Since these values are often sparsely populated, you may want to supplement this information with some tables to provide default values for these based on SCC-SIC combinations. *Note that in the initial version of the software, the cost of energy will not be accounted for in the cost equations and both capital and O&M costs are rolled into the single cost/ton value.* It will still be important to support analyses using different **discount rates** and **cost years** when retrieving cost information, but the discount rate is not relevant until the system distinguishes between operating and capital costs.

Capital Rec Fac: The capital recovery factor to use.

Discount Rate: The discount rate used to compute the capital recovery factor.

Last Modified Time: The last date and time an EMF user modified the efficiency record.

Last Modified By: The last EMF user to modify the efficiency record.

Details: Text that specifies information about the source of data for this row or reason it was changed.

Existing Measure: This field should be populated when the data on the row is provided assuming that a control measure has already been applied to the source. The contents of the field should be the control measure abbreviation that corresponds to

the existing measure. The reason for this field is that the efficiency of and cost of applying the measure may vary when there is already a control measure installed on a source.

Existing NEI Dev: This is used in conjunction with ExistingMeasureAbbr, and should specify the device code used in the NEI that corresponds to the currently installed device.

Note - The efficiency records must be unique based on the following four fields; Pollutant, Locale, Effective Date, and Existing Measure. This means that two records cannot have the same values for these four fields.

3. Now, let's see what the "Row Limit" field does. This field limits the number of efficiency records that are populated into the tab. There could be thousands of records, so a limit of 100 records is in place by default. Let's change the field and see what happens. **Change the "Row Limit" to 800 and then click on the "Apply" button.** You will now see 775 rows in the table instead of 100 rows.
4. Next, **use the "Row Filter" field to filter the records that show up in the table.** By using standardized Structured Query Language (SQL) WHERE clause syntax you can control which records are shown. Use the column header name as the field name. To apply the row filter, **click the "Apply" button.** Here are few examples of the SQL syntax:
  - a. Pollutant = 'NOX'
  - b. Pollutant IN ('CO', 'VOC', 'PM10')
  - c. Pollutant <> 'NOX'
  - d. Locale LIKE '37%'
  - e. Cost Per Ton > 1000 AND Locale LIKE '37%'

Type in **Locale like '37%' and Pollutant='NOX'** in the "Row Filter" field and click the **"Apply"** button. Scroll through the table and you will note how only records with a locale state code of 37 and pollutant of NOX are shown.

5. Editing an efficiency record: **Select the efficiency record for 'NOX' and Locale 37001 and then click the "Edit" button.** This will open the *Edit Efficiency Record Window*, an example of which is shown below. **Change the cost year to 2002, and enter a different cost per ton, and control efficiency.** Notice how the *Ref Yr Cost Per Ton* field changes when the cost year and cost per ton are changed. The Ref Yr Cost Per Ton field shows the cost in 1999 dollars. **Click Cancel to ignore your changes.** If you wished to save the changes you would instead click the "Save" button.

**Edit Efficiency Record for Control Measure: ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Oth...**

Pollutant:*	NOX	Control Efficiency (% Red):*	47.58
Locale:	37001	Rule Effectiveness (%):	100.0
Effective Date:		Rule Penetration (%):	100.0
Existing Measure Abbreviation:		Equation Type:	cpton
Existing NEI Device Code:	0	Capital Recovery Factor:	0.0
Cost Year:*	1999	Discount Rate (%):	0.0
Cost Per Ton Reduced:*	1800.0	Last Modified By:	Alison Eyth
Ref Yr Cost Per Ton Reduced:	1800.0	Last Modified Time:	05/06/2007 21:18

Details:

- Add an efficiency record by **clicking the “Add” button** on the *Efficiency Tab*. The same window discussed above will be displayed, but without any data filled in. **Select CO2 as the pollutant; enter 37 as the Locale to indicate that the measure applies only to North Carolina, and enter some values for Cost Year and Control Efficiency. Then click Save.** You have now **added data for a new pollutant** to the measure.

**Add Efficiency Record for Control Measure: ONRetrofit; HD Diesel Vehicles 8A & 8B; Urban Oth...**

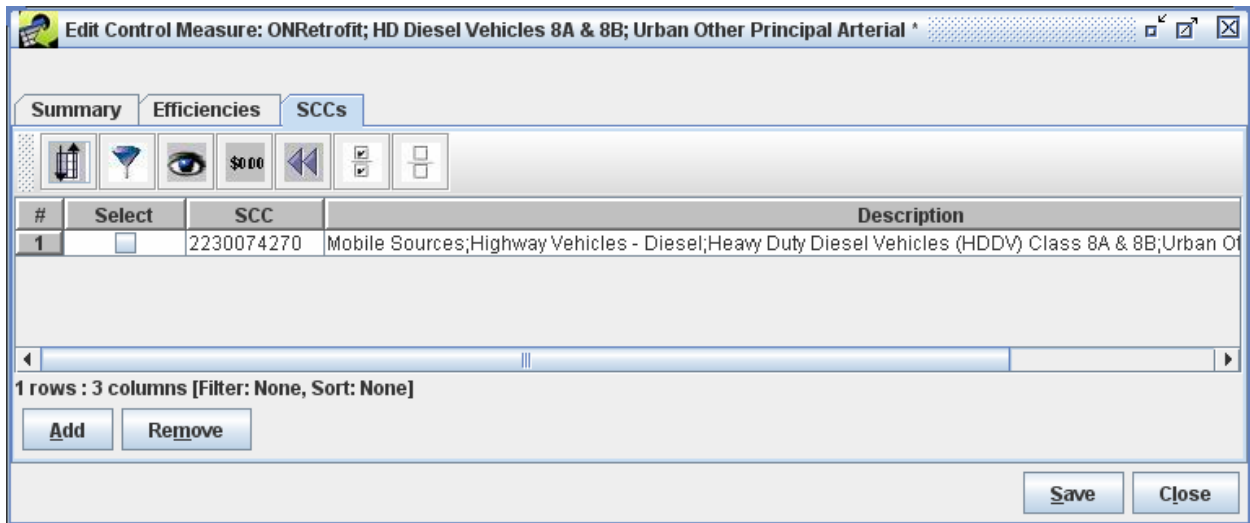
Pollutant:*	CO2	Control Efficiency (% Red):*	
Locale:		Rule Effectiveness (%):	100.0
Effective Date:		Rule Penetration (%):	100.0
Existing Measure Abbreviation:		Equation Type:	cpton
Existing NEI Device Code:		Capital Recovery Factor:	
Cost Year:*		Discount Rate (%):	
Cost Per Ton Reduced:*		Last Modified By:	
Ref Yr Cost Per Ton Reduced:		Last Modified Time:	


Details:

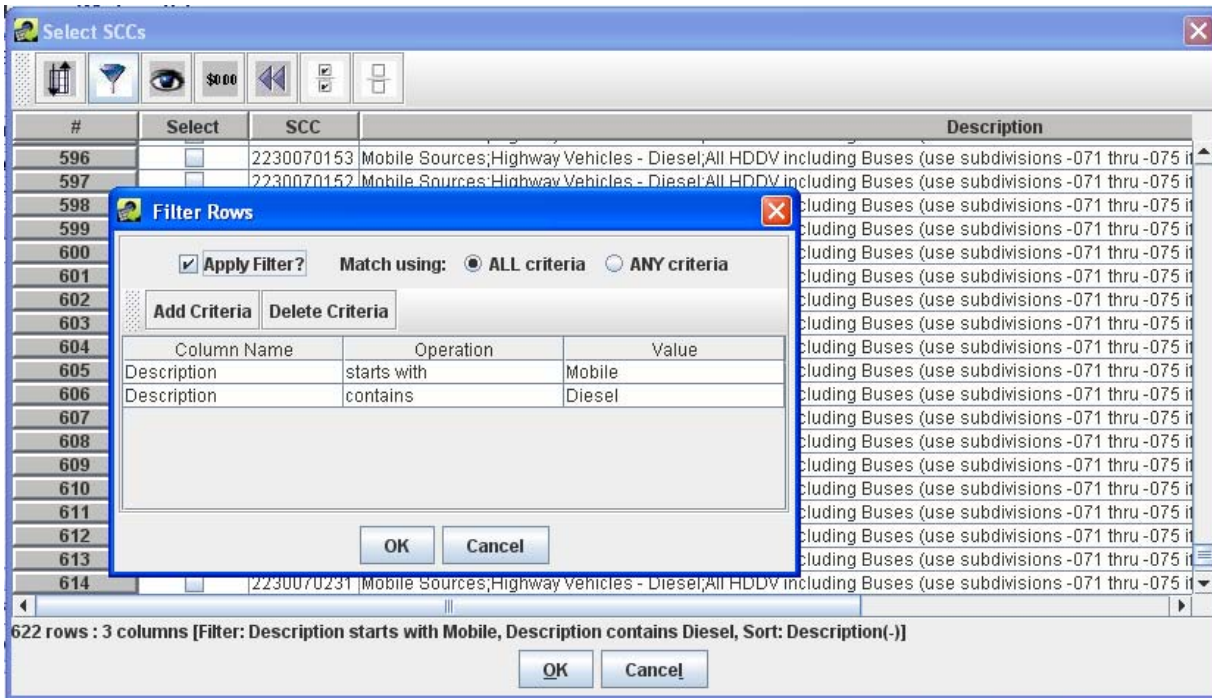
7. To see your newly added record, **enter the filter: Pollutant='CO2'**.
8. To remove the newly added record, **select the checkbox for the new record** and then **click the “Remove” button**. **Click Yes in the confirmation dialog**. If you had multiple records selected, all records would have been removed.

#### A.2.c. Examine the SCCs Tab

1. First, **click on the SCCs Tab** in the *Edit Control Measure Window* to get to this tab. **The SCCs tab contains SCC codes for sources to which the measure can be applied.** This is how the measures are mapped to the inventory sources. Note that the Description of this SCC is shown along with the code to help you better understand which SCCs are associated with the measure.



2. To associate additional SCC(s) with the measure, **click the “Add” button** to open the *SCC Selection Window*.
3. Now, you will use a filter to limit the list of SCCs. For this measure you are interested in SCCs that have description that start with “Mobile” and the description contains “Diesel”. In order to filter the SCCs, **click on the filter**  **button**. This will open the *Filter Rows Window*. **Important: the case of the words “Mobile” and “Diesel” must be correct for this filter to work properly.**
4. **Click the “Add Criteria” button**, to add one criterion to the table. For the new criterion, **change the “Column Name” field to “Description” and enter “Mobile” in the Value field**.
5. **Click the “Add Criteria” button again**, to add a second criterion to the table. For the new criterion, **change the “Column Name” field to “Description”, set the Operation to “contains” and enter “Diesel” in the Value field**
6. To filter the SCC list **click the “OK” button** on the *Filter Rows Window*. If you scroll through the list of SCCs, you will only see SCCs with names as specified in the filter.



7. **Add some SCCs to the measure by checking the checkbox for the SCCs and then clicking the “OK” button.** The selected SCCs should now appear in the list.
8. Now, **select the checkboxes for the records you added and then click the “Remove” button.** The records should no longer be shown in the table. Note – SCC code 2230074270 should be the only SCC code associated with this measure.
9. **Click the Close button at the bottom of the Control Measure editor to close the measure without saving your changes. Click Yes on the dialog that is confirming that you would like to discard your changes.** If you had wanted to save the changes, you would have instead clicked the “Save” button.

### A.3. Copy a control measure

Click the Select checkboxes for two measures that you would like to copy and then click the “Copy” button on the *Control Measure Manager Window*. The new measures will have names like Copy of “Measure Name”. You would then want to edit them (e.g. to set the abbreviation and change some values) by following the steps defined in section I.2. **Hint: If you cannot find them in the list, go over to the Last Modified Time column and click the column heading until you get a descending sort.**

### A.4. Advanced Exercise – Add an new control measure

If you have extra time, you may add a new control measure by following the same steps discussed in section I.3. The only difference is that you would **click the “New” button on the**

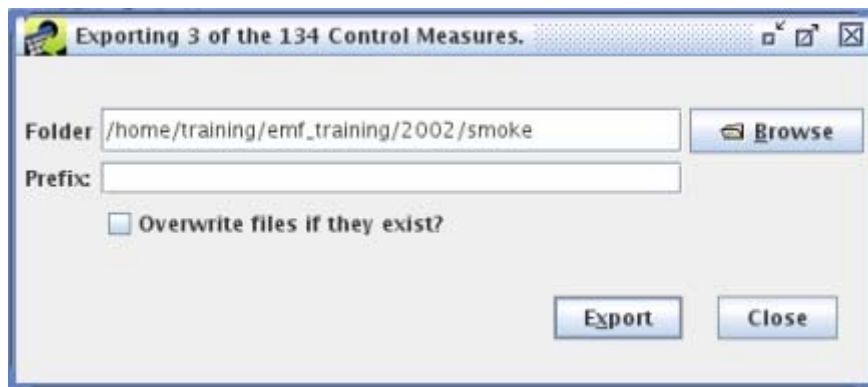
**Control Measure Manager Window** instead of the Edit button. Give it try, but remember that the new measure must have a unique name and abbreviation.

### A.5. Advanced Exercise - Exporting control measures

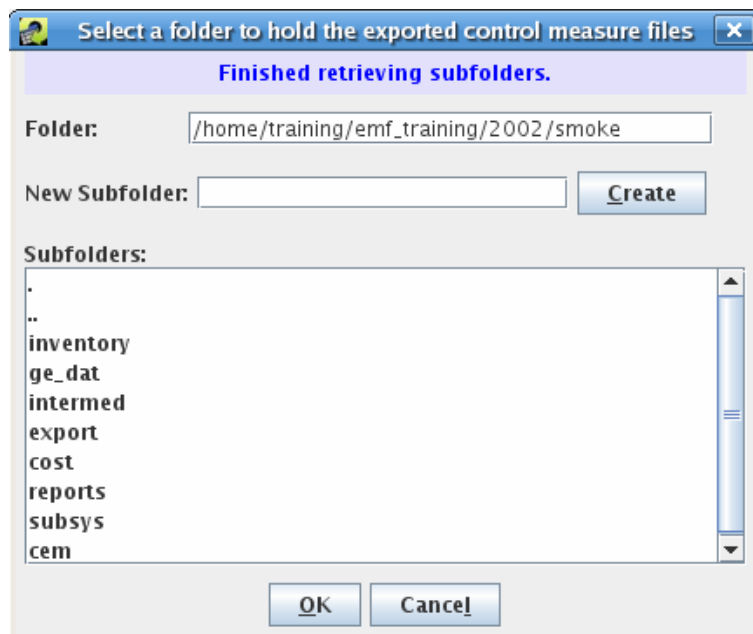
If you have extra time, you can follow the exercises in this section to learn how to export control measures into three CSV files—the summary file, efficiency file, and SCC file. The first row of all three files will contain the column headers.

Note - The *Folder Browser* shows you folders on the EMF server, so when the EMF Server and Client are running on different machines, your data files will be exported to the Server machine.

1. First, **select a few measures to export** by checking them in the *Control Measure Manager Window*.
2. Next, **click the “Export” button** on the *Control Measure Manager Window*. This will open the *Export Control Measure Window*.



3. Next, **click the “Browse” button**. This will open the *Folder Browser Window*.



4. Now, **choose the folder to export the files to**. For example, you could **navigate to the following directory: /home/training/emf\_training/2002/smoke/cost** You can double-click the folder to get to its subfolders. You can double-click on “.” to go up a directory, or simply type the path in by hand. Once you get to the folder, it will be displayed in the “Folder:” field. **Click the “OK” button** to set the export directory.
5. Now, **enter a prefix for the exported file names by putting a value in the Prefix field**. For example, use the prefix “export”.
6. Finally, start the export process by **clicking the “Export” button** on the *Export Control Measure Window*. The *Status Window* will show the status of the export.
7. Once the export has finished, you can view the export files by going to the desktop and double-clicking the training’s home icon. **Then navigate to the /home/training/emf\_training/2002/smoke/cost directory. Double click on the exported files so you can view them** in gedit (on Linux), or Excel (on Windows).
  - a. *prefix\_efficiencies.csv*
  - b. *prefix\_SCCs.csv*
  - c. *prefix\_summary.csv*

## **B. Control Strategy Manager**

The purpose of this section of the training is for you to learn how to use most features of the EMF Control Strategy Manager. Also, you will learn how to run control strategies and how to interpret the results.

The concept of a Control Strategy is integrated into the Emission Modeling Framework and is used to encapsulate a description of how control measures should be assigned to emission inventory sources. The input to a control strategy consists of one inventory dataset, filters to limit the sources included from those datasets, and a set of parameters to control how the strategy is run. Several algorithms will be available to assign sources to measures, including “maximum emissions reduction” and “least cost”.

The main output of the control strategy is a table of emission source-control measure pairings, each of which contains information about the cost and emission reduction achieved once the measure is applied to the source. A controlled emission inventory that implements the strategy can also be produced and then input to SMOKE. This inventory will show which measure is applied to the controlled sources. In addition, comments are placed at the top of the inventory file that indicate the strategy that produced it and the high level settings of that strategy.

**During the training, you will create a controlled inventory in one strategy and the use that as the input inventory for a secondary control strategy.**

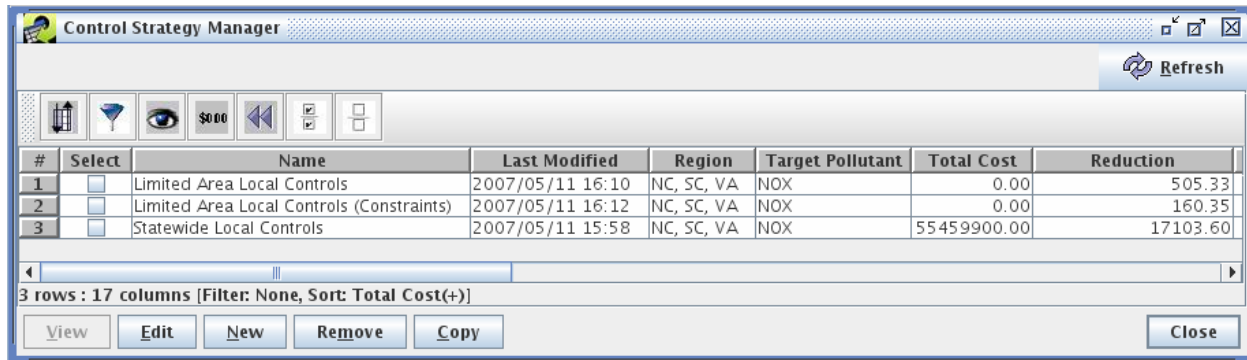
- The first strategy will be a run using statewide local control measures using an onroad mobile emission inventory for NC, SC, and VA.

- The controlled inventory produced from the first strategy will be the input inventory dataset for a second strategy that will apply local measures for a limited specified list of counties in the study area.
- For the third strategy run, you will apply a constraint that specifies that the cost should be less than \$5,000 annually per source for the target pollutant.

Essentially, you will evaluate how the different local measures affect the emission inventory—how much did it reduce each source, how much did it cost, etc. The measures applied to the sources during the strategy runs will have an additive effect on each source.

The Control Strategy Manager has the following major features:

- Stores the control strategy specifications in the database
- Facilitates storing and maintaining control strategies
- Summarizes control strategy information – target pollutant, cost year, total cost, reduction (in tons), etc.



The screenshot shows the 'Control Strategy Manager' window. It features a toolbar with icons for adding, deleting, and viewing strategies, along with a 'Refresh' button. Below the toolbar is a table with the following data:

#	Select	Name	Last Modified	Region	Target Pollutant	Total Cost	Reduction
1	<input type="checkbox"/>	Limited Area Local Controls	2007/05/11 16:10	NC, SC, VA	NOX	0.00	505.33
2	<input type="checkbox"/>	Limited Area Local Controls (Constraints)	2007/05/11 16:12	NC, SC, VA	NOX	0.00	160.35
3	<input type="checkbox"/>	Statewide Local Controls	2007/05/11 15:58	NC, SC, VA	NOX	55459900.00	17103.60

Below the table, it indicates '3 rows : 17 columns [Filter: None, Sort: Total Cost(+)]'. At the bottom, there are buttons for 'View', 'Edit', 'New', 'Remove', 'Copy', and 'Close'.

The following are brief descriptions of the columns in the *Control Measure Manager Window*.

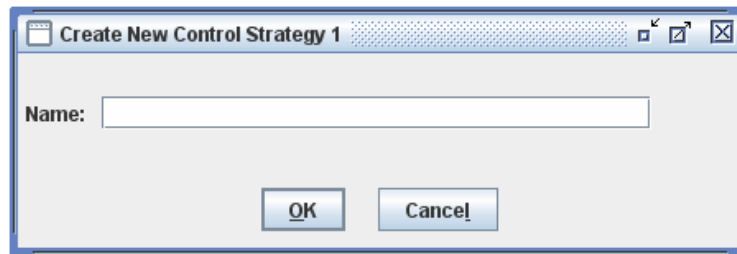
- Name: Unique name for the control strategy.
- Last Modified: The date and time on which the strategy was last modified.
- Region: The name of the geographic region to which the strategy was applied.
- Project: The name of the project for which this strategy was performed (e.g., Initial Ozone NAAQS).
- Strategy Type: The type of algorithm used to match the control measures with sources.
- Inv. Dataset: The name of the dataset used to run the strategy (*currently only one dataset may be specified for each strategy, but eventually the software will support selecting more than one*).
- Version: The numeric version of the inventory dataset used for the strategy.
- Inventory Type: The type of emissions inventory used for the strategy.
- Target Pollutant: The pollutant that is targeted as the primary interest for reduction in this control strategy.



- Cost Year: The cost year selected for the results of the strategy (i.e., all cost data obtained from the control measure will be converted to this year).
- Inv. Year: The year of the base inventory used for this strategy – note that this is metadata only and has no impact on the strategy results.
- Total Cost: The total annual cost of applying the strategy.
- Reduction: The absolute emissions reduction achieved for the target pollutant.
- Run Status: This specifies run status as “Not started”, “Completed”, or “Failed”.
- Completion Date: The date and time when the strategy run was completed.
- Creator: The person who created the strategy.

### **B.1. Create a control strategy for statewide local controls for a NC, SC, and VA mobile emission inventory**

1. Click the “New” button on the *Control Strategy Manager Window*. The following window will appear. Type “**Statewide Local Controls**” in the control strategy “Name:” field and click the “OK” button to create the control strategy.



2. Select the strategy just created by checking the checkbox, then click the “Edit” button to finish updating the rest of the strategy information. This will bring up the *Edit Control Strategy Window* as shown below.

**Edit Control Strategy: Statewide Local Controls**

**Summary** | Inventory | Measures | Constraints | Outputs

Name: Statewide Local Controls

Description:

Project:

Creator: EMF User

Last Modified Date: 04/29/2007 23:51

Copied From:

Type of Analysis: Choose a strategy type

**Parameters**

Cost Year: 0

Inventory Year: 0

Region:

Target Pollutant:

**Results**

Start Date: by EMF User

Completion Date:

Total Annualized Cost:

Target Poll. Reduction:

Save Copy Close Run Refresh Stop

3. Next, update the control strategy to have the desired values. **Change the fields in the *Summary Tab* so that they have the following values:**
  - a. **Type of Analysis = Max Emissions Reduction**
  - b. **Cost Year = 2000**
  - c. **Inventory Year = 2020**
  - d. **Region = NC, SC, VA [Type this in to the Region field]**
  - e. **Target Pollutant = NOX**
4. Now, **click on the *Inventory Tab***. Here you will specify the emission inventory to use during the strategy run and the version of the inventory dataset to use. *Note that you will select the inventory from the same inventory datasets that are available within the EMF data management system.* You could specify an optional Inventory Filter if you did not wish to allow all sources in your inventory to be controlled in this strategy. For example, if you only wanted to control sources with a particular set of SCCs, you could enter an Inventory filter similar to: "SCC like '231%'. Specifying a county file would also perform a filter on the inventory. If you select a file with a list of FIPS codes to include, then only the sources within the specified list of counties would be considered for controls. We will examine the County File feature when we set up the second strategy in this training.

5. Change the “Inventory Type” dropdown to “ORL Onroad Inventory (MBINV)”. Next click on the “Choose” button, to choose the inventory to use. Select the **NC\_SC\_VA\_2020\_National\_Controls\_w\_NLEV\_Crxns\_OnRoad.txt** inventory by clicking on it, and then click the “OK” button to associate the inventory to the strategy.



6. Click **Save** to store the strategy changes you have made so far to the database. Note that the strategy window will not close after a save.

## B.2. Select control measures for the control strategy


1. Click on the **Measures Tab** of the control strategy, to select measures to consider for this strategy. The purpose of this tab is to specify which of the available control measures should be considered when developing the control strategy. The simplest option is to include all measures, in which case you would leave the Clases to Include selection set to All. If instead you only wanted to include Known measures, you would click on Known. If you control-clicked on other classes of measure those would also be included. **In this**

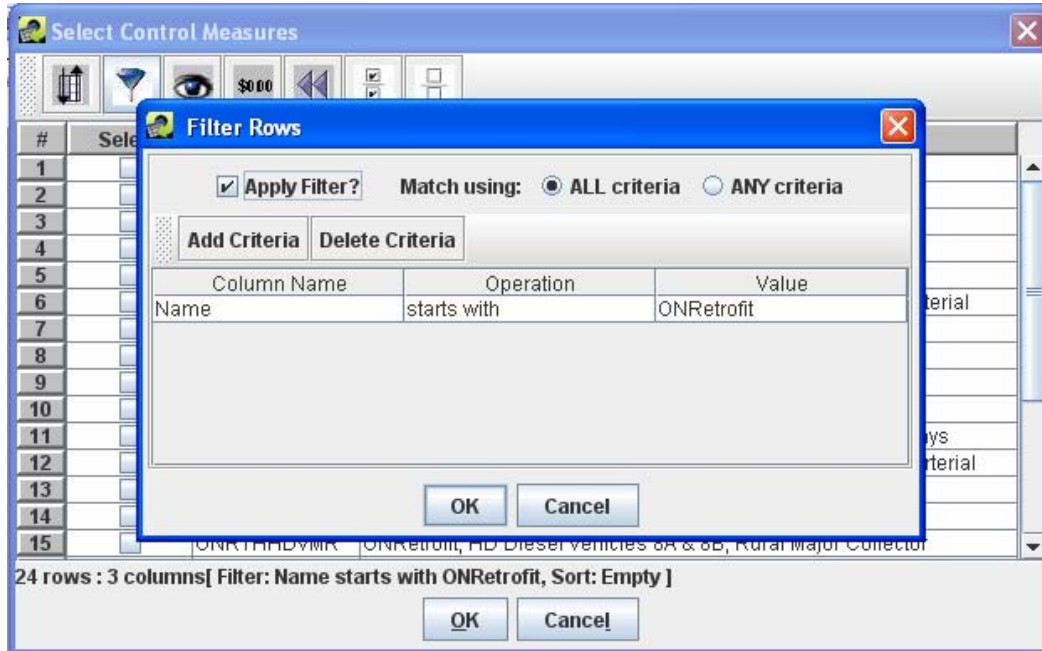
example, instead of specifying which Classes to Include, we will pick a specific subset of Measures to Include for the strategy in the next steps.


- Next, click on the “Add” button under the “Measures to Include:” section. This will bring up *Select Control Measures Window*.

#	Select	Abbrev	Name
1	<input type="checkbox"/>	BWCOLGT1IR	Best Workplaces; LD Gas Trucks 1 & 2; Rural Interstate
2	<input type="checkbox"/>	BWCOLGT1LR	Best Workplaces; LD Gas Trucks 1 & 2; Rural Local
3	<input type="checkbox"/>	BWCOLGT1MR	Best Workplaces; LD Gas Trucks 1 & 2; Rural Major Collector
4	<input type="checkbox"/>	BWCOLGT1AR	Best Workplaces; LD Gas Trucks 1 & 2; Rural Minor Arterial
5	<input type="checkbox"/>	BWCOLGT2CR	Best Workplaces; LD Gas Trucks 1 & 2; Rural Minor Collector
6	<input type="checkbox"/>	BWCOLGT1PR	Best Workplaces; LD Gas Trucks 1 & 2; Rural Other Principal Arterial
7	<input type="checkbox"/>	BWCOLGT1CU	Best Workplaces; LD Gas Trucks 1 & 2; Urban Collector
8	<input type="checkbox"/>	BWCOLGT1IU	Best Workplaces; LD Gas Trucks 1 & 2; Urban Interstate
9	<input type="checkbox"/>	BWCOLGT1LU	Best Workplaces; LD Gas Trucks 1 & 2; Urban Local
10	<input type="checkbox"/>	BWCOLGT1AU	Best Workplaces; LD Gas Trucks 1 & 2; Urban Minor Arterial
11	<input type="checkbox"/>	BWCOLGT1FU	Best Workplaces; LD Gas Trucks 1 & 2; Urban Other Expressways
12	<input type="checkbox"/>	BWCOLGT1PU	Best Workplaces; LD Gas Trucks 1 & 2; Urban Other Principal Arterial
13	<input type="checkbox"/>	BWCOLGT2IR	Best Workplaces; LD Gas Trucks 3 & 4; Rural Interstate
14	<input type="checkbox"/>	BWCOLGT2LR	Best Workplaces; LD Gas Trucks 3 & 4; Rural Local
15	<input type="checkbox"/>	BWCOLGT2MR	Best Workplaces; LD Gas Trucks 3 & 4; Rural Major Collector

- Now, you will use a filter to limit the list of measures.. For this strategy you are interested in measures that have name that start with “ONRetrofit”. In order to filter the


measures, **click on the filter**  **button**. This will open the *Filter Rows Window*.



- Click the “Add Criteria” button, to add one criterion to the table. Set the “Column Name” field to name and enter “ONRetrofit” in the Value field. :
- To filter the measure list **click the “OK” button** on the *Filter Rows Window*. If you scroll through the list of measures, you will only see measures with names as specified in the filter. *Note: this filter must be done from the Select Control Measures window, not straight from the filter icon on the Measures tab.*
- Next, to select these measures so you can add them to your strategy. **Click the “Select All Rows”**  **button**. This will check all the checkboxes.
- Click the “OK” button so the measures will be associated with your strategy.
- Click the Save button** to save the measure specification to the strategy. Next, you will move onto running the strategy and viewing the outputs of the strategy.

### B.3. Run control strategy and examine results

- To run the strategy, **click the “Run” button** at the bottom of the *Edit Control Strategy Window*. The strategy run will take a few minutes to be completed. To see the status of the strategy run, view the *Status Window*. You may click the **Refresh** button on this window if you want more frequent updates.

Status		
Last Update : 2007/05/06 22:59  Refresh		
Message Type	Message	Timestamp
Strategy	Completed running control strategy: Statewide Local Controls	2007/05/06 22:59
RunQASStep	Completed running QA step 'Summarize by County and Pollutant' for Version 'Initial Version' of Dataset 'Strategy_Statewide_Local_Controls_05062007_225920'	2007/05/06 22:59
RunQASStep	Started running QA step 'Summarize by County and Pollutant' for Version 'Initial Version' of Dataset 'Strategy_Statewide_Local_Controls_05062007_225920'	2007/05/06 22:59
RunQASStep	Completed running QA step 'Summarize by SCC and Pollutant' for Version 'Initial Version' of Dataset 'Strategy_Statewide_Local_Controls_05062007_225920'	2007/05/06 22:59
RunQASStep	Started running QA step 'Summarize by SCC and Pollutant' for Version 'Initial Version' of Dataset 'Strategy_Statewide_Local_Controls_05062007_225920'	2007/05/06 22:59
RunQASStep	Completed running QA step 'Summarize by Pollutant' for Version 'Initial Version' of Dataset 'Strategy_Statewide_Local_Controls_05062007_225920'	2007/05/06 22:59
RunQASStep	Started running QA step 'Summarize by Pollutant' for Version 'Initial Version' of Dataset 'Strategy_Statewide_Local_Controls_05062007_225920'	2007/05/06 22:59
Strategy	Started running control strategy: Statewide Local Controls	2007/05/06 22:59
CMExport	Export control measures finished	2007/05/06

2. Once the *Status Window* show the strategy run has completed, **click the “Refresh” button at the bottom of the *Edit Control Strategy Window***, to get the results for the strategy. To see the results go click on the *Summary Tab* and look at the Results section. This section will contain the following information:
  - a. Total Annualized Cost: The total cost of controlling the sources using the selected control measures.
  - b. Target Poll. Reduction: The target pollutant emission reduction (in tons). Note – this does not include pollutants that cobenefited from the strategy (i.e., if the measure also treats VOC, this total will not show that tonnage).

Edit Control Strategy: Statewide Local Controls

Summary
Inventory
Measures
Constraints
Outputs

Name: Statewide Local Controls

Description:

Project:

Creator: EMF User

Last Modified Date: 05/10/2007 15:25

Copied From:

Type of Analysis: Max Emissions Reduction

Parameters

Cost Year: 2000

Inventory Year: 2020

Region: NC, SC, VA

Target Pollutant: NOX

Results

Start Date: 05/10/2007 15:28:20 by EMF User

Completion Date: 05/10/2007 15:28:37

Total Annualized Cost: 5.546E7

Target Poll. Reduction: 1.71E4

Save
Copy
Close
Run
Refresh
Stop

- Next, **click on the Outputs tab** to examine the outputs from the strategy run. First, look at the Detailed Strategy Result. *The Detailed Strategy Result is a table that contains sources paired with control measures and the associated cost and emissions reduction that result from applying the specified measure to that source.* Later in the training, you will also create the controlled inventory from the strategy. This will be visible in the table once the controlled inventory has been created.

**Edit Control Strategy: Statewide Local Controls**

Summary Inventory Measures Constraints **Outputs**

**Results**

Export Folder: /home/training/emf\_training/costs Browse

Select	Input Dataset	Output Dataset	Product
<input type="checkbox"/>	NC_SC_VA_2020_National_...	Strategy_Statewide_Local_C...	Detailed Strategy Result

Export Analyze View

**Outputs**

☒ Controlled Inventory ☐ Custom Summaries

Create

Save Copy Close Run Refresh Stop

- To view the detailed result output of the strategy, **check the Select checkbox for the Detailed Strategy Result output and then click the “View” button.** This will open the *Dataset Properties View Window*.

**Dataset Properties View: Strategy\_Statewide\_Local\_Controls\_04302007\_005922**

Summary Data Keywords Notes Revisions Logs Tables QA

Name: Strategy\_Statewide\_Local\_Controls\_04302007\_005922

Description:
 

#Control strategy detailed result

#Implements control strategy: Statewide Local Controls

#Input dataset used:

NC\_SC\_VA\_2020\_National\_Controls\_w\_NLEV\_Crxns\_OnRoad.txt

Project:

Creator: emf

Dataset Type: Control Strategy Detailed Result

Time Period Start:	Status:	Created by control strategy
Time Period End:	Last Modified Date:	2007/04/30 00:59
Temporal Resolution:	Last Accessed Date:	2007/04/30 00:59
Sector:	Creation Date:	2007/04/30 00:59
Region:	Intended Use:	
Country:	Default Version:	0

Edit Properties Edit Data Close

5. From the *Dataset Properties View Window*, click the **Data Tab**. Click on the “**View**” button to view the Detail Strategy Result table in the *Data Viewer Window*.

**Data Viewer [Dataset:Strategy\_Statewide\_Local\_Controls, Version: Initial Version, Table: CSDR\_Statewide\_Local\_Controls]**

Sort Order:  **Apply** Current: 1 - 300 Filtered: 12299 of 12299

Row Filter:

DISABLE Boolean	CM_ABBREV String(10)	POLL String(20)	SCC String(10)	FIPS String(6)	PLANTID String(15)	POINTID String(15)	STACKID String(15)	SEGMENT String(15)	ANNUAL_COST Double	ANN_COST_PER_TON Double
<input type="checkbox"/>	ONRTMHDVIR	NOX	2230073110	37021					12440.0	10210.0
<input type="checkbox"/>	ONRTMHDVIR	VOC	2230073110	37021					0.0	0.0
<input type="checkbox"/>	ONRTMHDVIR	PM2_5	2230073110	37021					0.0	0.0
<input type="checkbox"/>	ONRTMHDVIR	NOX	2230073110	37023					35490.0	10210.0
<input type="checkbox"/>	ONRTMHDVIR	VOC	2230073110	37023					0.0	0.0
<input type="checkbox"/>	ONRTMHDVIR	PM2_5	2230073110	37023					0.0	0.0
<input type="checkbox"/>	ONRTMHDVIR	NOX	2230073110	37025					96.04	10210.0
<input type="checkbox"/>	ONRTMHDVIR	VOC	2230073110	37025					0.0	0.0
<input type="checkbox"/>	ONRTMHDVIR	PM2_5	2230073110	37025					0.0	0.0
<input type="checkbox"/>	ONRTMHDVIR	NOX	2230073110	37035					14790.0	10210.0
<input type="checkbox"/>	ONRTMHDVIR	VOC	2230073110	37035					0.0	0.0
<input type="checkbox"/>	ONRTMHDVIR	PM2_5	2230073110	37035					0.0	0.0
<input type="checkbox"/>	ONRTMHDVIR	NOX	2230073110	37045					17720.0	10210.0
<input type="checkbox"/>	ONRTMHDVIR	VOC	2230073110	37045					0.0	0.0
<input type="checkbox"/>	ONRTMHDVIR	PM2_5	2230073110	37045					0.0	0.0

**Add Note** **Close**

6. **Review the data in the *Data Viewer Window*.** Scroll to the left of the table and look at the information available. Also, it's possible to page through the table by clicking the buttons illustrated below.

Current: 1 - 300 Filtered: 8200 of 8200

The data in this table is given for each source (i.e., SCC and FIPS) and Pollutant. Take a notice of the following columns:

- CM\_Abbrev:** This is the control measure abbreviation for the measure that was used to treat the source.
- Annual\_Cost:** The annual cost of applying the measure.
- Ann\_Cost\_Per\_Ton:** The annual cost per ton of applying the measure.
- Control\_Eff:** The control efficiency that was applied to the source based on the measure efficiency records.
- Final\_Emissions:** The final emissions of the pollutant for the source, in tons, after applying the measure.
- Emis\_Reduction:** The emission reduction of the pollutant for the source, in tons.
- Inv\_Emissions:** The original amount of pollutant emitted prior to applying the measure via the strategy, in tons.



Note – If the input inventory was a point inventory; then the additional columns Plant Id, Point Id, Stack Id, and Segment would be filled in for each source.

Note – **The target pollutant for this strategy was NOX, but VOC and PM2\_5 also show up in the table.** Many of the measures applied in this strategy had cobenefits for VOC and PM2.5. Any additional pollutants in the inventory which the measures also control will appear in the detailed strategy result table.

7. Look at some additional information that was created as outputs from the control strategy run. First, **click the “Close” button** or click the minimize button on the *Data Viewer Window* to close or minimize the *Data Viewer Window*. Next, **click on the QA Tab.**

#	Select	Version	Name	Required	Order	Status	When
1	<input type="checkbox"/>	0	Summarize by County and Pollutant	<input type="checkbox"/>	1.0	Generated	2007/04/30 01:00
2	<input type="checkbox"/>	0	Summarize by Pollutant	<input type="checkbox"/>	1.0	Generated	2007/04/30 01:00
3	<input type="checkbox"/>	0	Summarize by SCC and Pollutant	<input type="checkbox"/>	1.0	Generated	2007/04/30 01:00
4	<input type="checkbox"/>	0	Summarize by US State and Pollutant	<input type="checkbox"/>	1.0	Generated	2007/04/30 01:00

4 rows : 12 columns[ Filter: Empty, Sort: Empty ]

View

Edit Properties Edit Data Close

The *QA Tab* contains additional tables that were created from the Detailed Strategy Result. Let’s review the “Summarize by US State and Pollutant” QA step.

8. **Select the “Summarize by US State and Pollutant” QA step** by checking the checkbox and then **click on the “View” button**. This will bring up the *View QA Step Window*. From this window you can export the table to a file (in a CSV format).

View QA Step: Summarize by US State and Pollutant – Strategy\_Statewide\_Local\_Contr...

Name: Summarize by US State and Pollutant

Version: Initial Version (0) Program: SQL

Arguments: select fips.state\_name, fips.state\_abbr, fips.fipsst, inv.POLL, avg(inv.Ann\_Cost\_per\_Ton) as avg\_cost\_per\_ton, sum(inv.Annual\_Cost) as Annual\_Cost, sum(inv.Final\_emissions) as Final\_emissions,

Order: 1.0 Required? ☐

Description:

QA Status: Generated Output Name: /\_US\_State\_and\_Pollutant\_DSID752\_V0

User: emf Run Status: Success

QA Date: 2007/05/11 15:39 Run Date: 05/11/2007 15:39

Current Output? ☒

Configuration:

Comments:

Folder: /home/training/emf\_training/2002/smoke Browse

Close View Results Export

9. The results cannot be viewed until they are exported. **Click the “Export” button** to export the report. Use the “Browse” button to select the export folder: /home/training/emf\_training/2002/smoke/cost. Check the *Status Window*, to see when the report has finished exporting.

Make a note of the “Output Name:” in the space provided below. This field is used by the system to name the new export file.

Output Name = \_\_\_\_\_

10. Now, to view the results of the QA step, click the **View Results** button. Note that a summary of the results is shown for each state and pollutant in a table that can sort, filter, and even make plots and compute statistics.
11. If you would like to see the exported table on the file system, **go to the desktop and double-click the training’s home icon. Then navigate to the /home/training/emf\_training/2002/smoke/cost directory.** The exported file will be named using the pattern: “Output Name\_” + Date (i.e., 14May2007). **Double click on the file** if you want to view it in a text editor. The first row in the file contains column headers and the subsequent rows contain the aggregated information. Note – the rows are aggregated on state name, state abbreviation, and pollutant.
12. There are other QA Steps / reports that could be used to summarize the detailed strategy results which are not created by default during the strategy run. To see these steps, do the

following: **Click the Edit Properties button** at the bottom of the Dataset Properties view window. Then **Go to the QA tab and click Add from Template**. Any additional steps that are available will appear in the list. In this case, you should see the following additional steps that are available as predefined QA step templates:

- a. Summarize by Control Measure and Pollutant
- b. Summarize by Source Group and Pollutant
- c. Summarize by Control Technology and Pollutant

#### B.4. Create a controlled inventory

1. To create the controlled inventory, go back to the *Edit Control Strategy Window* and **click the Outputs Tab** at the top of the *Edit Control Strategy Window*. Next, **click on the “Create” button** in the Outputs section (make sure the Controlled Inventory checkbox is checked). The creation of the controlled inventory will take a few minutes. To see the status of the creation of the controlled inventory, view the *Status Window*.

**Edit Control Strategy: Statewide Local Controls**

Summary Inventory Measures Constraints **Outputs**

**Results**

Export Folder: /home/training/emf\_training/costs Browse

Select	Input Dataset	Output Dataset	Product
<input checked="" type="checkbox"/>	NC_SC_VA_2020_National_...	Strategy_Statewide_Local_C...	Detailed Strategy Result

Export Analyze View

**Outputs**

☒ Controlled Inventory ☐ Custom Summaries

Create

Save Copy Close Run Refresh Stop

2. Once the *Status Window* shows the controlled inventory has been created, **click the “Refresh” button** at the bottom of the *Edit Control Strategy Window*, to get the controlled inventory to show up in the *Outputs Tab*

**Edit Control Strategy: Statewide Local Controls**

Summary Inventory Measures Constraints **Outputs**

**Results**

Export Folder:

Select	Input Dataset	Output Dataset	Product
<input type="checkbox"/>	NC_SC_VA_2020_National...	Strategy_Statewide_Local_C...	Detailed Strategy Result
<input type="checkbox"/>	NC_SC_VA_2020_National...	ControlledInventory_Statewid...	Controlled Inventory

**Outputs**

☒ Controlled Inventory ☐ Custom Summaries

## B.5. Examine the controlled inventory

1. Click the checkbox for the **Controlled Inventory** and then click on the **“View”** button. This will bring up the *Dataset Properties View Window* for the controlled inventory. From the Dataset Properties View Window, click the Data Tab. Now, click on the **“View”** button to view the Controlled Inventory in the *Data Viewer Window*.

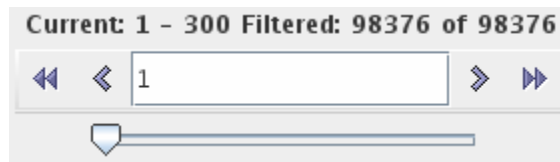
**Data Viewer [Dataset:ControlledInventory\_Statewide\_Local\_Controls\_05112007\_160331, Versio...**

Sort Order   Current: 1 - 300 Filtered: 98376 of 98376

Row Filter

FIPS String(6)	SCC String(10)	POLL String(16)	ANN_EMIS Double	AVD Do
37001	2201001150	V0C	13.47	
37001	2201001170	V0C	21.65	
37001	2201001190	V0C	8.68	
37001	2201001210	V0C	10.13	
37001	2201001230	V0C	95.65	
37001	2201001270	V0C	19.53	
37001	2201001290	V0C	53.24	
37001	2201001310	V0C	29.42	
37001	2201001330	V0C	101.35	

2. **Review the data in the Data Viewer Window.** Scroll to the left of the table and look at the information available. You can page through the table to see additional records by clicking the on the relevant button as illustrated below.



Here is a brief description of the columns in the controlled inventory:

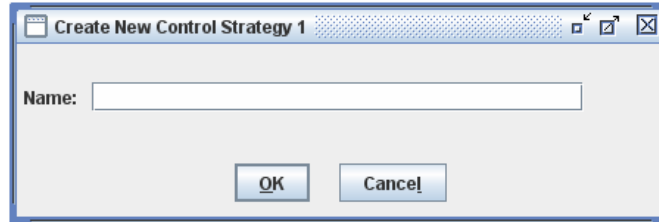
- a. FIPS: A five digit FIPS county code.
- b. SCC: The source classification code (SCC).
- c. POLL: The pollutant.
- d. ANN\_EMIS: The pollutant annual emissions, in tons.
- e. CEFF: The control efficiency (%) of the measure that treated the pollutant.
- f. REFF: The rule effectiveness (%) of the measure that treated the pollutant.
- g. RPEN: The control efficiency (%) of the measure that treated the pollutant.

**Note that the controlled sources have their annual emissions (ANN\_EMIS) reduced from the original inventory values, and the CEFF, REFF, and RPEN fields filled in based on the control efficiency, rule effectiveness and rule penetration from the control measure efficiency record that was applied.** If the source was not controlled by a measure in the strategy, then the annual emissions will be unchanged from the value in the starting inventory.

3. **Advanced Exercise:** Compare the controlled inventory to the input inventory for the strategy. You will be able to see how Ann\_Emis has been reduced for sources that had a matching measure. Here a few tips on how this can done:
  - a. Click on the Manage → Datasets menu item to open the Dataset Manager. Next, show only the “ORL Onroad Inventory (MBINV)” datasets. Then choose the input emission inventory and **click the “View” button.**
  - b. To help limit the number of rows, try using a “Row Filter” (e.g., FIPS = ‘37001’ AND SCC = ‘2230073150’). Use this filter in both the Data Viewer Window for the input inventory and the controlled inventory. Notice how both NOX and VOC have been reduced, but not the other pollutants.

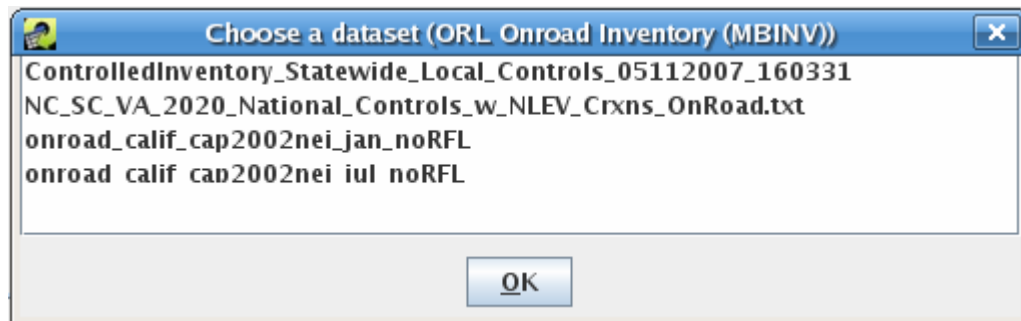
## **B.6. Create a new control strategy using the controlled inventory from the first strategy (and limit to certain counties)**

1. **Click the “New” button** on the *Control Strategy Manager Window*. Type **“Limited Area Local Controls”** in the control strategy **“Name:”** field and **click the “OK” button** to create the control strategy.

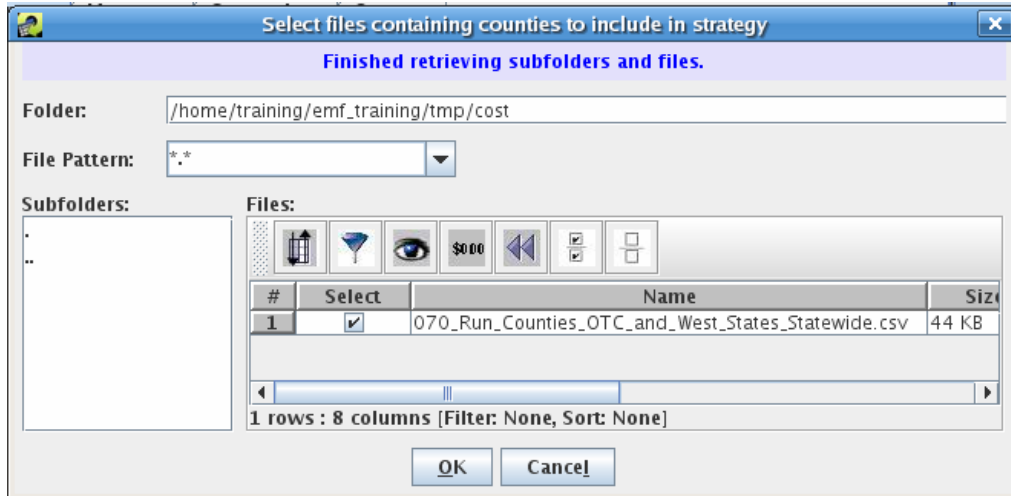


2. Next edit the strategy and set the following fields on the *Summary Tab* in the same way they were filled in for the first strategy:
  - a. Type of Analysis = Max Emissions Reduction
  - b. Cost Year = 2000
  - c. Inventory Year = 2020
  - d. Region = NC, SC, VA
  - e. Target Pollutant = NOX
3. Now, assign the controlled inventory from the previous control strategy to this strategy. **Click on the *Inventory Tab*** and choose the “ORL Onroad Inventory (MBINV)” inventory type. Then **click the “Choose” button** and select the controlled inventory.

**Note – Your controlled inventory will be named differently than the one shown below, because the controlled inventory names are made unique by appending a date (mmddyyyy) and timestamp (hhmmss) to end of the strategy name.**



4. For the next step you are going to associate a list of county codes that will limit the sources by county. So during this strategy run, only the counties specified in the file will be evaluated. To specify the file, **Click on the County File “Browse” button** to bring up the File Chooser Window. **Select the 070\_Run\_Counties\_OTC\_and\_West\_States\_Statewide.csv** file from the /home/training/emf\_training/tmp/costs directory. This file is a CSV formatted file that has a list of 5 digit FIPS county codes.



9. Next, choose the control measures that should be used for the strategy. **Click on the *Measures Tab***, so you can assign measures for this strategy. **Click on the “Add” button** under the “Measures to Include:” section. For this strategy you are interested in measures that have a **name that start with “Eliminate”**. Filter out these measures and add these to the strategy.
10. Now, **save and run the strategy**. Once the strategy run has completed (based on information in the *Status Window*), **click Refresh and then go to the *Summary tab* to review the results**.

Results	
Start Date:	05/10/2007 15:56:06 by EMF User
Completion Date:	05/10/2007 15:56:44
Total Annualized Cost:	0E0
Target Poll. Reduction:	5.053E2

## B.7. Create a copy of the previous strategy and constrain by cost

1. Go to the *Control Strategy Manager Window* and **select the *Limited Area Local Controls* strategy and click the “Copy” button**. This will create a copy of the last strategy created, with a name of “Copy of Limited Area Local Controls”. Open the copied strategy so you can change the name and add the treatment cost constraint. Change the name to **“Limited Area Local Controls (Constraints)”**.

2. Click on the **Constraints Tab** to add two constraints to the strategy.

Edit Control Strategy: Copy of Limited Area Local Controls ^

Summary Inventory Measures **Constraints** Outputs

Constraints for Target Pollutant:

Minimum Emissions Reduction (tons)

Minimum Control Efficiency (%)

Maximum 1999 Cost per Ton (\$/ton)

Maximum 1999 Annualized Cost (\$/yr)

Save Copy Close Run Refresh Stop

Here is a brief description of the fields on the *Constraints Tab*:

- a. Minimum Emissions Reduction (tons): The control measure must be able to reduce the target pollutant by this minimum tonnage for a particular source.
- b. Minimum Control Efficiency (%): The control measure must have a control efficiency greater than the specified control efficiency for a particular source and target pollutant.
- c. Maximum 1999 Cost per Ton (\$/ton): The control measure must have a cost per ton less than specified maximum cost per ton for a particular source and target pollutant. This cost is based on 1999 dollars.
- d. Maximum 1999 Annualized Cost (\$/yr): The control measure must have an annual treatment cost less than the specified annualized cost for a particular source and target pollutant. This cost is based on 1999 dollars.

For this strategy, **set two constraints**:

- a. **Minimum Emissions Reduction** = 1 ton (**type in 1**).
- b. **Maximum 1999 Annualized Cost** = \$5,000 (**type in 5000**).

These two constraints will make sure the strategy does not use any measures that cost more than \$5,000 for the target pollutant. Also, the strategy will not use any measures that do not reduce the target pollutant for at source by 1 ton. The constraints will lower the total cost and tonnage reduction from the previous strategy you ran. In the next section, you will learn how to view the cost and reduction summary information in the *Control Strategy Manager*.



- Now, **save and run the strategy**. Next, review the results once the strategy run has completed (monitor the *Status Window*). Remember to **refresh** the strategy once the run has completed so you can see the results on the *Summary Tab*.

Results	
Start Date:	05/10/2007 16:06:13 by EMF User
Completion Date:	05/10/2007 16:06:51
Total Annualized Cost:	0E0
Target Poll. Reduction:	1.604E2

## B.8. Compare strategies via the Control Strategy Manager

- Now that you have run several strategies, let's **revisit some of the columns in Control Strategy Manager Window**. This window gives a central location for viewing the summary results of the strategy. The **Total Cost and Reduction columns** show the cost of the strategy, and how much the target pollutant was reduced. Remember that the table can be sorted and filtered, which could help display only information that is relevant for your analysis (e.g., filter on strategies that have a target pollutant of NOX), or to order by the last modified date. Notice that the Total cost of the second two strategies was actually zero due to the nature of the measures that were applied. Also, the Limited Area strategy with constraints had a smaller emissions reduction than the one without them (as would be expected). Finally, the vast majority of the reductions were achieved in the first Statewide Local Controls strategy

#	Select	Name	Last Modified	Region	Target Pollutant	Total Cost	Reduction
1	<input type="checkbox"/>	Limited Area Local Controls	2007/05/11 16:10	NC, SC, VA	NOX	0.00	505.33
2	<input type="checkbox"/>	Limited Area Local Controls (Constraints)	2007/05/11 16:12	NC, SC, VA	NOX	0.00	160.35
3	<input type="checkbox"/>	Statewide Local Controls	2007/05/11 15:58	NC, SC, VA	NOX	55459900.00	17103.60

3 rows : 17 columns [Filter: None, Sort: Total Cost(+)]

Buttons: View, Edit, New, Remove, Copy, Close

## B.9. Advanced Exercise – Create a similar strategy with a different target pollutant

- Go to the *Control Strategy Manager Window* and select the last strategy created and **click the “Copy” button**. Open the copied strategy so you can change the target pollutant. **Change the “Target Pollutant:” to “VOC”** or to some other target pollutant. **Edit the “Name”** and change it to **“Limited Area VOC (Constraints)”**.

2. **Save and run the strategy.** Compare these results to other strategies. You can also see how different sources were affected by choosing a different target pollutant.
3. If you wish to play around with strategies further, try adding an Inventory filter based on some of the fields in the ORL Onroad Mobile Inventory dataset to one of your strategies and see how that influences the results.

### C. EMF Quality Assurance Manager – Advanced Training

In this section, you will learn how to use the EMF QA Manager to take a systematic approach to data quality assurance. Specifically, you will review and learn about the following:

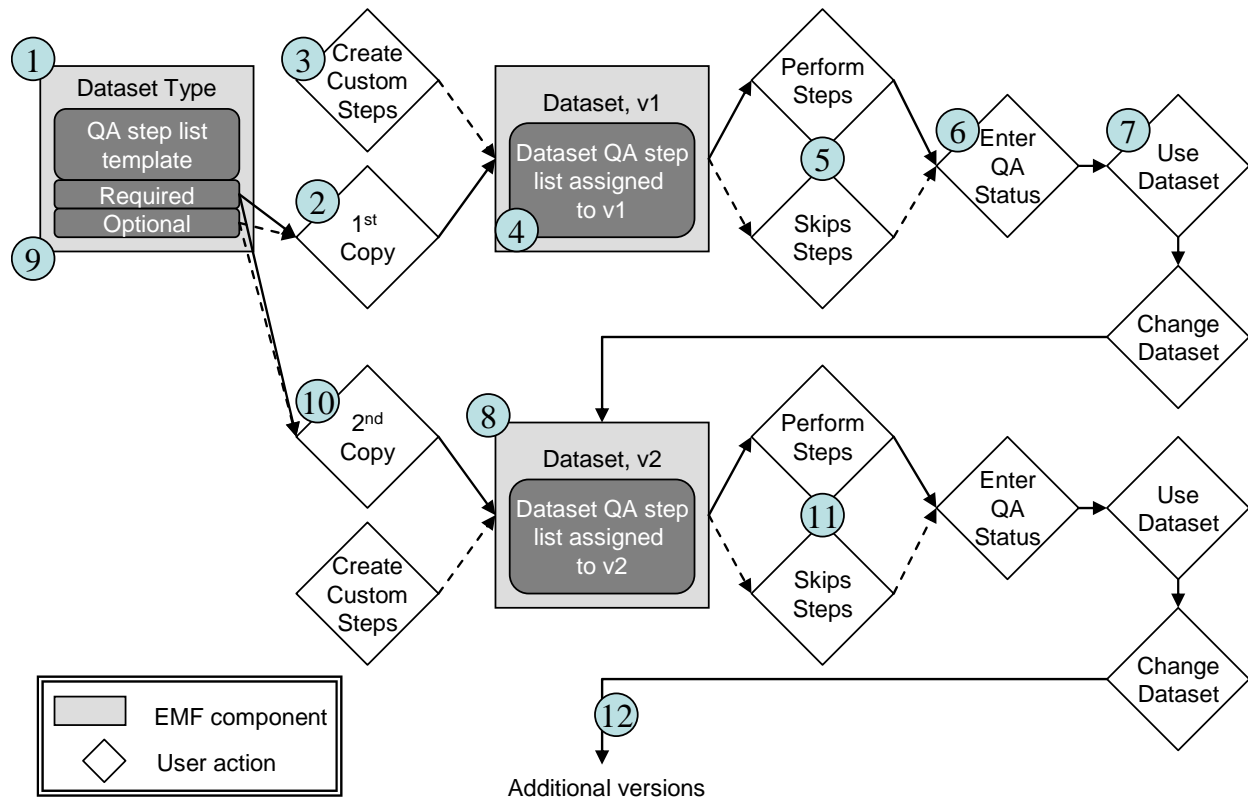
- The steps you will need to take while using the EMF quality assurance
- Adding QA steps to a dataset
- How to perform a QA step and record the results
- Creating a QA template
- Updating your QA steps from a revised template

#### C.1. EMF quality assurance overview

The EMF Quality Assurance Manager is an integral part of the Data Manager, which codifies an approach for quality assuring inputs and outputs of emissions modeling steps. The EMF supports a certain “way of doing things”, but allows users to enter and perform any QA steps on data that they believe is needed to do emissions modeling.

The diagram in Figure 1 below (as seen in the Introduction) explains how to use the EMF to perform and document data QA. The dashed lines represent optional linkages, which depend on choices made by users. The step numbers shown in the figure correspond to the numbers in the Introduction’s QA overview.

**Figure 1:** EMF approach to performing quality assurance of data



## **C.2. Adding QA steps to a dataset**

There are two ways to add QA steps to a dataset (1) from a template and (2) as a custom step just to that dataset. In the Introduction, we discussed adding from a template. In this Advanced training, you will learn about custom QA steps.

Unlike the Dataset Manager, there is no separate “main window” for the QA Manager. Instead, use the “QA” Tab on the Dataset Properties for quality assurance of a given dataset.

### **Adding a custom QA step**

A custom QA step is simply one added to an individual dataset instead of a Dataset Type (where the templates reside). A custom QA step cannot be shared with other datasets. The following steps will allow you to add a custom QA step.

1. **Open the *Dataset Manager* Window**
2. Use the pull-down at the top of the *Dataset Manager* to **select Dataset Type of “ORL Onroad Inventory (MBINV)”**.
3. **Click the appropriate checkbox at left to select the Dataset named “NC\_SC\_VA\_2020\_National\_Controls\_w\_NLEV\_Crxns\_OnRoad.txt”**
4. **Click the “Edit Properties” button.** You will see the Dataset Properties Edit Window
5. **Select the “QA” Tab.** You will see that the tab has a table header, and you will also see the QA steps added from template during the Introductory class.

6. From the QA Tab, click the “Add Custom” button. You will see this dialog window:

**Add Custom QA Step: onroad\_calif\_cap2002nei\_jul\_noRFL**

**Name:** Enter the name of your QA step

**Program:** Select the program or “Manual”

**Arguments:** Enter the program arguments (e.g., the SQL query statement)

**Order:** 0 ← Optional order to perform step (e.g., 3.1)

**Required?** ☐

**Description:** Explain the details of how to do the step and its purpose

**Version:** Initial Version (0) ← Select the version of the dataset to which the QA step applies

**OK** **Cancel**

7. Use the information in the box above to help you enter a custom QA step. Fill in the custom step with the following information:
- **Name:** “Compare pollutant list to expected list”
  - **Program:** “Manual”
  - **Arguments:** Leave blank
  - **Order:** 2.0
  - **Required:** Leave blank
  - **Description:** Compare the pollutants from the list generated in step order 1 to the list of expected pollutants. If all pollutants have emissions, then certify that the step is complete.
  - **Version:**
8. Click “OK”. You will now see your new QA step listed on the QA Tab table.

### C.3. How to perform a QA step and record the results

In this section, you will run some of the QA steps and document what happened. First, you will run the “Summarize by Pollutant with Descriptions” step and export the results. To do this, take the following steps:

1. In the QA Tab, open the “Summarize by Pollutant with Descriptions” step by **clicking on the checkbox to the left of the step and click the “Edit” button**. You will see the *Edit QA Step Window*.

The top part of the window has the details about running/performing the step. This is the same as the information you could enter in the manual QA step dialog, just completed.

**Edit QA Step: Summarize by Pollutant with Description - NC\_SC\_VA\_2020\_National...**

Name: Summarize by Pollutant with Description

Version: Initial Version (0) Program: SQL

Arguments: `select POLL, p.pollutant_code_desc, sum(ann_emis) as ann_emis  
from $TABLE[1], reference.pollutant_codes p where POLL=p.pollutant_code  
group by POLL, p.pollutant_code_desc order by POLL`

Order: 0.0 Required? ☒

Description:

The bottom part of the window has status information and will look like the following picture before a step has been run.

QA Status: Not Started

QA User:

QA Date:

Configuration:

Comments:

Export Folder: /home/training/emf\_training/2002/smoke **Browse**

**Save** **Close** **Run** **View Results** **Export**

2. A few notes about running QA steps with SQL instructions
  - a. Note the syntax of the query in the “Arguments” box of the *Edit QA step Window*. The \$TABLE[1] syntax allows this step to be generic. The \$TABLE[1] string is interpreted by the EMF as the first table in the dataset, which in most cases is the full dataset.
  - b. Other tables can be referenced in these queries, such as the “reference.pollutant\_codes” table in this example.
3. To run the step, **click the “Run” button.**
  - a. The *Status Window* tells you whether the query run has completed. **Check the status window and click its “Refresh” button.**
  - b. Currently in the EMF, you need to close and reopen the QA step to let the EMF update the QA status.
4. **Click the “Save” button and then reopen the step from the QA Tab using the “Edit” button.**
5. Export the results of the QA step by doing the following:
  - a. **Set the Export Folder by clicking the “Browse” button at bottom right and select the directory /home/training/emf\_training/2002/smoke/export**
  - b. **Click the “Export” Button**
6. **Using the “QA Status” pull down list, select “Complete”.** Notice how the QA User and QA Date have been set.
7. **Close the *Edit QA Step Window* by clicking the “Save” button.**
8. Using your computer’s file browser, confirm that they exported dataset has been written to your computer’s disk.

### **Exercise 5**

Perform the “custom” QA step that you added by manually comparing the results of the step with the data file provided: /home/training/emf\_training/tmp/qa\_list\_of\_pollutants.txt. On the QA step, document what you have found and set the QA status accordingly.

## C.4. Creating a QA template

In part C.2 above, you copied QA steps from a template. But, someone has to add the QA steps there in the first place. In this section, you will learn how to add steps to a QA template.

The QA template is stored with the Dataset Type, which therefore needs to be edited to add QA steps. Currently the EMF allows any users to edit Dataset Types, but future versions will allow only “authorized” users to do so.

Now you will edit the “ORL Onroad Inventory” dataset type and add a required QA step. To edit a Dataset Type, use the *Dataset Type Manager Window* as follows:

1. On the Main Menu, **click the Manage → Dataset Types menu option**. You will next see the *Dataset Type Manager Window* appear.
2. **Scroll through the table to find the “ORL Onroad Inventory” Dataset Type, and select it using the checkbox at left.**
3. With the Dataset Type selected, **click the “Edit” button**. You will see the *Edit Dataset Type Window*. This window has three sections, and the bottom section contains the QA Step Template.
4. To Add a step, **click the “Add” button at the bottom left of the *Edit Dataset Type Window***. You will see a *New QA Step Template Window*.
5. Add whatever QA step you like. If you know SQL, practice writing an SQL query that uses the \$TABLE[1] syntax to reference the data table of the dataset.

OR, if you are having trouble thinking of a QA step to add, try the following:

**Name:** Ensure all counties included

**Program:** Manual

**Arguments:** n/a

**Order:** 4.0

**Required:** Make this step required

**Description:** Compare the county list from the “Summarize by County and Pollutant” table to the master list of counties for the states in the inventory file.

6. **Click the “OK” button on the *New QA Step Template Window***
7. **Click the “Save” button on the *Edit Dataset Type Window*** to save and close that window.



## C.5. Updating your QA steps from a revised template

Suppose you want to apply your new QA step to your actual onroad-mobile dataset. In this section, we will return to your onroad mobile dataset and add your new QA step. Here are a few important notes about modifying the QA step list on a dataset, once QA steps have already been done.

- If you try to reapply a QA step template to a dataset version that already has QA steps, you'll only be permitted to add steps that have different names from the ones that are there already. None of the required or optional steps that you've added before can be added again. This helps prevent recopying of steps.
- However, if you rename a QA step in the QA step templates (but don't otherwise change it), the EMF won't know that the QA step is the same, and it will add it to your dataset.
- If you want to apply QA steps to a new version of a dataset, you'll be permitted to add all of the steps in the template.

Now you will add the new step from the template:

1. Return to the *Dataset Manager* and **Edit Properties** of the ORL onroad file "NC\_SC\_VA\_2020\_National\_Controls\_w\_NLEV\_Crxns\_OnRoad.txt"
2. **Go to the QA Tab and click the "Add from template" button.** You will see the *Add QA Steps Window*.
3. Select **ALL** of the "optional" steps, and click the "OK" button.



**Question:** Why did only one step get added? \_\_\_\_\_

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**Question:** True or False? When a QA step is "Required", it means you have to complete the step or the EMF will not allow you to use your dataset. \_\_\_\_\_