Coal Power Plant Database User's Manual

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2005 data

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Introduction

The National Energy Technology Laboratory (NETL) Coal Power Plant Database (CPPDB) consolidates large quantities of information on coal-fired power plants in a single location. The database contains 191 fields and provides information on over 1,700 boilers and associated units. The database supports Fossil Energy (FE) and NETL project management and analysis studies and is available in both the Excel and Access formats.

The consolidated version of the CPPDB is a single Excel spreadsheet containing the collected information. This update of the CPPDB has been upgraded to include pivot table and Access versions. The pivot table and Access versions of the database provide the user with methods of viewing and searching the data that were unavailable in previous versions. The specifics of the three versions are discussed in later sections of the user manual.

This user manual has been created in an effort to help a CPPDB user to understand the functions of the database as well as help improve the usefulness of the database. In an attempt to better inform CPPDB users of the information maintained in the database and its usefulness there is a section that briefly describes the data and all calculations in the database. The manual also contains a section on each of the various versions of the database and how the data was formatted to fit each version. Lastly, the manual contains a brief introduction to the creation and use of pivot tables.

Data and Data Sources

The NETL CPPDB contains emissions, generation, location, and firing information for all coal power plants in the United States. The information is based off of the most recent release of the Annual Steam-Electric Plant Operation and Design data form, Energy Information Agency (EIA) form 767, available at the time of the update. The most current data available at the time of the update is from 2005. All information collected from resources other than EIA 767 was collected for the corresponding year.

EIA Form 767:

The main resource, EIA form 767, can be found on the EIA website as a collection of Microsoft Excel files. The downloadable file is a steam-electric plant data file that includes annual data from organic-fueled or combustible renewable steam-electric plants with a generator nameplate rating of 10 or more megawatts regardless of current ownership and/or operation. The data are derived from the Form EIA-767 "Steam-Electric Plant Operation and Design Report." The file contains data on plant operations and equipment design (including boilers, generators, cooling systems, flue gas desulphurization, flue gas particulate collectors, and stacks). Beginning in the data year 2001, nuclear plants data are no longer collected by the survey. [1]

EIA Form 423:

The resource used to collect information on the coal state origin was gathered from the EIA form 423. This form is a collection of monthly deliveries of fossil fuels to generating facilities. Included are the specific energy sources, quantity of fuel delivered, the Btu content, sulfur content, ash content, as well as coal state of origin. The fuel cost data collected on the survey is not made available to the public due to it being classified as confidential. Records containing all zeros or blanks in the quantity field indicate a non-respondent to the survey.[2]

National Emissions Inventory:

The Environmental Protection Agency's (EPA) National Emissions Inventory (NEI) was used to collect information on the particulate emissions of the power plants. EPA's NEI is a national database of air emissions information with input from numerous state and local air agencies, from tribes, and from industry. This database contains information on stationary and mobile sources that emit criteria air pollutants and their precursors, as well as hazardous air pollutants (HAPs). The database includes estimates of annual emissions,

[1] Description collected from the EIA website (*http://www.eia.doe.gov/cneaf/electricity/page/eia767.html*)
[2] Description collected from the EIA website (*http://www.eia.doe.gov/cneaf/electricity/page/eia423.html*)

by source, of air pollutants in each area of the country. The NEI includes emission estimates for all 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands. Emission estimates for individual point or major sources (facilities), as well as county level estimates for area, mobile, and other sources, are available currently for years 1990 and 1996 through 2002 for criteria pollutants, and for years 1999 and 2002 for HAPs. A final version of the 2002 NEI was posted in February 2006.

Data from the NEI are used for air dispersion modeling, regional strategy development, regulation setting; air toxics risk assessment, and tracking trends in emissions over time. For emission inventories prior to 1999, criteria pollutant emission estimates were maintained in the National Emission Trends (NET) database and HAP emission estimates were maintained in the National Toxics Inventory (NTI) database. Beginning with 1999, criteria and HAP emissions data were prepared in a more integrated fashion in the NEI, which takes the place of the NET and the NTI.[3]

Clean Air Markets – Data and Maps:

Data and Maps (D&M) is an internet application that contains industry source emissions data. The objective of D&M is to provide an easy to use, interactive, and intuitive web—based interface to view unit, facility, emissions, and allowance data collected as part of EPA's emissions trading programs, as well as deposition data from the Clean Air Status and Trend Network (CASTNET).

The Emissions module accesses emissions data at either the unit level or monitoring location level for one or more facilities. The D&M allows users to create custom queries using the Emissions Query Wizard, selecting to view data associated with specific programs, facilities, units, and timeframes, as well as several other data characteristics. In addition, commonly requested sets of data can be quickly accessed by using the Quick Report feature. Emissions are available for years 1980, 1985, 1990 through the present.

Data Collection Method:

The method used for collecting data was the same method used in the previous version of the database. The EIA form 767 was used as the backbone of the database. Any information pulled from other resources such as the EPA Clean Air Markets D&M or the UDI databases were reorganized to match the structure of the EIA forms. The EIA forms are organized around the boilers with any ancillary unit referred to by their associated boilers.

Each plant, boiler, and associated unit is given an identification number. The plants are given Office of Regulatory Information Systems Identification (ORIS ID), which is used in each version of the database as a unique identifier for the plants. The other units in the

[3] Description collected from the EPA website *(http://www.epa.gov/ttn/chief/trends/)*

plant given unique identifiers are boilers, generators, flue gas desulfurization units, flue gas particulate units, cooling, system and the stack. All references to the individual units are based off of these numbers. Any non-EIA resource was restructured to match this reference style; for example, the NEI Criteria Air Pollutant (CAP) section didn't have corresponding identification numbers, therefore a cross-walk had to be created in order to incorporate the information into the database.

Once each resource was restructured with identification numbers matching the EIA, they were then incorporated into a single Excel spreadsheet. Each data point was extracted from the resource exactly as reported. The calculations that were made to the collected data are enumerated in Appendix B. All non-calculated fields contained in the database are presented exactly as they are in the above mentioned resources.

Excel Version

The Excel Spreadsheet version of the database is intended for users who are familiar with using the database in its previous version, want to have full control of the data, manipulate the data within Excel, or and may have existing tools or systems to use with the updated version. This version is structured in the same manner as the last version of the database. The columns are labeled using the identical color scheme and names as the previous version, created in 2005. Please refer to Appendix A for details on the layout and color scheme of the database. The only change is the addition of a few columns to increase available information on particulate emissions.

Database Structure:

The Excel version of the database is a single spreadsheet that contains 191 columns and 1,923 rows of information. The rows are sorted by the ORIS plant code. Each row contains information on a different boiler for a given power plant. Power plants typically have multiple boilers. A few rows are colored purple and contain asterisks (*). These rows contain data on ancillary units that are related to the boiler located in the previous row (see Figure 1). Note: units that are considered ancillary are units that are related to more than one boiler or one of multiple units related to a single boiler.

The Excel version also has 2 tabs each contains information on the database. The "Main DB" tab contains the data of the database. The second tab "Column Descriptions" contains the descriptions for each of the columns in the database. Please refer to Appendix A to view the column descriptions and color codes.

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	A	B	C	D	E	F	G	H	I	J	
1	NETL Coal Plant Database										
2	F_767_Plant	F_767_Plant	F_767_Plant	F_767_Plant	F_767_Plant	F_767_Plant	EPA Unit Emissions	EPA Unit Emissions	EPA Unit Emissions	EPA Unit Emissions	
3	B	D	C	J	L	M	N	O	L	M	
4	EIA-2005	EIA-2005	EIA-2005	EIA-2005	EIA-2005	EIA-2005	EPA-2005	EPA-2005	EPA-2005	EPA-2005	
5	Utility EIA Code	Utility Name	EIA Plant Code (ORISPL)	Plant Name	Plant Location State	Plant Location County	Plant Location Latitude (degrees)	Plant Location Longitude (degrees)	EPA Region	NERC Region	
99	9332	ndian River Operations In	594	Indian River	DE	Sussex	38.5833	-75.2333	3	Mid-Atlantic Area Council	Divis
100	9332	ndian River Operations In	594	Indian River	DE	Sussex	38.5833	-75.2333	3	Mid-Atlantic Area Council	Divis
101	9332	ndian River Operations In	594	Indian River	DE	Sussex	38.5833	-75.2333	3	Mid-Atlantic Area Council	Divis
102	4161	ıstellation Power Source	602	Brandon Sho	MD	Anne Arundel	39.1792	-76.5383	3	Mid-Atlantic Area Council	Divis
103	4161	ıstellation Power Source	602	Brandon Sho	MD	Anne Arundel	39.1792	-76.5383	3	Mid-Atlantic Area Council	Divis
104	6455	rogress Energy Florida In	628	Crystal River	FL	Citrus	28.9594	-82.7003	4	Southeastern Electric Reliability Council	Divis
105	6455	rogress Energy Florida In	628	Crystal River	*	*	*	*	*	*	
106	6455	rogress Energy Florida In	628	Crystal River	FL	Citrus	28.9594	-82.7003	4	Southeastern Electric Reliability Council	Divis
107	6455	rogress Energy Florida In	628	Crystal River	*	*	*	*	*	*	
108	6455	rogress Energy Florida In	628	Crystal River	FL	Citrus	28.9594	-82.7003	4	Southeastern Electric Reliability Council	Divis
109	6455	rogress Energy Florida In	628	Crystal River	FL	Citrus	28.9594	-82.7003	4	Southeastern Electric Reliability Council	Divis

Figure 1: Screen Shot of the Main Database Tab

Using the Database:

The first five rows contain source information on where the information in the column originates. Row two listed the original source of the information. Row three contains the specific column in the original source and the fourth row contains information on the organization and year from which the data derives. For example, data in the "Utility EIA Code" column, is from column B of EIA's Form 767 Plant file for the year 2005.

The columns in the database have been set up with the automatic filter option on. This will allow the users to more easily find any desired information. A user can either apply the filter by simply selecting which information he or she wishes to view or the user can create their own filter using the "(Custom…)" option. For example a user wishes to find all plants with electrostatic precipitators (ESP). The user would go to column DC "FGP Primary Unit Type 1, click the filter button, and select the custom option. This will open a window where the user can input a custom filter option. In this example the user would input "Electrostatic precipitator*" in the right drop down list as seen in Figure 2. The * is important, it tells the program that the user doesn't care which characters come after the "electrostatic precipitator," just that the plant has an ESP.

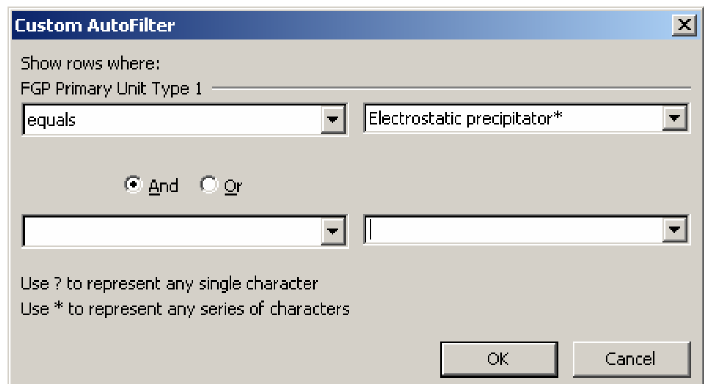


Figure 2: Custom Filters

When a filter is applied to the database, Excel will automatically change the color of the row numbers to blue. This will help the user to understand when the filter is applied. The column that has the filter turned on will have the down arrow button color changed to light blue as well.

The database also contains color codes similar to those seen in the earlier version of the database. As mentioned, purple rows contain information on ancillary units. Cells colored green indicated that the information stored in the cells comes from a different resource. The associated resource can be found highlighted in green at the top of the column. The color yellow means that the cell contains questionable data. Data is considered questionable if it if from a year other than 2005.

Notes: The database is set up to automatically freeze columns A-D and rows 1-5 so that the user is able to reference which plant they are looking at as well as the type of information. If the user wishes to remove unfreeze the column, he or she can do this by clicking on windows and selecting "Unfreeze Panes." If the user would like to refreeze the columns, he or she can do this by highlighting the cell where he/she wishes the column and rows to be frozen, then return to the windows button and select "Freeze Panes."

Pivot Table Version

Benefits of the Pivot Table Version:

The pivot table version of the database has been created for users familiar with the use of pivot tables. Pivot tables allow users to easily create tables, restructure tables, and manipulate data. This version of the database contains 10 separate excel worksheets each containing a unique default pivot table designed to provide a starting point for the user to create crosscuts of certain types of data. The main database, the source of the pivot table data, has been hidden to prevent users from unintentionally changing values.

This section of the user manual provides information on the pivot table version of the database and some specific instructions, but is not a tutorial on using Excel pivot tables. That information can be found in Appendix D or in Microsoft publications.

Changes to the Data Structure:

The data stored in the Excel spreadsheet version was restructured in order to allow for the use of pivot tables. Pivot tables require that each piece of information has its own individual row. This means that each relationship between boilers, generators, and each ancillary unit will need its own row. In the spreadsheet version of the database, relationships between boilers and ancillary units are defined by listing each associated unit in a single cell located on the same row as the boiler. This style was changed to break out each of the unit IDs in separate rows each while repeating the associated boiler IDs; (see Figures 3 and 4 for an illustration).

Boiler ID	Generator ID
B1	Gen 1, Gen 2
B2	Gen 1, Gen 2

Figure 3: Excel Data Structure

Boiler ID	Generator ID
B1	Gen 1
B1	Gen 2
B2	Gen 1
B2	Gen 2

Figure 4: Pivot Table Data Structure

Two other major changes to the data were made so that the pivot tables would display the correct information. The data that will be displayed in the "Data Field" (see Figure 5) of the pivot table could not be repeated. If the information contained in the Data Field is repeated then the automated calculation will be incorrect. For example Gen 1 seen in Figure 3 would only display the name plate capacity once or else the pivot table would show the nameplate capacity as double the actual capacity.

The last major structural change to the data deals with the information stored in the "Row Field" (see Figure 5). The information displayed in the Row Field of a pivot table must be repeated for each occurrence. If the information is not repeated then the pivot table will incorrectly label that piece of information as "*(blank)*." For example, Gen 1 in Figure 3 has been labeled as "operational." The "operational" status needs to be repeated for each occurrence of Gen 1 or else the pivot table will show the status of the generator as both "operational" and "*(blank)*."

Using the Pivot Table Version:

The 10 default pivot tables are categorized to correspond with the color coded headings created in the Excel version of the database. The Plant Location table contains information on the plant's utility, owner, and location. The Boiler table, contains data on the boilers manufacturer, hours under load, and other performance information. The Boiler Fuel table contains data on fuel usage, heat content, origin, and CO_2 emissions. The Generator table contains data on the generator type, performance, and steam type. The NOx table contains information on NO_x control processes and emissions. The Sulfur table contains information on SO_2 emissions, FGD performance, and FGD sludge generated. The Particulate & Ash table contains information on particulate control, emissions, and ash generation. The Cooling Water table contains information on the cooling water system type, water withdrawal source, discharge temp, and costs. The Flue Stack table contains information on the stack height.

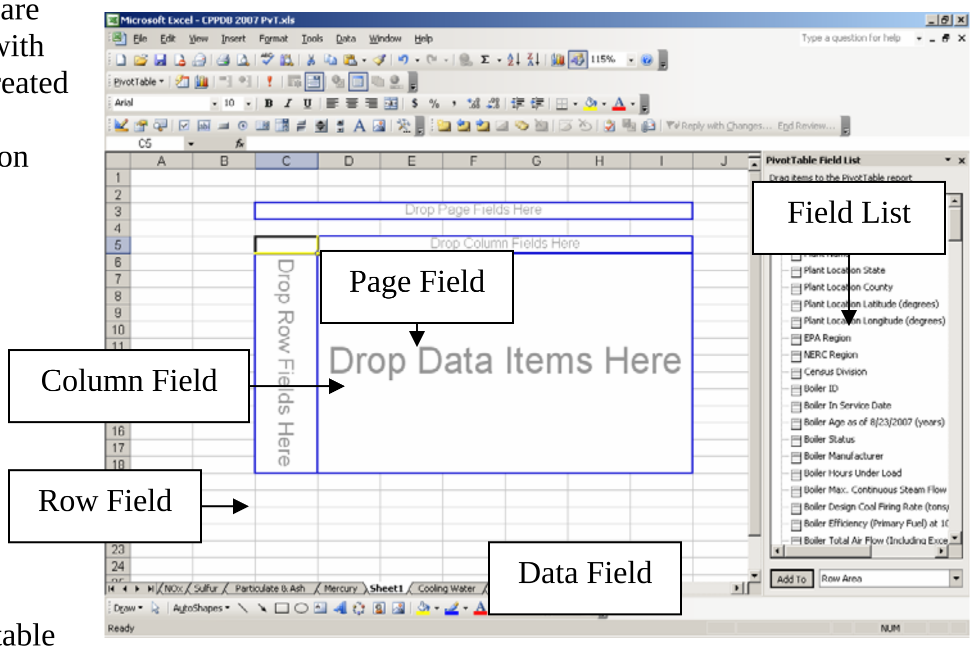


Figure 5: Pivot Table Fields

A pivot table is made up of multiple sections. The "Page Field" is a way to filter all the data maintained in the table. The column and row sections allow the user to group data by the fields he or she chooses. Using the Column field to group data will rapidly reach the limits of Excels memory; therefore it is best to group the data using the row field. The Row field also groups data from left to right and the column field will group data from top to bottom. The Data field allows the user to drop any information he or she wishes to analyze. The field list section is where the user can select fields to include in the pivot table. Once the user has decided on the appropriate fields for the pivot table, the field can be dragged and dropped into the appropriate section of the pivot table.

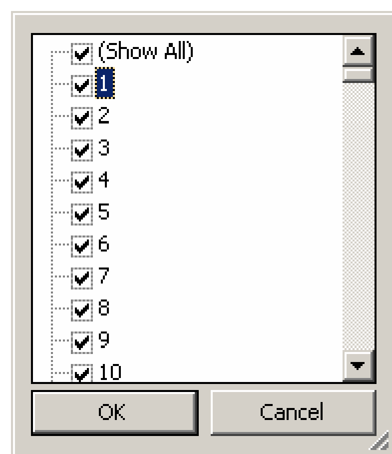


Figure 6: Pivot Table Filter

Note: The default pivot tables do not automatically show the "Field list." To open the field list, users must right-click on a pivot table and then select the last option on the list, the "Show Field List" option.

Applying Filters:

The default pivot tables are structured with the Plant State location field as the filter stored in the page field. The default value of the filter is set to show all the states. Unfortunately, when a field is stored in the Page Field, all options or only a single option must be chosen. If a user wishes to show two states, the state field must be dragged and dropped into the Row field section of the pivot table.

The user is also able to apply filters to each of the fields maintained in the "Row Field" section. Applying the filters is performed by clicking on the downward facing arrow in the right corner of the appropriate column. Once this is done, the user will see a list of option to choose from (see Figure 6). If the user wishes to select a single option, he or she must first uncheck the "(Show All)" field. On the other hand if the user wishes to show all but a single option, he or she should just uncheck that option and the correct filter will be applied. Once finished setting the filter, the user must press the "OK" button or none of the changes will take.

Pivot Tables and Calculations:

One of the most useful aspects of a pivot table is the ability to perform calculations quickly. Each field in a pivot table can be individually set to a different calculation. In order to access the calculations, a user must right click on a field located in the "Data Field" section of the pivot table and select the "Field Settings…" option. The pivot table will then present the user with a small window containing multiple options (see Figure 7). In this window the user may apply basic calculations to the selected field.

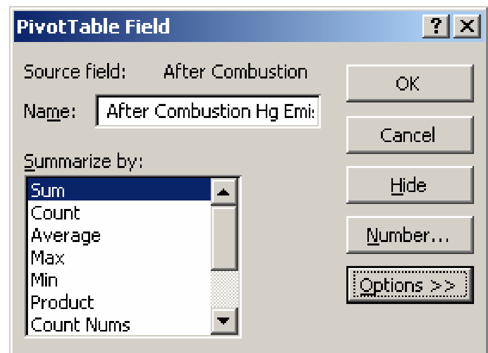


Figure 7: Basic Field Calculations

To add more complicated calculations, the user can add calculated fields to the pivot tables. These fields allow users to create their own fields containing their own formulas. In order to create a calculated field, the pivot table tool bar has to be visible, then select PivotTable > Formulas > Calculated fields. Once the user has selected "Calculated Field…" he or she will see a window that will allow a formula and field name to be inserted (see Figure 8). The user can select separate fields to insert into the formula by selecting them from the list in the lower left hand side of the window. A calculated field is a useful tool that allows the user to reference a field in a pivot table without being concerned with any changes in the structure of the pivot table.

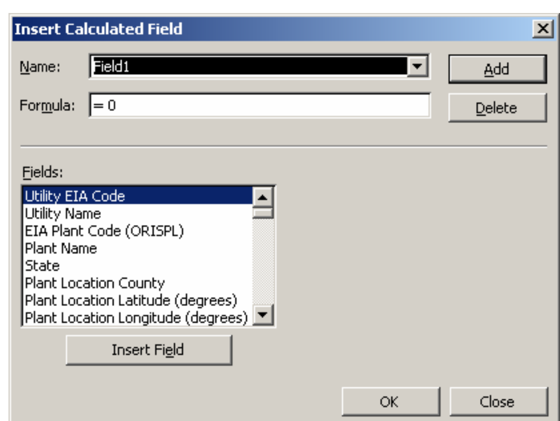


Figure 8: Pivot Table Calculated Fields

For more information on how to create and use pivot tables, please refer to Appendix D. Appendix D contains step-by-step instructions on how to create pivot tables and includes links to free online courses provided by Microsoft. The pivot table version of the CPPDB was created for individuals familiar with the use of pivot tables. This version will help those users more easily manipulate data and generate reports.

Access Version

Benefits of the Access Version:

An Access-compatible version of the database was created in order to allow quick searches of the substantial amount of data stored in the database, particularly for those users who are familiar with Access and prefer its functionality.

Multiple forms are used to govern the user's flow through the Access controls and to determine the user's needs. These forms were created to allow the user to select various categories of information to view and to enter specific search criteria that will hasten the search process. The results of the query are displayed in an output form. This form can be exported to Excel or other applications if the user wishes to work further with the data.

Note: this version of the database uses more computer memory due to the numerous macros needed to facilitate the search function. Most modern machines should operate the database well. If problems are encountered, use the Excel version.

Changes to the Data Structure:

The data structure of the Access database varies greatly from that of the Excel and Pivot table versions. This version is set up with multiple relational databases. A relational database is a collection of tables containing related information. Once these tables have been created, the relationships between the tables are established through unique ID number and junction tables. The benefits of this type of data structure are numerous. A relational database allows for increased ease of maintaining data, updating data, reduced memory requirements, and most importantly, the ability to search data.

The relational tables were created by dividing the data into various categories consistent with color codes used in the Excel version. A unique key was created for each of the individual rows in these tables. These keys were created to help establish the relationships between the individual fields of data.

The unique keys were created by mimicking the system established by EIA form 767. Each plant is given a unique ID. Using this ID combined with the boiler ID and each of the corresponding units (i.e., generator, FGD, or stack), a unique key was created. Once these keys were made, a separate table called a "junction" table was created. This junction table establishes the relationships of the individual tables. This setup helps to solve the problems of illustrating boilers with multiple units and single units connected to multiple boilers.

Using the Access Version:

The Access version of the database is set up solely for searching the database—no editing of data is allowed. If the user wishes to manipulate the data for any reason, he or she can export the data to an Excel file where any calculation may be performed. The database, once opened, will take the user through three forms which help to establish the search criteria.

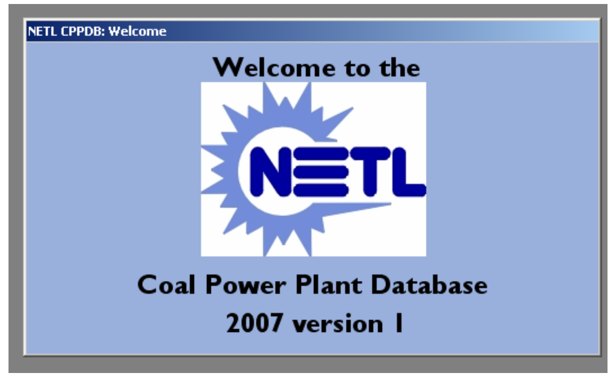


Figure 9: Welcome Form

Upon initiating the application, the user will notice a welcome screen. This form is setup as a welcome sign that will appear for two seconds before the second form opens.

The Information Request Form:

The second form a user will encounter is an information request form. This form is used to establish what type of information the user wishes to find. There are eight fields present: “Boiler Information,” “Fuel Usage,” “Generator,” “Pollutant,” “Solid Waste,” “Pollutant” “Control Device,” “Cooling Water,” and “Stack” information.

The boiler field will provide the user with the boiler’s age, manufacturer, performance, and firing type. The fuel usage selection will provide the user with information on the fuel type, coal origin, heat content, and consumption. The generator field provides information on electricity generated and steam type. The pollutant category provides information on particulate; and NO_x, SO_x, and CO_2 emissions. The pollutant control device, once selected, will provide information on the all of the control devices and some design parameters. The cooling water section provides information on the type of cooling system, the water withdrawal source, and installation costs. The stack selection provides information on the design parameters of the stack as well as information on the flue gas. Each of the information types is broken into individual fields in Appendix C.

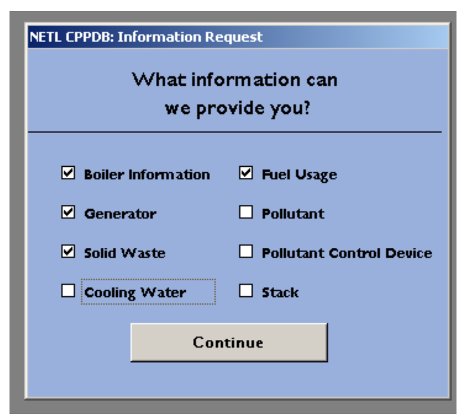


Figure 10: Information Request Form

The default values for the information request form are set to include all the information types listed above. To limit the search results, the user must deselect appropriate topics by unchecking the boxes (see Figure 10). If the default values are left selected, the user will receive a resulting table containing 191 columns that match the Excel version of the database. Figure 10 shows what options a user would select if he or she wanted only boiler, fuel, and generator information of certain plants.

The Search Request Form:

The Search Request form allows the user to refine the search. On this form the user will input any criteria for the information he or she wishes to view. If a user wishes to search for power plants located in, Pennsylvania, with generators over 250 megawatts, he or she would input the requirements seen in Figure 11. If the user in this example requested the same limits on information as seen in Figure 10 then the unrelated search fields would be disabled.

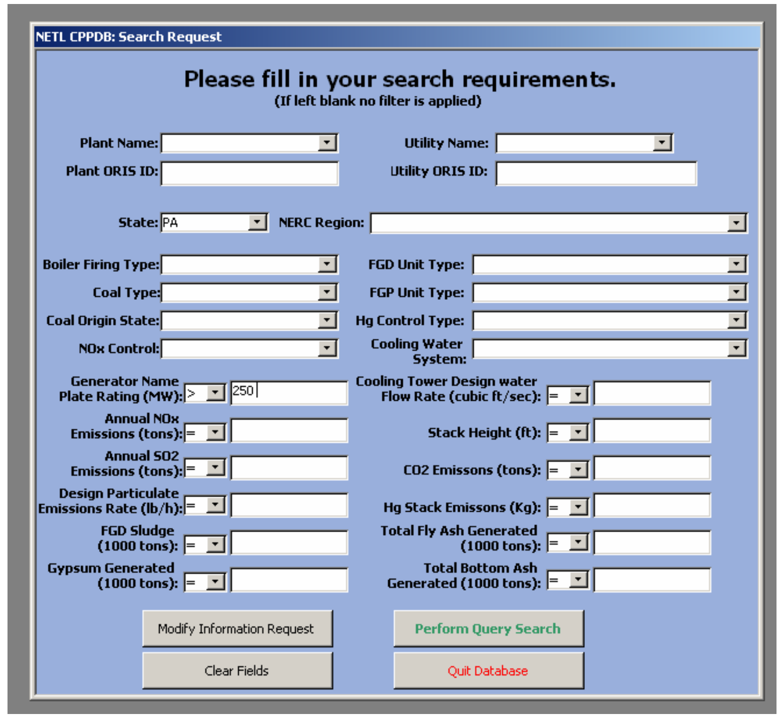


Figure 11: Search Request Form

Each requirement added to the search will limit the number of results the user receives. For example, Figure 11 is a search that shows the input for a user who is looking for all plants that are located in Pennsylvania *AND* have generators with a nameplate rating of over 250 megawatts.

The controls on this form include 12 combo boxes, 2 text boxes, and 12 combo text boxes. The combo boxes provide the user with an alphabetical list of options to choose from. The list represents the information held in particular fields of the database. There are two ways to fill in these controls. The user can select the option from a list as seen in Figure 12 or he or she can begin to type an entry and the program will choose the closest entry. To clear combo box controls, the user just has to delete what is entered or select the Clear Fields button.

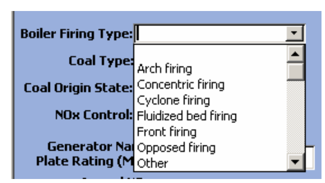


Figure 12: Combo Boxes

The two text boxes are for people who know a particular plant or utility ORIS number. For example, if the user inputs 3 into the Plant ORIS ID text box, information will be displayed on the Barry plant located in Alabama.

The 12 combo text box controls allow the user to input specific requirements for the search. A user can search for particular plants with a certain level of carbon dioxide emissions or plants with stack heights above a certain level. These controls require a numerical input. Non-numerical characters will not be accepted in these fields.

The last part of the form contains four buttons allowing the user to navigate through the program. The “Modify Information Request” button will take the user back to the “Information Request” form and provide access to change the options selected on the form. The “Clear Fields” button will clear any input in the control fields of the form.

The “Perform Query Search” button will open the “Results” form, displaying the results of the user’s search. The final button “Quit Database” will exit the Access program.

On selecting the “Perform Query Search” button on the “Search Request” form, the user will see two separate forms open. The first form is a pop-up window, seen in Figure 13. The pop up window is there to inform the user to press the ESC button to continue to perform operations on the database.

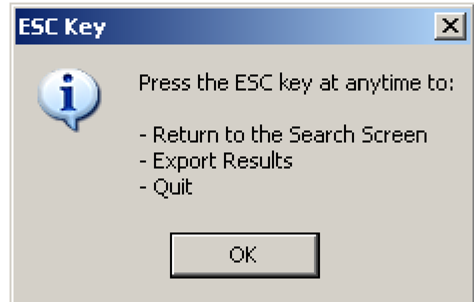


Figure 13: Pop-up Reminder

The Results Form:

The last major form the user will view is the “Results” form, Figure 14. This form is displayed in a datasheet format that will allow easy viewing of the user’s results. The only columns that will be viewable will be the ones associated with the selections made on the “Information Request” form. This database mimics the Excel version in that the columns are displayed in a similar order. The results the user retrieves are set up so that they cannot be modified. If the user wishes to manipulate and work with any of the data, must first be exported to Excel.

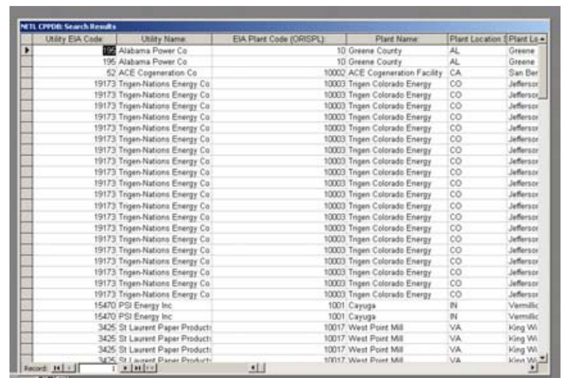


Figure 14: Results Form

The last form a user will encounter is accessed by pressing the ESC button while viewing the “Results” form. There are three options for the user to choose from: exporting the results to Excel, returning to the search form, and quitting the program as seen in Figure 15. The button “Export Results” will open a window asking the user to save and name the Excel file that will contain the search results. There will be a default name generated for the search results—the name is formatted as “Search Results,” plus the date and time the results were saved. The “Return to Search” button closes the “results” form and opens the “Search Request” form. When the user returns to the search, form all inputs from the previous search are saved on the form until the user either exits the program or clears the fields. The “Quit Database” button will exit the Access program.

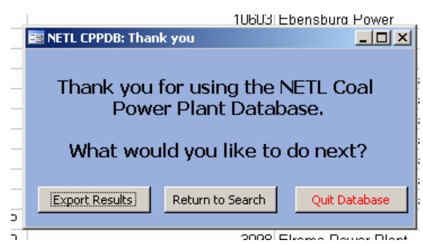


Figure 15: Final Form

As stated above, the Access version of the CPPDB is intended for users trying to find specific information quickly. This version is structured to utilize the benefits that accompany a relational database. There are three major forms that a user will encounter in this database. The first requests the user to select specific information to search. The second form is used for the input of search parameters, and the last form displays the results of the search. This structure will help to reduce the amount of time wasted when dredging through a large database for information.

Appendix A – Column Descriptions

This appendix contains a list of the data columns contained in the database. Each column is described by its column identifier, the alphabetic listing, and the column name. The information below provides a list of calculations used in each of the corresponding rows, the appropriate units, any needed notes and a list of all acronyms used. This appendix also contains a list of the color codes used throughout the database.

Color Scheme:

Column Title Color	Group #	Type of Data
Peach	Group 1	Name, Location, EIA code
Pale Yellow	Group 2	Boiler Data
Light Blue	Group 3	Fuel Data
Pale Green	Group 4	Generators, Generation Information, Steam Data
Purple	Group 5	NO_x Data
Bright Green	Group 6	Sulfur Data
Yellow	Group 7	Particulates and Ash Data
Fuchsia	Group 8	Cooling Water Data
Peach	Group 9	Flue/Stack Data
Light Green	Group 10	Utility Information
Gray	Group 11	Notes
Purple	Group 12	Sort key

Color Code:

(yellow)	Cells highlighted in yellow contain questionable data, but no basis was available to change the source data
(green)	Cells highlighted in green contain data that were changed based on more reliable information than the source data
(purple)	Represents a row added to accommodate an ancillary unit for an existing boiler
*	An asterisk in a cell means that either the cell should not have data entered, or the entry is for a shared unit and the data appear in the previous row

Column List and Description:

Column	Description	Acronym	Acronym / Units / Notes
All		NL	Not listed, meaning the data are relevant but could not be found or the formula could not be calculated because of missing data
All		N/A	Not applicable, meaning the data for that cell does not apply to the unit in question
A	EIA utility code, a unique identifier for each utility	None	
B	Utility name	None	
C	EIA Plant Code (ORISPL)	ORISPL	ORIS stands for Office of Regulatory Information Systems, which was an office within the old Federal Power Commission, the predecessor to FERC The PL stands for Plant
D	Plant name	None	
E	State name of plant location	None	
F	County name of plant location	None	
G	Latitude of plant location	None	Degrees
H	Longitude of plant location	None	Degrees
I	EPA Region	None	
J	NERC Region	None	
K	Census Division	None	
L	Unique identifier for each boiler at a plant	None	
M	Month and year of boiler in-service date	None	
N	Boiler age as of June 30, 2005	None	Years
		Formula	(TODAY() - column M) / 365.25
O	Boiler status	None	
P	Boiler Manufacturer	None	
Q	Hours boiler operated to drive the generator producing electricity	None	Hours (hr)
R	Maximum continuous steam flow from boiler at 100% load	None	Thousands of pounds per hour (1000 lb/h)
S	Design coal firing rate at maximum continuous steam flow	None	Tons per hour
T	Boiler efficiency using coal at 100%	None	Percent

	load		
U	Total air flow to boiler (including excess air) at 100% load	None	Standard cubic feet per minute (scfm) at 68 deg F and 1 atm
V	Type of firing used on coal	None	
W	Wet or dry bottom (wet has slag tanks at furnace throat to contain and remove molten ash)	None	
X	Primary fuel type (grade of coal)	None	
Y	State of origin for largest coal source in 2002	None	
Z	Amount of coal consumed (primary fuel plus other coal if applicable)	None	Thousands of tons
AA	Average coal heat content (high heating value, HHV) for current reporting year	None	British thermal units per pound (Btu/lb)
AB	Total boiler heat input from all fuels for current reporting year	None	Millions of British thermal units (mm Btu)
		Formula	Column Z * 1000 * 2000 * column AA / 1000000 / (column AC / 100)
AC	Percentage of total annual boiler heat input coming from the primary fuel	None	Percent
AD	Average coal ash content for current reporting year	None	Percent
AE	Average coal sulfur content for current reporting year	None	Percent
AF	Boiler CO2 emissions for current reporting year	None	Tons
AG	Alternate fuels that boiler is equipped to burn	None	
AH	Year alternate fuel last burned	None	
AI	Designation of generator(s) that can receive steam from the given boiler	None	
AJ	Designation of generator for which relevant information is presented	None	
AK	Generator nameplate rating	None	Megawatts (MW)
AL	Net annual electrical generation from the referenced generator	None	Megawatt hours (MW-h)
AM	Net plant heat rate (calculated)	None	British thermal units per net kilowatt hour (Btu/kW-h)
		Formula	Column AB * 1,000,000 / (column AL * 1,000)
AN	Turbine capacity factor (calculated)	None	Percent (MW-hr generated divided by MW-hr potential based on generator nameplate rating)

		Formula	Column AL / (column AK * 8760)
AO	Jurisdiction of the most stringent boiler NOx regulation	None	
AP	Acid Rain Program NOx phase and group classification	None	
AQ	Numeric NOx emission standard associated with column AO	None	
AR	Units of numeric NOx emission standard in column AQ	lb/mm Btu	Pounds per million British thermal units
		ppm	Parts per million
		lb/hr	Pounds per hour
AS	Year boiler was or is expected to be in compliance with NOx regulation	None	
AT	NOx compliance strategy, if not in compliance	None	
AU	NOx control status	None	
AV	Primary NOx control process reported on Form EIA-767	None	
AW	Secondary NOx control process reported on Form EIA-767	None	
AX	Tertiary NOx control process reported on Form EIA-767	None	
AY	Primary NOx control process reported on EPA emissions detail spreadsheet	None	
AZ	Secondary NOx control process reported EPA emissions detail spreadsheet	None	
BA	Manufacturer of low NOx burner, if applicable	None	
BB	Amount of time NOx control process operated in current reporting year	None	Hours (hr)
BC	Controlled NOx emission rate for entire current reporting year	None	Pounds per million British thermal units (lb/mm Btu)
BD	Controlled NOx emission rate for May through September only in current reporting year	None	Pounds per million British thermal units (lb/mm Btu)
BE	Total annual NOx emissions in current reporting year per EPA	None	Tons
BF	Annual average NOx emission rate in current reporting year	None	Pounds per million British thermal units (lb/mm Btu)
		Formula	(Column BJ * 2000) / column AB
BG	Jurisdiction of the most stringent boiler SO2 regulation	None	

BH	Phase designation per the Clean Air Act Amendments of 1990	None	
BI	Numeric SO2 emission standard associated with column BG	None	
BJ	Units of numeric SO2 emission standard in column BI	lb/mm Btu	Pounds sulfur dioxide per million British thermal units
		lb S/mm Btu	Pounds sulfur per million British thermal units
		lb/h	Pounds per hour
		ppm	Parts per million
		%S in fuel	Weight percent sulfur in fuel
		% S removal eff.	Weight percent sulfur removal efficiency from uncontrolled state
BK	Year boiler was or is expected to be in compliance with SO2 regulation	None	
BL	SO2 compliance strategy, if not in compliance	None	
BM	Unique identifier for each FGD unit at a plant	None	
BN	FGD unit status	None	
BO	FGD unit type	None	
BP	FGD unit manufacturer	None	
BQ	FGD unit in-service date	None	
BR	Total number of FGD unit scrubber trains (or modules)	None	
BS	Total number of FGD unit scrubber trains operated at 100% load	None	
BT	Hours FGD unit in-service during current year	None	Hours (hr)
BU	Estimated SO2 removal efficiency at annual operating factor	None	Percent (%)
BV	Estimated SO2 removal efficiency at 100% load	None	Percent (%)
BW	FGD sorbent type	None	
BX	Quantity of sorbent used during current year	None	Thousands of tons
BY	Estimated FGD waste and salable by-products produced annually (0% moisture)	None	Thousands of tons
BZ	Total amount of gypsum generated during the current year	None	Thousands of tons
CA	Amount of generated gypsum that was sold as a by-product	None	Thousands of tons
CB	Total FGD sludge generated (0%	None	Thousands of tons

	moisture)		
CC	Total FGD sludge sold as a by-product (0% moisture)	None	Thousands of tons
CD	Does the ability exist to bypass flue gas around the FGD unit	None	
CE	Design SO2 removal efficiency at 100% generator load	None	Percent
CF	Design SO2 emission rate at 100% generator load	None	Pounds per hour (lb/h)
CG	Design flue gas exit flow rate at 100% generator load	None	Actual cubic feet per minute (acfm)
CH	Design flue gas exit temperature at 100% generator load	None	Degrees Fahrenheit (deg F)
CI	Percent of total flue gas entering FGD unit at 100% generator load	None	Percent
CJ	FGD design specification for ash in coal	None	Weight percent
CK	FGD design specification for sulfur in coal	None	Weight percent
CL	Total FGD O&M costs (feed materials, chemicals, labor, supervision, waste disposal, maintenance, materials and all other costs)	None	Thousands of dollars
CM	FGD by-products sales revenues for the current year	None	Thousands of dollars
CN	Total installed cost of FGD unit (includes structures, equipment, sludge transport and disposal system, plus others; excludes land)	None	Thousands of dollars
CO	Total annual SO2 emissions in current reporting year per EPA	None	Tons
CP	Annual average SO2 emission rate in current reporting year	None	Pounds per million British thermal units (lb/mm Btu)
		Formula	(Column CT * 2000) / column AB
CQ	Jurisdiction of the most stringent boiler particulate regulation	None	
CR	Numeric particulate emission standard associated with column CQ	None	
CS	Units of numeric particulate emission standard in column CR	lb/mm Btu	Pounds per million British thermal units
		% of opacity	Percent of opacity
		lb/h	Pounds per hour
		gr/scf	Grains per standard cubic foot (7000 grains/lb)

		lb/1000 lb stack gas	Pounds particulate per thousand pounds of flue gas in the stack
CT	Year boiler was or is expected to be in compliance with particulate regulation	None	
CU	Particulate compliance strategy, if not in compliance	None	
CV	Unique identifier for each particulate control unit at a plant	None	
CW	Particulate control unit status	None	
CX	Primary particulate control device type	None	
CY	Secondary particulate control device type	None	
CZ	Particulate control device in-service date	None	
DA	Hours particulate control device in-service during current year	None	Hours (hr)
DB	Estimated particulate removal efficiency at annual operating factor	None	Percent
DC	Estimated particulate removal efficiency at 100% load	None	Percent
DD	Typical particulate emission rate at annual operating rate	None	Pounds per million British thermal units (lb/mm Btu)
DE	Total ash generated	None	Thousands of tons
		Alternate	Total ash was calculated on EIA's F_767_boiler_fuel spreadsheet and entered here
DF	Total fly ash generated	None	thousands of tons
		Formula	Pro-rated per boiler in same proportion as total ash generated, unless different boiler types were involved. In later case, adjustments made as appropriate using AP-42 as a guide.
DG	Total fly ash sold as a by-product	None	Thousands of tons
		Formula	Pro-rated per boiler in same proportion as total ash generated (or in same proportion as total fly ash generated if different boiler types were involved.)
DH	Total bottom ash generated	None	thousands of tons

		Formula	Pro-rated per boiler in same proportion as total ash generated, unless different boiler types were involved. In later case, adjustments made as appropriate using AP-42 as a guide.
DI	Total bottom ash sold as a by-product	None	Thousands of tons
		Formula	Pro-rated per boiler in same proportion as total ash generated (or in same proportion as total bottom ash generated if different boiler types were involved.)
DJ	PM25 Filterable (tons)	None	
		Formula	(NEI 2002 reported emissions) * (Column AB / SUM(Column EY for the whole plan))
DK	PM25 Primary (tons)	None	
		Formula	(NEI 2002 reported emissions) * (Column AB / SUM(Column EY for the whole plant))
DL	PM10 Filterable (tons)	None	
		Formula	(NEI 2002 reported emissions) * (Column AB / SUM(Column EY for the whole plant))
DM	PM10 Primary (tons)	None	
		Formula	(NEI 2002 reported emissions) * (Column AB / SUM(Column EY for the whole plant))
DN	PM Condensable (tons)	None	
		Formula	(NEI 2002 reported emissions) * (Column AB / SUM(Column EY for the whole plant))
DO	Total controlled particulate emissions less than 2.5 microns per AP-42 calculation	None	Tons
		Formula	Column Z * 1000 * (AP42EmissionFactor * column AD) / 2000
DP	Total controlled particulate emissions less than 10 microns per AP-42 calculation	None	Tons
		Formula	Column Z * 1000 * (AP42EmissionFactor * column AD) / 2000
DQ	Total controlled particulate emissions per AP-42 calculation	None	Tons
		Formula	Column Z * 1000 *

			(AP42EmissionFactor * column AD) / 2000
DR	Total allowable particulate emissions less than 2.5 microns	None	Tons
		Formula	Column Z * 1000 * column AA / 10^6 * column GI * (column DU / column DV)
DS	Total allowable particulate emissions less than 10 microns	None	Tons
		Formula	Column Z * 1000 * column AA / 10^6 * column GI * (column DT / column DV)
DT	Total typical particulate emissions less than 2.5 microns	None	Tons
		Formula	Column Z * 1000 * column AA / 10^6 * column DI * (column DT / column DV)
DU	Total typical particulate emissions less than 10 microns	None	Tons
		Formula	Column Z * 1000 * column AA / 10^6 * column DI * (column DU / column DV)
DV	Fraction of total controlled particulate emissions less than 2.5 microns	None	Lb PM-2.5 / lb PM
		Formula	Column DT / column DW
DW	Design particulate removal efficiency at 100% generator load	None	Percent
DX	Design particulate emission rate at 100% generator load	None	Pounds per hour (lb/h)
DY	Design flue gas exit flow rate at 100% generator load	None	Actual cubic feet per minute (acfm)
DZ	Design flue gas exit temperature at 100% generator load	None	Degrees Fahrenheit (deg F)
EA	Particulate control device design specification for ash in coal	None	Weight percent
EB	Particulate control device design specification for sulfur in coal	None	Weight percent
EC	Total ash (fly ash and bottom ash) collection and disposal operating and maintenance costs	None	Thousands of dollars
		Formula	Columns AV + AW + AX + AY from spreadsheet F_767_Plant
ED	Fly ash by-product sales revenue	None	Thousands of dollars
		Formula	Pro-rated per boiler in same proportion as total bottom ash sold
EE	Bottom ash by-product sales revenue	None	Thousands of dollars
		Formula	Pro-rated per boiler in same proportion as total bottom ash

			sold
EF	Intermingled fly ash and bottom ash by-product sales revenue	None	Thousands of dollars
		Formula	Pro-rated per boiler in same proportion as total intermingled ash sold
EG	Total installed cost of particulate control device (excluding land)	None	Thousands of dollars
EH	2002 Total Annual Boiler Heat Input, All Fuels (used for ratio)	None	
		Formula	Calculated on the 2002 F767_Boiler_Fuel spreadsheet and entered here
EI	Unique identifier for each cooling system at a plant	None	
EJ	Cooling system status	None	
EK	Source of cooling water	None	
EL	Primary cooling system description (part 1)	None	
EM	Secondary cooling system description (part 1)	None	
EN	Cooling system in-service date	None	
EO	Average annual cooling water withdrawal rate	None	Cubic feet per second (ft^3/s)
	If cooling system services more than one boiler	Formula	Pro-rated between boilers based on the size of the turbine/generator set serviced by the boiler
EP	Average annual cooling water discharge rate	None	Cubic feet per second (ft^3/s)
	If cooling system services more than one boiler	Formula	Pro-rated between boilers based on the size of the turbine/generator set serviced by the boiler
EQ	Average annual cooling water rate of consumption	None	Cubic feet per second (ft^3/s)
	If cooling system services more than one boiler	Formula	Pro-rated between boilers based on the size of the turbine/generator set serviced by the boiler
ER	Maximum cooling water intake temperature during winter peak load month	None	Degrees Fahrenheit (deg F)
ES	Maximum cooling water intake temperature during summer peak load month	None	Degrees Fahrenheit (deg F)

ET	Maximum cooling water discharge temperature during winter peak load month	None	Degrees Fahrenheit (deg F)
EU	Maximum cooling water discharge temperature during summer peak load month	None	Degrees Fahrenheit (deg F)
EV	Total chlorine added to the cooling water in current reporting year	None	Thousands of pounds (1000 lb)
	If cooling system services more than one boiler	Formula	Pro-rated between boilers based on the size of the turbine/generator set serviced by the boiler
EW	Cooling pond in-service date	None	
EX	Total cooling pond volume	None	Acre-feet (acre-ft)
EY	Cooling tower in-service date	None	
EZ	Cooling tower type details	None	
FA	Design water flow rate through cooling tower at 100% load	None	Cubic feet per second (ft^3/s)
	If cooling system services more than one boiler	Formula	Pro-rated between boilers based on the size of the turbine/generator set serviced by the boiler
FB	Cooling tower power requirements at 100% load	None	Megawatts (MW)
FC	Total installed cost of cooling ponds	None	Thousands of dollars (1000 $)
FD	Total installed cost of cooling towers	None	Thousands of dollars (1000 $)
FE	Total installed cost of chlorine equipment	None	Thousands of dollars (1000 $)
FF	Total installed cost of cooling system	None	Thousands of dollars (1000 $)
FG	Unique identifier for each stack at a plant	None	
FH	Unique identifier for each flue at a plant	None	
FI	Stack (or Flue) Status	None	
FJ	Stack in-service date	None	
FK	Height of stack from ground level to top of flue	None	Feet (ft)
FL	Cross-sectional area of flue at stack discharge	None	Square feet (ft^2)
FM	Average summer stack flue gas exit temperature	None	Degrees Fahrenheit (deg F)
FN	Average winter stack flue gas exit temperature	None	Degrees Fahrenheit (deg F)
FO	Design flue gas exit flow rate at 100% load	None	Actual cubic feet per minute (acfm)
FP	Design flue gas exit temperature at	None	Degrees Fahrenheit (deg F)

	100% load		
FQ	Design flue gas exit velocity at 100% load	None	Feet per second (ft/s)
FR	Allowable PM Emissions Factor, lb/mmBtu	None	

Appendix B – Calculations

In addition to the raw data taken from the data sources, some database entries were determined through calculation. Calculated values are documented below. In each case, the formula is shown for the first cell entry in the column.

Column N – Boiler Age

EIA-767 frequently provided the boiler in-service date for a unit (column M). In this case, the age was calculated by simply subtracting the in-service date from the current date, using the built in "Today()" function in Excel, and dividing the result by 365.25. Subtracting two dates in Excel returns the number of days between the dates, and dividing by 365.25 converts the days to years.

Formula: (TODAY() – M7) / 365.25

Column AA – Annual Average Primary Fuel Heat Content

EIA-767 reports the quantity of each fuel consumed by a given boiler and the average heat content of that fuel on a monthly basis. The primary fuel heat content was calculated by taking a weighted average of the monthly data. In spreadsheet F767_Boiler_Fuel.xls, monthly fuel consumption for January through December is given in columns F through Q, the total annual fuel consumption in column R, and the monthly fuel heat content in columns S through AD. The calculation reduces to the following:

Formula: (F2*S2 + G2*T2 + H2*U2 + I2*V2 + J2*W2 + K2*X2 + L2*Y2 + M2*Z2 + N2*AA2 + O2*AB2 + P2*AC2 + Q2*AD2) / R2

The calculation was made on the Boiler_Fuel spreadsheet, and the result was transferred to the appropriate cell in the NETL Coal Database. It is important to note that this result is for the primary fuel (heat input basis) only. For example, if a unit's heat input consisted of 70% from bituminous coal and 30% from other sources, the average heat content is for the bituminous coal only. The relative importance of this effect can be determined from Column BE, which contains the percentage of heat input from the primary fuel.

Column AB – Total Annual Boiler Heat Input (All Fuels)

The total annual boiler fuel input for all fuels was calculated by multiplying the quantity of primary fuel consumed by its average annual heat content and then dividing by fraction of the heat input provided by the primary fuel.

Formula 1: Z7 * 1000 * 2000 * AA7 / 1000000 / (AC7 / 100)

The factors 1000 and 2000 convert thousands of tons of coal to pounds of coal, the factor of one million is to provide the result in millions of Btus, and the factor of 100 is to convert a percentage to a fraction.

Column AC – Percent of Total Annual Boiler Heat Input from Primary Fuel

The Boiler_Fuel spreadsheet from EIA-767 was used to make this calculation. The total heat input from each fuel was calculated, and then the percentage input from the primary fuel was determined. The sample calculation is for Barry Unit 1, the first plant listed in the Boiler_Fuel spreadsheet. Formula 1 calculates the total heat input from coal, Formula 2 the total heat input from natural gas, and Formula 3 the percentage heat input derived from coal (the primary fuel). Coal quantities are given in thousands of tons, hence the factor of 1000 to convert to tons, and the factor of 2000 converts tons to pounds. Heat content is given in Btus per pound. The factor of 1,000,000 simply makes the heat input result in millions of Btus.

Formula 1: 2000 * 1000 * (F2*S2 + G2*T2 + H2*U2 + I2*V2 + J2*W2 + K2*X2 + L2*Y2 + M2*Z2 + N2*AA2 + O2*AB2 + P2*AC2 + Q2*AD2) / 1,000,000

Natural gas quantities are given in thousands of standard cubic feet (scf), hence the factor of 1000 to convert to scf. Heat content is given in Btus per scf. The factor of 1,000,000 again makes the heat input result in millions of Btu's per Formula 2.

Formula 2: 1000 * (F3*S3 + G3*T3 + H3*U3 + I3*V3 + J3*W3 + K3*X3 + L3*Y3 + M3*Z3 + N3*AA3 + O3*AB3 + P3*AC3 + Q3*AD3) / 1,000,000

Formula 3: (Formula 1 result) / (Formula 1 result + Formula 2 result) *100

The calculations were made on the Boiler_Fuel spreadsheet, and the results were transferred to the NETL Database spreadsheet.

Column AD – Annual Average Primary Fuel Ash Content

This calculation is similar to the average annual heat content calculation in column AA. Ash contents are reported on a monthly in the Boiler_Fuel spreadsheet, and a weighted average was calculated based on the amount of fuel used each month. Ash content for January through December is contained in columns AG through AR.

Formula: (F2*AG2 + G2*AH2 + H2*AI2 + I2*AJ2 + J2*AK2 + K2*AL2 + L2*AM2 + M2*AN2 + N2*AO2 + O2*AP2 + P2*AQ2 + Q2*AR2) / R2

The calculation was made on the Boiler_Fuel spreadsheet, and the result was transferred to the appropriate cell in the NETL Coal Database. It is important to note that like the fuel heat content, this result is for the primary fuel (heat input basis) only.

Column AE – Annual Average Primary Fuel Sulfur Content

This calculation is similar to the average annual ash content calculation in column AD. Sulfur contents are reported on a monthly basis in the Boiler_Fuel spreadsheet, and a weighted average was calculated based on the amount of fuel used each month. Sulfur content for January through December is contained in columns AT through BE.

Formula: (F2*AT2 + G2*AU2 + H2*AV2 + I2*AW2 + J2*AX2 + K2*AY2 + L2*AZ2 + M2*BA2 + N2*BB2 + O2*BC2 + P2*BD2 + Q2*BE2) / R2

The calculation was made on the Boiler_Fuel spreadsheet, and the result was transferred to the appropriate cell in the NETL Coal Database. It is important to note that like the fuel heat content and ash content, this result is for the primary fuel (heat input basis) only.

Column AM – Net Plant Heat Rate

The net plant heat rate was calculated using the net electrical generation from the associated turbine/generator as reported in EIA-767 (MW-hr) and the total boiler heat input as reported by EPA (millions of Btus).

Formula: (AB7 * 1,000,000) / (AL7 * 1000)

The factor of 1,000,000 converts millions of Btus to Btus and the factor of 1000 converts MW-hr's to kW-hr's. The heat rate result is in Btu/kW-hr.

Column AN – Turbine Capacity Factor

The turbine capacity factor is calculated by comparing the actual number of MW-hrs generated to the total potential number of MW-hrs that could have been generated if the turbine ran at full nameplate capacity for the entire year. Column AL contains the actual annual net generation in MW-hr. Column AK contains the turbine/generator nameplate rating, which when multiplied by 8760 hours gives the maximum potential generation for the year.

Formula: AL7 / (AK7 * 8760)

Column BK – Actual Annual NOx Emission Rate

The actual annual NO_x emission rate was calculated using the EPA reported boiler emissions in tons and the EPA reported total boiler heat input.

Formula: BJ7 * 2000 / AB7

The factor of 2000 converts tons of NO_x to pounds of NO_x, and the remainder of the formula is straightforward.

Column CE – Gypsum Generated

Gypsum generated is one of a number of data points that is reported in EIA-767 on a plant basis rather than a boiler basis. In the cases where there is only a single FGD unit per plant, the data are directly transferable. In the cases where there are more than one FGD units per plant, the gypsum generated, if any, must be pro-rated.

It was assumed that if a plant generated gypsum and had more than one FGD unit, then all the FGD units contributed to the gypsum total. Further, it was assumed that the amount of gypsum produced was proportional to the amount of sorbent used. Sorbent consumed was reported on an individual FGD unit basis in EIA Form-767. Therefore, where appropriate, gypsum production was calculated as follows using the Widows Creek plant (ORISPL code 50) as an example:

Formula 1: CC37 / SUM($CC$31:$CC$32) * {Input from column AJ, spreadsheet F_767_Plant}

Formula 2: CC38 / SUM($CC$31:$CC$32) * {Input from column AJ, spreadsheet F_767_Plant}

The input from spreadsheet F_767_Plant represents the total gypsum generated by the plant in thousands of tons. The first term represents the fraction of total plant sorbent used by the unit of interest.

Column CF – Gypsum Sold as a By-product

Like gypsum generated, gypsum sold is reported on a plant basis. The same methodology is used pro-rate gypsum sold among individual units using the amount of gypsum produced as the pro-rating factor.

Columns CH and CG – FGD Sludge Generated and FGD Sludge Sold as Byproduct

Calculations for FGD sludge generated and sold are analogous to the gypsum generated and sold calculations described above.

Column CR – FGD Byproduct Sales Revenue

FGD byproduct sales revenues are also reported on a plant basis and are pro-rated among individual units based on the amount of byproduct sold in a similar manner to the above calculations.

Column CU – Actual Annual SO_2 Emissions

The actual annual SO_2 emission rate was calculated using the EPA reported boiler emissions in tons and the EPA reported total boiler heat input.

Formula: CT7 * 2000 / AB7

The factor of 2000 converts tons of SO_2 to pounds of SO_2, and the remainder of the formula is straightforward.

Column DJ – Total Ash Generated

The total ash generated is calculated one of two ways. If the boiler in question used only one solid fuel during the year, Formula 1 is used. If the boiler in question used more than one solid fuel, the alternative method described below was used.

If a boiler used only one solid fuel, it is by definition the primary fuel. Thus, total ash content is calculated by taking the total primary fuel input and multiplying by the annual average ash content. The factor of 100 converts the ash content from a percent value to a fraction.

Formula 1: Z7 * AD7 / 100

If more than one solid fuel was used during the year, the ash content was calculated on the Boiler_Fuel spreadsheet and then transferred to the NETL Coal Database. The calculation simply sums the product of total annual fuel consumption and annual average ash content for each solid fuel. It was assumed that all gas and liquid fuels had ash contents of zero. Because the data were not provided on the Boiler_Fuel spreadsheet, the following solid fuel ash contents were assumed:

- Petroleum coke 1.5%
- Tire-derived fuel 1.5%

- Wood-derived solids 1.5%
- Municipal solid waste 5.0%
- Other biomass solids 5.0%

Typically, the quantity of alternative fuels used is small so that the assumed ash content has little impact on total ash generated.

This calculation was performed using a macro coded with Visual Basic for Applications (VBA), thus the above mentioned formula is not stored in the cells.

Column DK – Total Fly Ash Generated

Total fly ash generated is another quantity that is reported on a plant-wide basis rather than an individual boiler basis. The fly ash is pro-rated between boilers based on the total ash generated per boiler as calculated in the previous column. Using the five unit Barry Plant (ORISPL code is 3) as an example, the formula is as follows:

Formula 1: DJ6 / SUM(DJ6:DJ10) * {Input from column R, spreadsheet F_767_Plant}

Formula 2: DJ7 / SUM(DJ7:DJ10) * {Input from column R, spreadsheet F_767_Plant}

And so on for each of the units within the plant.

Column DL – Fly Ash Sold as a Byproduct

Fly ash sold is reported on a plant-wide basis rather than an individual unit basis. It is assumed that if a plant has sales of fly ash that the ash came from all units in proportion to the total fly ash generated per unit. Thus, using the EC Gaston plant (ORISPL code 26) as an example, the formulas are as follows:

Formula 1: DK20 / SUM($DK$20:$DK$24) * {Input from column V, spreadsheet F_767_Plant}

Formula 2: DK21 / SUM($DK$20:$DK$24) * {Input from column V, spreadsheet F_767_Plant}

And so on for each unit in the plant.

Column DM – Total Bottom Ash Generated

Total bottom ash generated is another quantity that is reported on a plant-wide basis rather than an individual boiler basis. The bottom ash is pro-rated between boilers based on the total ash generated per boiler as calculated in column DG. Using the five unit Barry Plant (ORISPL code 3) as an example, the formula is as follows:

Formula 1: DJ6 / SUM(DJ6:DJ10) * {Input from column X, spreadsheet F_767_Plant}

Formula 2: DJ7 / SUM(DJ6:DJ10) * {Input from column X, spreadsheet F_767_Plant}

And so on for each of the units within the plant.

Column DN – Bottom Ash Sold as a Byproduct

Bottom ash sold is reported on a plant-wide basis rather than an individual unit basis. It is assumed that if a plant has sales of bottom ash that the ash came from all units in proportion to the total bottom ash generated per unit. Thus, using the Gorgas plant (ORISPL code 8) as an example, the formulas are as follows:

Formula 1: DM13 / SUM($DM$13:$DM$17) * {Input from column AB, spreadsheet F_767_Plant}

Formula 2: DM14 / SUM($DM$13:$DM$17) * {Input from column AB, spreadsheet F_767_Plant}

And so on for each unit in the plant.

Columns DO through DS – NEI CAP Particulate Matter Emissions Estimates

The information presented in these columns contains actual emissions from the plants. The emissions are collected from the NEI which was released in 2006 containing information from the year 2002. The information report in the NEI database is on a per plant basis and needs to be both broken down on a per unit basis and ratio in order to be comparable to the 2005 data. The ratio was created by calculating the 2002 total annual boiler heat input and comparing that with the 2005 total annual boiler heat input. The ratio for breaking the information up into a per unit basis is done by comparing the total boiler heat input for each unit. By combining these ratios and simplifying them, Formula 1 is created.

Formula 1: Input from NEI *(AB13)/(SUM(EY13,EY14,EY15,EY16,EY17))

Columns DT through EA – AP42 Fine Particulate Emissions Estimates

The information presented is based on emission factors (pounds of emissions per tons of coal burned) contained in the EPA publication, AP-42, Fifth Edition, which is a compilation of emission factors. The factors are based on actual measurements and are rated A through E with A representing the most reliable factors and E the least reliable. The majority of the emission factors based on size specific particulate emissions are rated D and E, with only one being rated C. Therefore, the user should view the information in these columns as being only semi-quantitative. AP-42 does not contain $PM_{2.5}$ and PM_{10} information for all coal/boiler/control device combinations found in the database. Where it was felt that the factor for a listed combination would reasonably represent an unlisted combination, that factor was used. In other cases, NL is entered to indicate that insufficient data were available to make the estimate.

Columns DT, DU, and DV

These columns represent the estimated annual $PM_{2.5}$, PM_{10}, and total PM controlled emissions based on the appropriate AP-42 factor, coal consumption, and ash content of the coal being fired. The exception is that the emission factors for stokers do not require the ash content of the coal. Note that the source data used for the database does not specify the type of stoker, so the factors for spreader stokers were applied to all stokers. The formula used for PC boilers and cyclone is given in Formula 1 and for stokers in Formula 2:

Formula 1: Z7 * 1000 * (AP42EmissionFactor * AD7) / 2000
Formula 2: Z7 * 1000 * AP42EmissionFactor / 2000

Where Z7 is the annual coal consumption in thousands of tons and AD7 is the ash content of the coal in weight %. The 1000 multiplier converts coal consumption to tons and the 2000 multiplier converts pounds of emission to tons.

And so on for each unit in the plant.

Columns DW and DX – Allowable $PM_{2.5}$ and PM_{10} Emissions

Since the majority of plants have their emission limits expressed in lb/mm Btu, all other plant emission limits were converted to this basis using the appropriate design data and the results are displayed in column GJ. This column is used in calculating the allowable annual emissions (in tons) based on plant heat input as follows:

Formula 1: Z7 * 1000 * AA7 / 10^6 * GI7 * (DT7 / DV7)

Where Z7*1000 is the annual coal throughput, AA7 is the heat content in Btu/lb, GI7 is the allowable emission, rate in lb/mm Btu, DT7/DV7 is the ratio of $PM_{2.5}$ emission to total emissions and 10^6 converts Btu to mm Btu. The conversions for tons of coal to pounds and emissions from pounds to tons are not shown since they mathematically cancel. The calculation for allowable PM_{10} is similar except that column DU replaces column DV.

And so on for each unit in the plant.

Columns DY and DZ – Typical $PM_{2.5}$ and PM_{10} Emissions

The numbers in these columns are typical for the individual plant based on actual PM emissions during the data year. The formula used in these calculations is:

Formula 1: Z7 * 1000 * AA7 / 10^6 *DI7 * (column DU / column DV)

Where DI7 is the actual emission rate for the unit in lb/mm Btu with all other variables are the same as for "Allowable Emissions."

And so on for each unit in the plant.

Column EA – Fraction of $PM_{2.5}$ in Controlled PM Emissions

This column is simply the ratio of column DT to column DV.

Column EH – Total Ash Collection and Disposal O&M Costs

Reported on a plant-wide basis, total ash collection and disposal O&M costs were pro-rated among units based on the total ash generated per unit. The F_767_Plant spreadsheet provides collection and disposal costs for fly ash and bottom ash. The four individual costs were summed in column CB of the Plant spreadsheet. Thus, using the Barry plant (ORISPL code 3) as an example, the formulas are as follows:

Formula 1: DJ6 / SUM($DJ$6:$DJ$10) * {Input from column CB, spreadsheet F_767_Plant}

Formula 2: DJ7 / SUM($DJ$6:$DJ$10) * {Input from column CB, spreadsheet F_767_Plant}

And so on for each unit in the plant.

Column EI – Fly Ash Byproduct Sales Revenue

Fly ash byproduct sales revenue is reported on a plant-wide basis rather than an individual unit basis. It is assumed that if a plant has fly ash sales revenue that the revenue came from all units in proportion to the total fly ash sold per unit. Thus, using the Widows Creek plant (ORISPL code 50) as an example, the formulas are as follows:

Formula 1: DL26 / SUM($DL$26:$DL$30) * {Input from column BJ, spreadsheet F_767_Plant}

Formula 2: DL27 / SUM($DL$26:$DL$30) * {Input from column BJ, spreadsheet F_767_Plant}

And so on for each unit in the plant.

Column EJ – Bottom Ash Byproduct Sales Revenue

Bottom ash byproduct sales revenue is reported on a plant-wide basis rather than an individual unit basis. It is assumed that if a plant has bottom ash sales revenue that the revenue came from all units in proportion to the total bottom ash sold per unit. Thus, using the AES Petersburg plant (ORISPL code 994) as an example, the formulas are as follows:

Formula 1: DN243 / SUM($DN$243:$DN$248) * {Input from column BK, spreadsheet F_767_Plant}

Formula 2: DN246 / SUM($DN$243:$DN$248) * {Input from column BK, spreadsheet F_767_Plant}

And so on for each unit in the plant.

Column EK – Intermingled Ash Byproduct Sales Revenue

Intermingled ash byproduct sales revenue is reported on a plant-wide basis rather than an individual unit basis. It is assumed that if a plant has intermingled ash sales revenue that the revenue came from all units in proportion to the total ash generated per unit. Thus, using the GRDA plant (ORISPL code 165) as an example, the formulas are as follows:

Formula 1: DJ58 / SUM($DJ$58:$DJ$59) * {Input from column BL, spreadsheet F_767_Plant}

Formula 2: DJ59 / SUM($DJ$58:$DJ$59) * {Input from column BL, spreadsheet F_767_Plant}

And so on for each unit in the plant.

Column EO – Cooling Water Annual Average Withdrawal Rate

In some cases where multiple cooling water systems were reported for a single plant, a total withdrawal rate was provided for the combined systems rather than individually. In those cases the withdrawal rate was pro-rated among systems based on the nameplate capacity of the associated turbine/generator. Thus, using the Cholla plant (ORISPL code 113) as an example, the formulas are as follows:

Formula 1: AK44 / SUM($AK$71:$AK$47) * {Input from column F, spreadsheet F_767_Cooling_System}

Formula 2: AK45 / SUM($AK$44:$AK$47) * {Input from column F, spreadsheet F_767_Cooling_System}

And so on for each cooling system included in the total annual average withdrawal rate.

Column EP – Cooling Water Annual Average Discharge Rate

The same methodology was used as for the previous column.

Column EQ – Cooling Water Annual Average Consumption Rate

The same methodology was used as for column FF.

Column EV – Annual Quantity of Chlorine Added to Cooling Water

In cases where total chlorine is specified for multiple cooling systems, the amount of chlorine is pro-rated among individual systems in one of two ways. If all of the cooling systems are of the same type, chlorine is pro-rated based on the average annual cooling water withdrawal rate (Formula 1).

Formula 1: AK44 / SUM($AK$44:$AK$47) * {Input from column M, spreadsheet F_767_Cooling_System}

And so on for each cooling system associated with the total chlorine input.

Column FF – Total Installed Cost of Cooling System

Total installed cost of the cooling system is pro-rated according to the annual average withdrawal rate in the same manner as Formula 1 for column FM. In this case, the input comes from column AH of F_767_Cooling_System.

Appendix C – Information Request Categories

The Access version of the database opens with a form requesting the user to select an information type. The information types are groups of information that will be displayed once the user selects the corresponding box. The information types are broken out below with each associated column name listed.

Plant Location:

The plant location information is default information that will always be viable on the results form.

Plant Location State	Plant Location County	Plant Location Latitude (degrees)	Plant Location Longitude (degrees)
EPA Region	NERC Region	Census Division	

Boiler Information:

Boiler ID	Boiler In Service Date	Boiler Age as of 8/8/2007 (years)	Boiler Status
Boiler Manufacturer	Boiler Hours Under Load	Boiler Max Continuous Steam Flow at 100% Load (1000 lb/h)	Boiler Design Coal Firing Rate (tons/h)
Boiler Efficiency (Primary Fuel) at 100% Load (%)	Boiler Total Air Flow (Including Excess Air) at 100% Load (scfm)	Boiler Firing Type (Primary Fuel)	Wet or Dry Bottom

Fuel Usage:

Primary Fuel	Coal Origin State (Largest Source in 2005)	Primary Fuel Consumed (1000 tons)	Average Annual Heat Content, Primary Fuel (HHV, Btu/lb)	Total Annual Boiler Heat Input, All Fuels (mm Btu)
% of Total Annual Boiler Heat Input from Primary Fuel	Average Annual Ash Content, Primary Fuel (%)	Average Annual Sulfur Content, Primary Fuel (%)	Primary Alternate Fuel That Can be Burned	Year Alternate Fuel Last Burned

Generator:

Generator ID	Generator Nameplate Rating (MW	Net Annual Electrical Generation (MW-h)	Net Plant Heat Rate (Btu/kWh)	Turbine Capacity Factor

Pollutant:

Controlling Particulate Regulation	Particulate Emission Standard	Particulate Emission Standard Units	Particulate Regulation Compliance Year	Particulate Compliance Strategy
PM 25 Filterable (tons)	PM 25 Primary (tons)	PM 10 Filterable (tons)	PM 10 Primary (tons)	PM Condensable (tons)
AP42 PM25 Filterable (tons)	AP42 PM10 Filterable (tons)	AP42 Total PM Filterable (tons)	PM25 Emission Allowable (tons)	PM10 Emission Allowable (tons)
PM25 Emission Typical (tons)	PM10 Emission Typical (tons)	Fraction of PM25 in Controlled PM Emissions	Controlling SO2 Regulation	Phase Designation
SO2 Emission Standard	SO2 Emission Standard Units	SO2 Regulation Compliance Year	SO2 Compliance Strategy	Annual SO2 Emissions (tons)
Annual SO2 Emissions (lb/mm Btu)	CO2 Emissions (tons)	Annual Actual NOx Emission Rate (lb/mm Btu)	Total Annual Boiler heat input, all fuels (2002)	Annual Controlled NOx Emission Rate (lb/mm Btu)
May-Sept Controlled NOx Emission Rate (lb/mm Btu)	Annual NOx Emissions (tons)	FGD Unit ID	FGD Unit Status	FGP Unit ID
FGP Unit Status				

Solid Waste:

Total Ash Generated (1000 tons)	Fly Ash Generated (1000 tons)	Fly Ash Sold as By-Product (1000 tons)	Total Bottom Ash Generated (1000 tons)	Bottom Ash Sold as By-Product (1000 tons)
Design Fuel Spec for Coal Ash (%)	Ash Collection and Disposal O&M Costs (1000 $)	Fly Ash By-Product Sales Revenue (1000 $)	Bottom Ash By-Product Sales Revenue (1000 $)	Intermingled Ash By-Product Sales Revenue (1000 $)
Sorbent Type	Sorbent Quantity (1000 tons)	FGD Waste Plus Salable By-Products Generated (1000 tons)	Gypsum Generated (1000 tons)	Gypsum Sold as By-Product (1000 tons)
FGD Sludge Generated (1000 tons)	FGD Sludge Sold as By-Product (1000 tons)	By-Product Sales Revenue (1000 $)		

Pollutant Control Device:

FGP Unit ID	FGP Unit Status	FGP Primary Unit Type 1	FGP Secondary Unit Type	Unit In Service Date
Annual FGP Unit In Service Hours	Actual Annual Particulate Removal Efficiency (%)	Particulate Removal Efficiency at 100% Load (%)	Particulate Emission Rate at Operating Conditions (lb/mm Btu)	Design FGP Collection Efficiency (%)
Design Particulate Emission Rate (lb/h)	Design FGP Collector Exit Gas Flow Rate (acfm)	Design FGP Collector Exit Gas Temperature (deg F)	Design Fuel Spec for Coal Sulfur (%)	FGP Collector Installed Cost (1000 $)

Cooling Water:

Cooling System ID	Cooling System Status	Cooling Water Source	Primary Cooling System	Secondary Cooling System
Cooling System In Service Date	Cooling Water Annual Average Withdrawal	Cooling Water Annual Average	Cooling Water Annual Average	CW Maximum Intake Temp,

	Rate (cubic ft/s)	Discharge Rate (cubic ft/s)	Consumption (cubic ft/s)	Winter Peak Load Month (deg F)
CW Maximum Intake Temp, Summer Peak Load Month (deg F)	CW Maximum Discharge Temp, Winter Peak Load Month (deg F)	Maximum Discharge Temp, Summer Peak Load Month (deg F)	Chlorine Added to CW (1000 lb)	Cooling Pond In Service Date
Cooling Pond Total Volume (acre-ft)	Cooling Tower In Service Date	Cooling Tower Type Details	Cooling Tower Design Water Flow Rate (cubic ft/s)	Cooling Tower Design Power Requirement (MW)
Installed Cost of Cooling Ponds (1000 $)	Installed Cost of Cooling Tower (1000 $)	Installed Cost of Chlorine Eqp't (1000 $)	Total Installed Cost of Cooling System (1000 $)	

Stack:

Stack ID	Flue ID	Stack (or Flue) Status	Stack (or Flue) In Service Date	Flue Height at Top from Ground Level (ft)
Cross-Sectional Area at Top of Flue (ft^2)	Flue Gas Exit Temperature, Summer (deg F)	Flue Gas Exit Temperature, Winter (deg F)	Design Flue Gas Exit Rate (acfm)	Design Exit Temperature (deg F)
Design Exit Velocity (ft/s)				

Appendix D – Step by Step Instructions to Creating Pivot Tables[4]

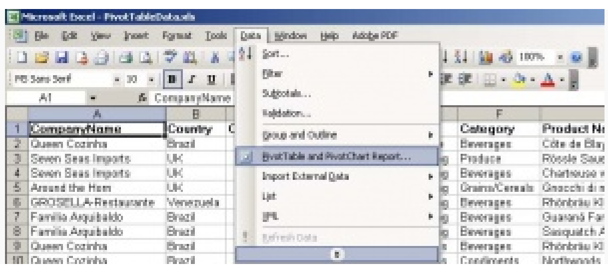
A PivotTable is an interactive table program that allows the user to group and summarize large amounts of data in a concise, tabular format for easier reporting and analysis. One advantage of this feature in Excel is that it allows you to rearrange, hide, and display different category fields within the PivotTable to provide alternate views of the data.

Creating a pivot table:

1. Start Microsoft Excel.

2. Download the data used for this exercise at [PivotTable source file] so you can follow along. (data link: http://www3.ns.sympatico.ca/mdelaney/pivottabledata.xls)

3. Click on the Data menu and choose PivotTable and PivotChart Report.



4. Answer the questions presented as follows:

[4] This tutorial was provided by wikiHow—a free resource that helps millions of people by offering solutions to the problems of everyday life. http://www.wikihow.com/Create-Pivot-Tables-in-Excel

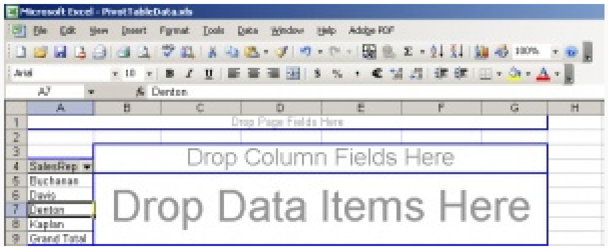
5. Specify the location of the data you are going to summarize. If you have your data in an Excel list that is currently open, Excel will automatically select the cell range.

6. Click Next.

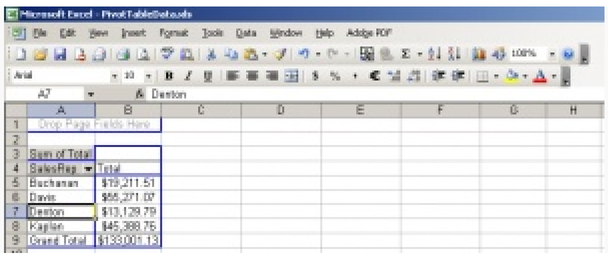
7. Ensure the New Worksheet option is selected after you click Next from the previous step, and then click Finish.

8. Assemble the PivotTable. The PivotTable field list can be a lifesaver for new and advanced users alike.

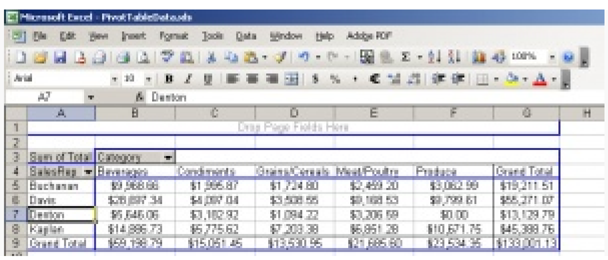
9. Looking at the data, let's say you want to see how your sales representatives did. Add SalesRep field to the Row area. To do that, click on SalesRep, change the dropdown to Row Area and click Add.



10. Next, add the Total field to the Data area.



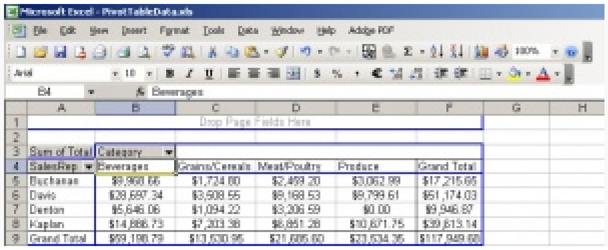
11. That just tells you how much of everything they sold, but what if you want to see how much in each category? Add the Category field to the Column area.



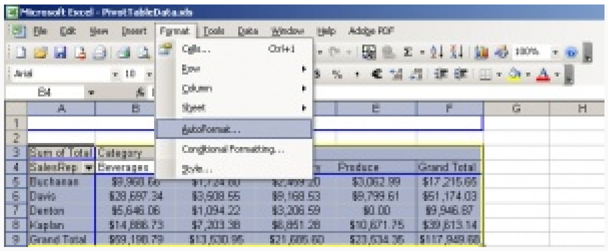
12. 

Supposing you don't want the Condiments category as part of the analysis, click on the dropdown arrow beside Category and deselect Condiments.

13. Click OK. Notice how the Grand Totals have been recalculated to not include results from the Condiments category...



14. To make a PivotTable attractive, there are a multitude of AutoFormats available. Click on the Format menu and choose AutoFormat.



Autoformat PivotTables

15. You're done, unless you want to do further analysis!

Other resources:

PivotTable report 101 – http://office.microsoft.com/en-us/excel/HA010346321033.aspx?pid=CH010714011033

Free online courses:

PivotTable I: What's so great about PivotTable reports? - http://office.microsoft.com/training/Training.aspx?AssetID=RC010136191033&CTT=6&Origin=RC010136191033

PivotTable II: Swing into action with PivotTable reports – http://office.microsoft.com/training/training.aspx?AssetID=RC010286901033&pid=CH062528071033