Poster Session - Platform Presentation

An Analysis Is Only as Good as the Data on which it Is Based: EIA Electric Power Surveys and Their Quality Assurance Reviews

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An analysis is only as good as the data on which it is based.

How many times has that statement been made, but how often is this statement considered before analysts analyze data and modelers run data through their models? Too often, it is too late. The process is too far along to allow corrections to the data when problems are found; at least parts of the analysis will be flawed.

In processing data and developing emissions inventories for utilities and – with the multiple structural changes in the electric power industry – nonutilities, it has become increasingly clear that although overall data quality may be good, frequently there are data problems that can easily be identified and corrected. It could be that those incorrect data will cause distinct problems for certain analyses and should be corrected before they are applied. Although State data and other data collected by EPA are often used in developing emission inventories, electric power data are most often obtained from the Energy Information Administration (EIA), a quasi-independent Department of Energy agency that is charged with legally collecting and publicly providing data. Electric power data can be obtained from its website at www.eia.doe.gov/cneaf/electricity/page/data.html.

The two major EIA electric power data surveys that will be reviewed are the EIA-767 ("Annual Steam-Electric Plant Operation and Design Report") and the EIA-860B ("Annual Electric Generator – Nonutility"). Comparisons will be made to other electric power data surveys, namely the EIA-860A ("Annual Electric Generator Report – Utility"), the EIA-759 ("Monthly (Utility) Power Plant Report"), the EIA-900 ("Monthly Nonutility Power Plant Report"), and the EPA's Emissions Tracking System/Continuous Emissions Monitoring (ETS/ CEM) data.

The two useful detailed checklists specify which EIA electric power survey data elements to look at to determine internal consistency within each survey form; which data elements to compare between consecutive years of each data form; and which similar data elements to compare across different electric power survey forms. These tools, if implemented, will allow electric power industry data developers, as well as modelers and analysts, to become more confident that the electric power data they are using are consistent and robust.

Annual Steam-Electric Operation and Design Report (EIA-767)
Data Files Checklist

I. Internal Consistency (checking among the different EIA-767 files from the same year)

A. Monthly Compared to Annual Fuel Totals

Check that for all boilers with fuel (and for every fuel at the boiler) in the BFUEL.dbf file that the twelve monthly totals add up to the annual total in this file.

B. Missing Records

In previous years there were examples of records being 'missing' from one or more of the data files. Compare all records in the PINFO file for the presence of records in other files. Look at the files below first, as these concerned us in the past. Remember that if a plant is less than 100 MW it is not required to fill out the generation section, cooling system information, flue gas particulate collector information, or flue & stack pages of the survey.

1. Note any generator ID records in GINFO.dbf that do not have a match in PCONFIG.dbf.

2. Note any plants that have at least one boiler in BFUEL.dbf with positive fuel use, but that do not have any generators with positive generation in GINFO.dbf.

C. Missing Data

In previous years there were examples of data being 'missing' from one or more of the data files. Check every variable in all of the data bases for variables that should always be present and/or nonzero, but are not. Look at the variables below first, as these have concerned us in the past. Remember that if a plant is less than 100 MW it is not required to fill out the generation section, cooling system information, flue gas particulate collector information, or flue & stack pages of the survey.

1. In BFUEL.dbf, when coal consumption is positive, coal heat, sulfur, and ash content should be positive as well; when oil consumption is positive, oil heat and sulfur content should be positive as well; when gas consumption is positive, gas heat content should be positive as well.

2. Maximum continuous steam flow at 100% load should not be zero (for non nuclear boilers) in BDESIGN.dbf.

3. Check if all variables except the year are zero or missing in CANNUAL.dbf, CDESIGN.dbf, RANNUAL.dbf, or RDESIGN.dbf for any records; in previous years there were some cases, but there should not be any.

4. Each plant in the GINFO.dbf should have nonzero generation (only check when in one-to-one correspondence with a boiler and located at a plant with a

total nameplate capacity of greater than 100 megawatts).

5. Hours under load in BFUEL.dbf should be positive when the boiler has positive fuel consumption.

6. In PINFO.dbf, check that no plant names have been cut off. For example, 'Indian Point 3 Nuclear' was cut off as 'Indian Point 3 Nucle' last year.

7. In SDESIGN.dbf, check that no stack parameters are missing for any records. This includes HEIGHT, CROSSSECT, RATE100, TEMP100, and VEL100.

8. Check for any other missing data in the EIA-767 data files.

D. 'Other' Fuel Values

1. If any record in BFUEL has an 'other' fuel value, is there a corresponding 'other' fuel code always present for that month?

2. If there is an 'other' fuel code, is it the same 'other' fuel code for all months?

3. Check that all 'other' fuel codes are consistent throughout the file. For example, in last year's file both FO2 and F02 were present. (FO2 is correct in this instance.)

4. If the 'other' fuel code starts with OT (OT, OTL, OTG, or OTS) and is, therefore, a nonstandard 'other' fuel code; is there a corresponding supplemental note in the printed footnotes received from EIA?

E. Special Cases

Are there any 'special' cases that need to be noted? Examples from previous years are:

1. Venice (ORISPL=913) had a generator 1-6 and Sixth Street (ORISPL=1058) had a generator 1-2 in the PCONFIG file, as IDs for only five generators are allowed.

2. Sterlington (ORISPL=1404) had a generator 7ABC since EIA informed us that this plant's generator is knowingly allowed to differ from the EIA-860A's separate generator designations of 7A, 7B, and 7C.

3. Louisiana 1 (ORISPL=1391) had a boiler ALL, Mayo (ORISPL=6250) had boilers 1A and 1B, Roxboro (ORISPL=2712) had boilers 3A, 3B and 4A, 4B, Mountain Creek (ORISPL=3453) had boilers 3A and 3B, Handley (ORISPL=3491) had boilers 1A and 1B, Glen Lyn (ORISPL=3776) had boilers 51 and 52, and North Branch (ORISPL=7537) had boilers A and B which do not appropriately report fuel data on the boiler level.

II. Previous Year Consistency (checking against EIA-767 files of the previous year)

A. Compare against the previous year and delineate those plants/boilers/generators that are present with positive fuel data in the previous year, but are not present with positive fuel data in the current year; and vice versa.

1. Check for plants with positive fuel use or nonzero generation in the previous year EIA-767 that do not have positive fuel use or nonzero generation in the current year EIA-767; and vice versa. Determine if these differences appear justified.

2. Check for boilers with positive fuel use in the previous year EIA-767 that do not have positive fuel use in the current year EIA-767; and vice versa. Determine if these differences appear justified.

3. Check for generators with nonzero generation in the previous year EIA-767 that do not have nonzero generation in the current year EIA-767; and vice versa.. Determine if these differences appear justified.

B. Compare 'other' fuels at each plant versus the previous year; note any differences and/or omissions and determine if these differences appear justified.

III. External Consistency (checking against other electric power data bases of the same year) Comparisons between like and identical data elements, as well as plant/boiler/generator inclusion among current year EIA-767/EIA-900 boilers, EIA-860A/EIA-860B generators, and Scorecard ETS/CEM boilers need to be made. Be sure to note that the data discrepancies between EIA-767 and each of the other data bases do **not** imply that the EIA-767 data are incorrect, but rather that there are inconsistencies that should be addressed. If there are fewer than twenty examples for any given problem, list them in the Word Perfect document; above this number, a separate Excel workbook will need to be created.

A. Comparisons with the EIA-759/EIA-900/EIA-906 of the same year

1. Delineate non-nuclear plants with positive fuel data that are included in the current year EIA-767 but not operating in the EIA-759/EIA-900/EIA-906 for the current year

2. List differences in plant names between the EIA-767 and the EIA-759/EIA-900/EIA-906 (excluding abbreviations, periods, commas, apostrophes, first names, and initials.)

3. List differences in operating company codes between the EIA-767 and the EIA-759/EIA-906. These differences will result in a different company operating a plant. Additionally, for each operator name difference, give an example of a plant operated by this operator.

4. List differences in operating company names (excluding abbreviations) between the EIA-767 and the EIA-759/EIA-906. Additionally, for each operator name difference, give an example of a plant operated by this operator.

5. Create a workbook with eight spreadsheets detailing when the current year steam, steam combined cycle, and nuclear prime mover EIA-759/EIA-900/EIA-906 data are compared with EIA-767 fossil fuel steam data (use EIA-767 units: thousand short tons for coal, thousand barrels for oil, and million cubic feet for gas). Include the thirty worst absolute value and percent change differences in the quantities of coal, oil and gas burned, as well as generation. Disregard differences of less than ten percent, as this is the cutoff used by EIA – this may result in fewer than thirty records for some of the comparisons. Whenever possible, research and list as footnotes explanations for the differences. Furthermore, bold the ten worst unexplained differences on each page.

6. Compare the 'other' fuel code provided in the BFUEL.dbf file, and the fuel description field from the EIA-759/EIA-900/EIA-906. Note if the fuel listed as being used in BFUEL.dbf is not present or has zero consumption and generation in the EIA-759. Be certain that these plants are all present with steam prime movers in the EIA-759/EIA-900/EIA-906 file.

B. Comparisons with the EIA-860A/EIA-860B of the same year

1. Check for generator IDs that differ from those in the current year EIA-860A/EIA-860B, but seem to be the same generator.

2. Delineate plants with positive fuel data that are included in the current year EIA-767 but not operating in the EIA-860A/EIA-860B for the current year

3. Check against EIA's sold plant list to make certain that all sold plants have had their operating status in the EIA-860A changed to 'SD', and that all of these plants have been added to the EIA-860B (if they have a facility nameplate capacity of at least one megawatt).

4. List differences in plant names between the EIA-767 and the EIA-860A/EIA-860B (excluding abbreviations, periods, commas, apostrophes, first names, and initials.)

5. List differences in operating company codes between the EIA-767 and the EIA-860A/EIA-860B. These differences will result in a different company operating a plant. Additionally, for each operator name difference, give an example of a plant operated by this operator.

6. List differences in operating company names (excluding abbreviations) between the EIA-767 and the EIA-860A/EIA-860B. Additionally, for each

operator name difference give an example of a plant operated by this operator.

7. List differences in county names (excluding abbreviations, the words ‘county’ or ‘parish’, etc.) between the EIA-767 and the EIA-860A.

8. Compare fuel use between the EIA-767 and the EIA-860B for any plants that are in the sold plants file. Since fuel use is reported at different levels in these two files (boiler level in the EIA-767 vs plant level in the EIA-860B), comparisons will be made at the plant level. Furthermore, we only need to ascertain that fuel use for each fuel is not greater in the EIA-860B than in the EIA-767, as these plants have transferred to the EIA-860B at some point during the year. (Note, if the plant was sold at or about January 1 of the given year, the fuel use data could legitimately be the same.)

C. Comparisons with the ETS/CEM data base of the same year

1. Delineate plants that have positive data in the ETS/CEM data base for the current year, but are not included in the current year EIA-767 with positive fuel data.

D. Comparison of latitudes and longitudes

1. Compare Pechan’s latest LATLON.dbf file with the current year EIA-767's latitude and longitude, after converting from degree-minute-second to a decimal number. List only those plants with latitudes and/or longitudes that differ by at least 0.5 degrees.

2. Map all latitudes and longitudes using GIS to determine if any plants are placed outside the county in which they are listed; if so list those plants that are more than five kilometers outside of their respective counties.

Annual Electric Generator--Nonutility (Form EIA-860B)
Data Files Checklist

I. Internal Consistency (checking among the EIA-860B files from the same year)

For any problems found in this section, note if the issue also existed in the previous year's file.

A. Missing Records

In previous years, there were examples of records being 'missing' from one or more of the data files. Compare all plants in NUPPFAC.dbf for the presence of records in other files. Look at the files below first, as they are the most critical. Remember that this is only relevant if the plant has either positive fuel data and/or positive generation in the relevant files.

1. Check that all generators with positive generation in GENERATOR.dbf match against a facility in NUPPFAC.dbf.

2 Check that all generators in GENERATOR.dbf match against a generator in GENENERGY.dbf and vice versa.

3. Check that all records in FUELQUAN.dbf match against a plant in NUPPFAC.dbf.

4. Check that all records in COGEN.dbf match against a plant in NUPPFAC.dbf.

5. Check that all records in NOXEQUIP.dbf match against a facility in NUPPFAC.dbf.

B. Missing Data

In previous years there were examples of data being 'missing' from one or more of the data files. Check every variable in all of the data bases for variables that should always be present and/or nonzero, but are not. Look at the variables below first, as these have been problems in the past. Remember that this is only relevant if the plant has known positive fuel data and/or positive generation.

1. List all plants which have zero total generation (in both NUPPFAC.dbf and GENERATOR.dbf) and zero total fuel use (in FUELQUAN.dbf). It is important to determine if these plants were in fact not in use during this year.

2. List all plants which have zero total fuel use (in FUELQUAN.dbf) but which have nonzero total generation (in either NUPPFAC.dbf and GENERATOR.dbf). It is important to determine if these plants did in fact have fuel use during this year. Note that all facilities which ONLY list energy sources in GENENERGY.dbf that do not use fuel (such as hydro, geothermal, solar, and wind turbine plants) should be removed from this list since they will not have fuel

consumption.

3. List all plants which have nonzero total fuel use (in FUELQUAN.dbf) but which have zero total generation (in both NUPPFAC.dbf and GENERATOR.dbf). It is important to determine if these plants did in fact have generation during this year.

4. In NUPPFAC.dbf, check for missing plant zip codes. These plant zip codes are needed to assign both county name and FIPS county codes for the plant.

5. In NUPPFAC.dbf, check for missing utility service area codes. This utility service area code is critical for aggregating the data from the facility to the correct aggregate entity. Additionally, check that all plants also have a utility service area name listed.

6. In NUPPFAC.dbf, check for missing net useful thermal energy values when there is a record for this facility in COGEN and when the facility is not listed as a bottoming cycle system in NUPPFAC.dbf.

7. In NUPPFAC.dbf, check for missing sulfur content values for coal when coal is present in FUELQUAN.dbf for a plant, for petroleum when petroleum is present in FUELQUAN.dbf for a plant, and for other fuels which have a sulfur content (for example municipal solid waste or tires – up to four such fuels can be listed in NUPPFAC.dbf per plant) when such a fuel is present in FUELQUAN.dbf for a plant.

8. In NUPPFAC.dbf, check that NAICS codes are given for all plants and that when the second NAICS code is filled in for a given plant that the first NAICS code is always filled in as well.

9. In NUPPFAC.dbf, check that for all plants there is both an owner code and an owner name given.

10. In NUPPFAC.dbf, check that for all plants that assert that they have been sold have a purchaser listed for that plant.

11. In FUELQUAN.dbf, list instances where a plant has a record with zero fuel use but nonzero heat content or for any instances where a plant has a record with positive fuel use with zero heat content.

12. In FUELQUAN.dbf, list instances where a plant has a record with no units of measurement for either fuel quantity or fuel heat content.

13. In COGEN.dbf, list instances where the applied thermal use is listed as ‘OT’ (other), but for which an ‘other’ applied thermal use description is not given in the

other applied thermal use field.

14. In NOXEQUIP.dbf, look for instances where the NO_x equipment code is listed as 'OT' (other), but for which an 'other' NO_x equipment description is not given in the other NO_x equipment code field.

C. Conflicting Data

In previous years there were examples of data in one or more of the data files conflicting with other data in the same or other data files. Check every variable which relates to other variables, starting with the variables below first; these have been problems in the past. Remember that this is only relevant if the plant has known positive fuel data and/or positive generation.

1. Check that the facility zip codes are in the State listed for that facility. For those which do not match, it is necessary to determine whether the zip code or the State listed is correct. It can sometimes be helpful to look at the previous year's EIA-860B files for corroboration.

2. Check that information regarding cogeneration is consistent between NUPPFAC.dbf and COGEN.dbf. There are three facets of this: list cases where the facility reported being a bottoming cycle system in NUPPFAC.dbf but the facility is not listed in COGEN.dbf; list cases where facilities are listed in COGEN.dbf but do not report either net utility thermal output or that the facility was a bottoming cycle system in NUPPFAC.dbf; and list cases where the facility reported both net utility thermal output and that it was a bottoming cycle system in NUPPFAC.dbf (Facilities are currently not supposed to report net useful thermal output if they are bottoming cycle systems, though the reason for this is unclear.).

3. Check that information regarding NO_x control equipment is consistent between NUPPFAC.dbf and NOXEQUIP.dbf. There are two facets of this: list cases where the facility reported having NO_x control equipment in NUPPFAC.dbf but the facility is not included in NOXEQUIP.dbf; and list cases where facilities are listed in NOXEQUIP.dbf but for which the facilities are not listed as having NO_x control equipment in NUPPFAC.dbf.

4. Compare the total facility generation reported in NUPPFAC.dbf with the sum of the generator level generation for that facility contained in GENERATOR.dbf. As these generation values should be identical, list those that are different and determine which is the correct value; for those that only differ by a few kilowatt-hours determine first if the problem is due solely to rounding error.

5. Compare the total nameplate capacity reported in NUPPFAC.dbf with the sum of the nameplate capacities for that facility contained in GENERATOR.dbf. As these nameplate capacity values should be identical, list those that are different and determine which is the correct value; for those that only differ by a few

kilowatts determine first if the problem is due solely to rounding error.

6. In NUPPFAC.dbf, check the file for cases where there is more than one owner name listed (at different plants) using the same owner code. It is critical that there be a unique relationship between owner code and owner name.

7. In NUPPFAC.dbf, check the file for cases where there is more than one utility service area listed (at different plants) using the same utility service area code. It is critical that there be a unique relationship between utility service area code and utility service area name.

8. In GENERATOR.dbf, check for those generators that report nonzero operating hours, but have zero generation reported for that generator. Also check for those generators that reported zero for their operating hours, but have nonzero generation reported for that generator.

9. In GENENERGY.dbf, check for single generators which have multiple fuels that are all listed as being the primary fuel (ignore those listed as 'CAN BE' primary fuel).

D. Out of Range Data

In previous years there were examples of data in one or more of the data files that were out of what would be considered a reasonable range. Check every variable to see if any values are extreme outliers, and if they are, check them for reasonableness; start with the variables below first, as these have been of concern in the past.

1. Examine carefully generator start dates before 1900, and start dates below 1930 for steam prime mover generators.

2. Examine net useful thermal energy values in NUPPFAC.dbf by carefully looking at those values which are extreme outliers, especially for those facilities with values above one billion (units are million BTU). In previous years, this has often been due to the form preparer filling in this value with values based on the incorrect units.

3. Examine all fuels individually in FUELQUAN.dbf. Sort by both quantity and heat content and carefully look at those values that are extreme outliers for each fuel. In previous years, this has often been due to the form preparer filling in the values with either the incorrect units or the data entry person adding or averaging the reported data incorrectly.

4. Examine all instances in FUELQUAN.dbf where there are 'other' fuels and determine if we are able to place each into a standard fuel category; report those for which we are unsure into which fuel category to place the fuel.

II. Previous Year Consistency (checking against EIA-860B files of the previous year)

A. Inclusion

1. Compare against the previous year and list those plants that are present in the previous year, but are not present in the current year; and vice versa. Determine if these differences appear justified.

2. Check to see if all utility plants sold during the data year (according to EIA's list) show up in the EIA-860B file.

B. Conflicting Data

1. Compare facility State locations for all plants with those from the previous year; list any plants for which the State has changed and determine which is correct. Check both against what the previous year EIA-860B originally lists as the facility State and any updates that we made, if appropriate. Facility zip code and facility city may be helpful in making this determination.

2. Compare utility area service codes for all plants with those from the previous year; list any plants for which the utility area service code has changed and determine which of the codes is correct. Check both against what the previous year EIA-860B originally lists and any updates that we made, if appropriate.

3. Compare generator start dates for all generators with those from the previous year; list any generators for which the generator's start date has changed; and determine which of the dates is correct.

4. Compare generator prime movers for all generators with the previous year; list any generators for which the generator's prime mover has changed; and determine which of the prime movers is correct.

5. Compare all owners, using owner codes, against the previous year; list any owner codes that have different owners between the two years.

III. External Consistency (checking against other electric power data bases of the same year)

Comparisons between like and identical data elements, as well as plant/generator inclusion among EIA-860A (for sold facilities only), EIA-767 (for sold facilities only), and the EIA-900/EIA-906 (for facilities greater than 50 MW only and when the data become available) need to be made. Be sure to note that the data discrepancies between EIA-860B and each of the other data bases do **not** imply that the data are incorrect, but rather that there are inconsistencies that should be addressed.

A. Comparisons with the EIA-860A (compare for sold facilities only) of the same year

1. Delineate plants with positive fuel data and/or generation that are included in the EIA-860B but are not present in the EIA-860A.

2. Delineate plants which are included in both the EIA-860A and the EIA-860B, but which are not listed as having been sold in the EIA-860A.

3. Delineate plants which are included in both the EIA-860A and the EIA-860B with different plant codes, meaning that they are actually duplicate records. For these cases, a determination must be made as to which of the records needs to be removed.

4. Check for generator IDs that differ from those in the EIA-860B, but seem to be the same generator.

5. List differences in plant names between the EIA-860B and the EIA-860A (excluding abbreviations, periods, commas, apostrophes, first names, and initials.)

6. List differences in county names (excluding abbreviations, the words 'county' or 'parish', etc.) between the EIA-860B and the EIA-860A.

7. List differences in facility State locations between the EIA-860B and the EIA-860A.

8. List differences in utility names between the EIA-860B and EIA-860A; compare only the utility service areas in the EIA-860B against the owners and/or operators with the same codes in the EIA-860A.

B. Comparisons with the EIA-767 (compare for sold facilities only) of the same year

1 Delineate plants with positive fuel data and/or generation that are included in the EIA-860B but not reported in the EIA-767 with positive fuel data and/or generation.

2. Check for generator IDs that differ from those in the EIA-860B, but seem to be the same generator.

3. List differences in plant names between the EIA-860B and the EIA-767 (excluding abbreviations, periods, commas, apostrophes, first names, and initials.)

4. List differences in county names (excluding abbreviations, the words 'county' or 'parish', etc.) between the EIA-860B and the EIA-767.

5. List differences in facility State locations between the EIA-860B and the EIA-767.

6. Examine fuel use by fuel for plants that were sold by utilities to nonutilities in either an earlier year relative to the data file (data should be within ten percent between the two files, as both contain the whole year of data), in the same year as the data file (data should be greater in the EIA-767 file, as it contains the whole year of data while EIA-860B only contains the portion of the year after the sale), or in a future year relative to the data file (data should not be present in the EIA-860B). List the differences.

C. Comparisons with the EIA-900/EIA-906 of the same year (for facilities greater than 50 MW only and when the data become available)

1. Delineate plants with positive fuel data and/or generation that are included in the EIA-860B but not listed in the EIA-900/EIA-906 with positive fuel data and/or generation and are greater than 50 megawatts.

2. List differences in plant names between the EIA-860B and the EIA-900/EIA-906 (excluding abbreviations, periods, commas, apostrophes, first names, and initials.)

3. List differences in facility State locations between the EIA-860B and the EIA-900/EIA-906.

4. For plants that report to the EIA-860B and the EIA-900/EIA-906, list differences in types of fuel used by each plant, as well as amount of plant fuel use for those fuels reported by both sources.

5. List differences in plant level generation between the EIA-860B and the EIA-900/EIA-906.

6. List differences in prime movers between the EIA-860B and the EIA-900/EIA-906.

7. List differences in owner name between the EIA-860B and the EIA-900.

8. List differences in operating company name between the EIA-860B and the EIA-906.

D. Comparisons with the EIA-861 of the same year

1. Check that all utility service area codes present in the EIA-860B are present as utility codes in the EIA-861.

2. Check that all utility service area names in the EIA-860B, matching on utility service area code, have the same utility name in the EIA-861.

E. Comparisons with the ETS/CEM of the same year

1. Check that all plants with positive emissions in the annual ETS/CEM file are in the EIA-860B, and that they have positive fuel use in the EIA-860B.

2. Check that all plants with positive emissions in the ozone season ETS/CEM file are in the EIA-860B, and that they have positive fuel use in the EIA-860B.

References

Energy Information Administration, "Annual Electric Generator Report – Nonutility," Form EIA-860B, Washington, DC.

Energy Information Administration, "Annual Electric Generator Report – Utility," Form EIA-860A, Washington, DC.

Energy Information Administration, “Annual Steam-Electric Plant Operation and Design Report,” Form EIA-767, Washington, DC.

Energy Information Administration, “Monthly Nonutility Power Plant Report,” Form EIA-900, Washington, DC.

Energy Information Administration, "Monthly (Utility) Power Plant Report," Form EIA-759, Washington, DC.

U. S. Environmental Protection Agency, Acid Rain Emissions Scorecard, Emissions Tracking System/Continuous Monitoring data, Washington, DC.