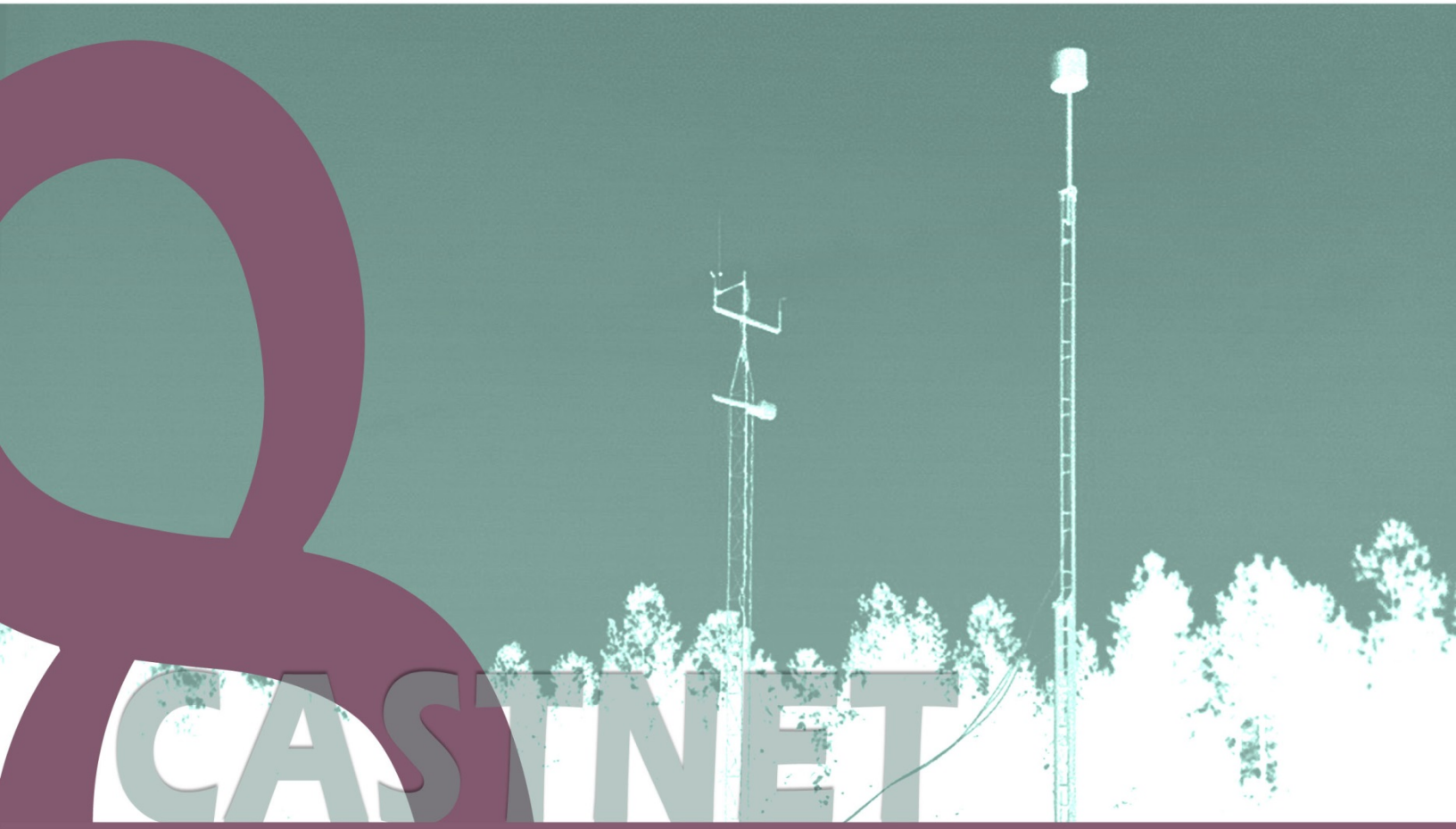
amec foster wheeler




# Appendix 6: CASTNET Data Operations Standard Operating Procedures

Revision 8.3

Prepared for: US Environmental Protection Agency

# Clean Air Status and Trends Network

# Quality Assurance Project Plan

Revision 8.3

**Appendix 6:**

# CASTNET Data Operations
# Standard Operating Procedures

October 2015

# TITLE: DATA ANALYSIS AND REPORTS

Effective Date: 11-9-11

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| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Mgr | 10/26/12 | |
| MS | QA Mgr | 10/30/13 | |
| MS | QA Mgr | 10/23/14 | |
| | | | |

# DATA ANALYSIS AND REPORTS

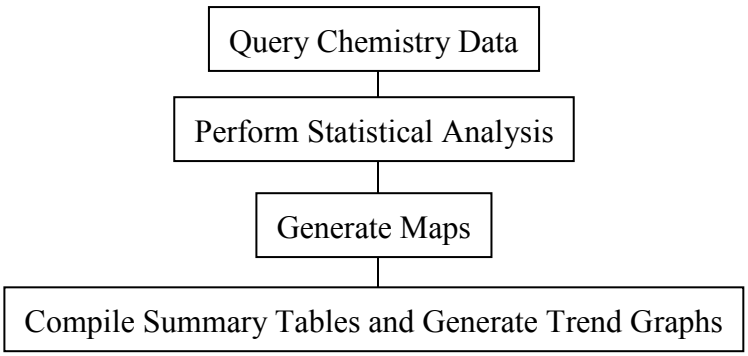
## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide guidance to AMEC E&I, Inc. (AMEC) Clean Air Status and Trends Network (CASTNET) Data Management Center (DMC) staff for performing the necessary data analysis and production of the required standard figures for CASTNET quarterly and annual data reports.

## 2.0 SCOPE

These processes apply to the preparation of standard quarterly and annual CASTNET reports. A working knowledge of Structured Query Language (SQL), Microsoft® Access™, MapInfo®, Microsoft® SQL Server™, and Microsoft® Excel™ is assumed.

## 3.0 SUMMARY




## 4.0 MATERIALS

Laptop or personal computer
Microsoft SQL Server
MapInfo
Microsoft Excel
Permissions and access to utilize databases

## 5.0 SAFETY

The same level of care and caution should be exercised while using the laptop/computer as would be taken when using any electrically powered device. Keep all cords out of walkways. If needed, use appropriately rated extension cords and surge protectors, and do not overload the electrical circuit. Keep liquids and food away from the computer and keyboard.

Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using

the computer. Take breaks regularly to allow muscles to relax and to promote blood flow, including standing up, briefly walking around the room, and stretching to counteract the repetitive motion activities and extended periods of sitting.

# 6.0 PROCEDURE

## 6.1 Quarterly Reports: Dry Chemistry

All analyses and figures described in this section are developed from atmospheric concentration data obtained from the three-stage filter pack installed weekly at all dry deposition-configured CASTNET sites.

> ***Note**: All query examples contained within Sections 6.1 through 6.3 refer to the CASTNet Second Quarter 2001 Data Report (Q2 2001 Report).*

### 6.1.1 Creating the DRYCHEM_REPORT table

Creation of dry chemistry concentration figures requires the use of a temporary table generated for the sole purpose of producing the quarterly report. This table, the DRYCHEM_REPORT, is created in the *castnet_working* database by first inserting all records from the DRYCHEM table, which is part of the *castnet* database. Before creating the table for the current quarterly report, verify that the table associated with the previous report was archived and deleted from the *castnet_working* database. The following query is used from the SQL Server™ Query Analyzer:

```
SELECT * INTO castnet_working.dbo.drychem_report FROM castnet.dbo.drychem
```

DRYCHEM records represent the archived Level 3 concentration data set. However, when analysis begins, this data set is usually not complete for every site for the quarter being reported. For example, when analysis commenced for the Q2 2001 Report, the maximum "date off" for site SUM156 was January 30, 2001. Since second quarter (Q2) concludes at the end of June, an additional five months of data were needed. To complete the data set for the quarter, the "Dry Chemistry Calculation Process" within the CASTNET Data Management System Application is run for the range of dates for which data are missing. This range is determined by finding the earliest maximum "date off" present among active sites (group by site_id) in the DRYCHEM table and the maximum "date on" needed to complete the quarter. Determination of which samples are included in a calendar quarter is based on the midpoint of the sample period. Therefore, the last week required to complete the quarterly sample period may extend into the next calendar quarter. For the Q2 2001 Report, Week 27 is the last sample needed as the midpoints fall on either 6/29/01 or 6/30/01, both within Q2. To determine the maximum ("date on") needed, the following query of the FILTER_PACK table (*castnet* database) is used:

```
SELECT
   lab_key,
   site_id,
   dateon,
   dateoff,
   CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)) AS mid_point
FROM
   filter_pack
WHERE
   lab_key LIKE '%01-27*%'
ORDER BY
   CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT (real,dateon))/2)) DESC
```

Examination of the “mid_point” results field indicates that all samples fall within the current quarter. Using the earliest maximum (“date off”) present for any site within DRYCHEM and the earliest “date on” for the last sample week needed to complete the quarter, enter the date range into the “Dry Chemistry Calculation Process,” and calculate concentrations for all sites. Once these calculations are completed, add the necessary records to the DRYCHEM_REPORT table using the following query:

```
INSERT INTO drychem_report(
     lab_key,
     site_id,
     type,
     dateon,
     dateoff,
     tso4,
     tso4_f,
     tno3,
     tno3_f,
     tnh4,
     tnh4_f,
     ca,
     ca_f,
     mg,
     mg_f,
     na,
     na_f,
     k,
     k_f,
     nso4,
     nso4_f,
     nhno3,
     nhno3_f,
     wso2,
     wso2_f,
     wno3,
     wno3_f,
     total_so2,
     total_no3,
     flow_volume,
     flow_volume_f,
     valid_hours,
     valid_hours_f,
     std2local_cf,
     temp_source,
     comment_codes,
     qa_code
)
SELECT
     drychem_temp.lab_key,
     drychem_temp.site_id,
     drychem_temp.type,
     drychem_temp.dateon,
     drychem_temp.dateoff,
     drychem_temp.tso4,
     drychem_temp.tso4_f,
     drychem_temp.tno3,
     drychem_temp.tno3_f,
     drychem_temp.tnh4,
     drychem_temp.tnh4_f,
     drychem_temp.ca,
     drychem_temp.ca_f,
     drychem_temp.mg,
```

```
      drychem_temp.mg_f,
      drychem_temp.na,
      drychem_temp.na_f,
      drychem_temp.k,
      drychem_temp.k_f,
      drychem_temp.nso4,
      drychem_temp.nso4_f,
      drychem_temp.nhno3,
      drychem_temp.nhno3_f,
      drychem_temp.wso2,
      drychem_temp.wso2_f,
      drychem_temp.wno3,
      drychem_temp.wno3_f,
      drychem_temp.total_so2,
      drychem_temp.total_no3,
      drychem_temp.flow_volume,
      drychem_temp.flow_volume_f,
      drychem_temp.valid_hours,
      drychem_temp.valid_hours_f,
      drychem_temp.comment_codes,
      drychem_temp.std2local_cf,
      drychem_temp.temp_source,
      drychem_temp.qa_code
FROM
   drychem_report RIGHT JOIN drychem_temp ON (drychem_report.lab_key = drychem_temp.lab_key)
WHERE
   drychem_report.lab_key IS NULL
```

The "RIGHT JOIN" in the "SELECT" statement (in combination with the "WHERE" clause) determines the records needed to complete the DRYCHEM_REPORT table.

### 6.1.2 Quarterly Mean Concentration Maps

Each quarterly report contains maps of time-weighted, mean concentrations for 11 atmospheric constituents. The maps are developed to show the following:

1. Sulfur dioxide ($SO_2$) – current quarter, current year [i.e., Q2 2001];
2. Particulate sulfate ($SO_4^{2-}$) – current quarter, current year;
3. Nitric acid ($HNO_3$) – current quarter, current year;
4. Particulate ammonium ($NH_4^+$) – current quarter, current year;
5. Particulate nitrate ($NO_3^-$) – current quarter, current year;
6. Total $NO_3^-$ – current quarter, current year;
7. Particulate calcium ($Ca^{2+}$) – current quarter, current year;
8. Particulate potassium ($K^+$) – current quarter, current year;
9. Particulate magnesium ($Mg^{2+}$) – current quarter, current year; and
10. Particulate sodium ($Na^+$) – current quarter, current year.
11. Particulate chloride ($Cl^-$) – current quarter, current year.

Quarterly mean concentrations require that 69 percent of the weeks during the quarter are valid. All samples are weighted based on their "runtime" (the length of time the filter pack is on the tower). For example, a sample that ran for two weeks is counted twice as much in the mean as a sample that ran for only one week. The midpoint of the sample period is used to determine which weeks are assigned to the quarter and year being analyzed. Formulas for the six major analytes

are as follows (See Section 6.1 for an explanation of the DRYCHEM table field names used in the formulas):

$SO_2$ = (0.667*nso4)+wso2,
$SO_4^{2-}$ = tso4,
$HNO_3$ = nhno3,
$NH_4^+$ = tnh4,
$NO_3^-$ = tno3, and
Total $NO_3^-$ = tno3+(0.9841*nhno3).

Maps developed for the quarterly report are based on tables in an Access™ database created expressly for this task. In this database, queries, such as the following one for $SO_2$ for Q2 2001, are used to calculate mean quarterly concentrations for all sites. Queries use SQL Server™ 7.0 syntax and are set up as SQL Pass Through Queries to directly access the SQL Server™ 7.0 tables. A "Make-Table" query in the Access™ database is used to access the SQL Pass Through Query and create the new data table:

```
SELECT
   drychem_report.site_id,
   DATEPART(qq,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) as
quarter,
   DATEPART(yy,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) as
year,
   100.0*(drychem_days.SO2_total_days)/(drychem_days.total_days) as pct_so2_2001,
   avg_so2_2001 =
      CASE
         WHEN 100.0*(drychem_days.SO2_total_days)/(drychem_days.total_days) > 69
         THEN (SUM(((0.667*nso4)+wso2)*(CONVERT(real,dateoff-
dateon))/(drychem_days.SO2_total_days)))
         ELSE null
      END
FROM
   castnet_working.dbo.drychem_report INNER JOIN castnet_working.dbo.drychem_days ON
   (castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id
AND
   DATEPART(qq,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) =
drychem_days.quarter AND
   DATEPART(yy,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) =
drychem_days.year)
```

```
WHERE
   (
   (DATEPART(qq,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) = 2) AND
   (DATEPART(yy,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) = 2001) AND
   ((nso4_f is null) OR (nso4_f='U') OR (nso4_f='L') OR (nso4_f='R') OR (nso4_f='#') OR
(nso4_f='S'))
AND
   ((wso2_f is null) OR (wso2_f='U') OR (wso2_f='L') OR (wso2_f='R') OR (wso2_f='#') OR
(wso2_f='S')) AND
   ((flow_volume_f is null) or (flow_volume_f ='L')) AND
   (drychem_report.site_id<> 'ASH235' AND drychem_report.site_id <> 'MCK231')
   )
GROUP BY
   drychem_report.site_id,
   DATEPART(qq,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))),
   DATEPART(yy,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))),
   drychem_days.total_days,
   drychem_days.SO2_total_days
```

To run queries to calculate the mean quarterly concentrations for each of the remaining five major analytes, replace [(0.667*nso4)+wso2] in the "CASE" statement with the formula for the specific analyte. Also, replace the flags in the "WHERE" clause (i.e., nso4_f) with the flag for the specific analyte. Verify that the target quarter and year are also set in the "WHERE" clause (shown in **underline/bold**). In addition, all references to the previously queried analyte (i.e., $SO_2$) must be changed to the current analyte of interest. For example, $SO_2$ is changed to the current analyte of interest in SO2_total_days, pct_SO2_2001, and average SO2 2001 (shown in **bold**).

The SQL Pass Through Queries in the Access™ database are dependent on the presence of the DRYCHEM_DAYS table in the *castnet_working* database. This table must be recreated for each quarterly report. It contains the number of total possible days for the quarter and the number of valid days present during the quarter for a specific site by analyte. DRYCHEM_DAYS is used to correctly weight individual samples included in the quarterly mean. See Attachment A for the full script used to create this table.

The fields contained in the DRYCHEM_DAYS table include:

- site_id
- quarter
- year
- actual_days
- total_days
- SO2_total_days
- SO4_total_days
- HNO3_total_days
- NO3_total_days
- NH4_total_days
- TOTNO3_total_days
- Ca_total_days
- K_total_days
- Mg_total_days
- Na_total_days

SQL Pass Through Queries are set up for the six major analytes, chloride, and the cations, $Ca^{2+}$, $K^{+}$, $Mg^{2+}$, and $Na^{+}$, for the relevant quarter for both the current and previous years. Although maps for previous years and maps of percent difference between years are no longer included in the reports, they can be useful as a quality control or data analysis tool. Once these queries are set up, an Access™ query is used to combine them into a table for each year. The SITE table is linked in the Access™ database and then joined with the relevant queries for each year to obtain latitude and longitude values for each site.

After these summary tables are created, the percent difference between each value for each site for the current quarter and the corresponding value for the same quarter of the previous year is calculated by joining the two tables on site_id, latitude, and longitude. The percent difference is calculated as:

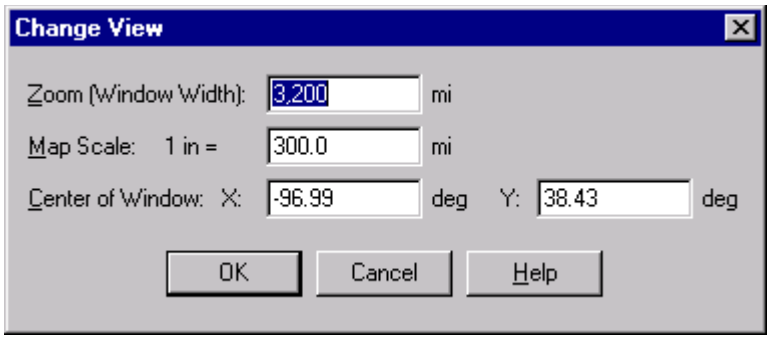
$$PercentDifference = 100 * \frac{([concentration\ from\ current\ quarter, year] - [concentration\ from\ previous\ quarter, year])}{[concentration\ from\ previous\ quarter, year]}$$

The Access™ database must now be set up as an open database connectivity (ODBC) data source for access by MapInfo®, the program used to create maps for quarterly and annual reports. Some maps in the annual reports may be produced using ArcGIS (www.esri.com/software/arcgis/). After opening MapInfo®, open the "WholeUSA" table (for the Jacksonville office, located in directory P:\castnet\logos_and_ publishing\base_maps\) to obtain a map of the continental United States. The following are the settings for the map:

- **Projection**: Under the "Map" menu option, select "Options." Click the "Projection" button. In the "Category" combo box, select "Region Equal-Area Projection." Then select "Equal Area Projection (North America)" from the "Category Members" list box.
- **Map Scale/Center Positioning**: To center the map for the preferred display, select "Map" and "Change View." The dialog box shown below (Figure 1) will display. Set the zoom to 3,200 miles and specify the map scale so that 1 inch = 300.0 miles. Finally, to center the window, enter the coordinates for the center position in degrees latitude and longitude as

38.40 and -96.97 respectively. The X dimension is longitude and values in the Northern Hemisphere must start with a negative value.

**Figure 1**




To access the data for the maps, select "Open DBMS Table" from under the "File" menu option. Select the ODBC data source that points to the Access™ database created for the current quarterly report. From the list of tables and queries provided, select one of the tables with data to map. Follow the import wizard and save the MapInfo® table in the directory created for the quarterly report. Before the data in a table is displayed on a map, it must be made mappable. The "Make Table mappable" command makes a table in a remote database mappable. Any MapInfo® table may be displayed in a table browser, but only a mappable table may have graphical objects attached and be displayed in a map window. To make a DBMS table mappable, choose the "Make DBMS Table Mappable" command under the "Table," then "Maintenance" menu listings. The "Select DBMS" dialog displays for selection of a DBMS table to make mappable. Once that appears, select a DBMS table, then choose "OK." The Make Table mappable dialog displays. Make the appropriate selections for your table, then choose "OK." The table is made mappable and may then be displayed in a map window.

In order to manipulate the values in the table, it must be unlinked from the Access™ database, which is accomplished by selecting "Unlink DBMS table…" under the "Table" then "Maintenance" menu listings.

Values on the maps for the six major analytes are shown with one significant figure past the decimal point. The four cations ($Ca^{2+}$, $K^{+}$, $Mg^{2+}$, and $Na^{+}$) and chloride are displayed with two significant figures past the decimal point. Data in the MapInfo® table are altered to provide this level of precision by selecting "Table Structure…" under the "Table" and then "Maintenance" menu listings. After the table has been selected from the list, all quarterly mean concentration fields are changed by selecting "decimal" from the "Type" combo box and entering "1" into the "Decimals" text box (enter "2" for the four cations). Make the change for all fields and then click "OK."

Points on the map must be created for all sites by selecting "Create Points…" under the "Table" menu option. Select the correct table name in the "Create Points for Table" combo box and click the "using symbol" button. Select the filled-in-circle from the "Symbol" combo box and set the font size to six. Verify that the X coordinates are from the longitude column and that the Y coordinates are from the latitude column.

The table and points just created are overlaid on the map by selecting "Layer Control…" under the "Map" menu option. Click "Add…" in the "Layers" area of the form and select the relevant table name. Click the box under the yellow tag that is associated with the table name. Click the "Label…" button. Select the appropriate field name in the "Label with" combo box. Click "Allow Overlapping Text." Click the upper right anchor point. Finally, click the "Aa" font button in the "Styles" area of the form. On the "Text Style" form, set the "Font" combo box to "Arial Narrow" and set the size to "10." Click the "Box" radio button in the "Background" area of the form.

The data analyst must determine the most efficient way to produce all 11 maps. If the Access™ tables are assembled correctly, batches of maps can be prepared by simply switching the column used as the label. Map labels **CAN** be moved and then switched but **CANNOT** be edited and then switched. For example, the anchor point can be changed, and then the label successfully switched. However, the label cannot be edited (i.e., changing 1 to 1.0) and then be followed by a successful label switch. Editing is most effectively done after all map workspaces have been created.

To complete a map, first verify that no labels are overlapping. This usually requires changing the anchor points for OXF122, MKG113, and CDR119 to the upper center position along with changing the anchor points for SHN418 and PED108 to the lower right position. All labels have one significant digit to the right of the decimal (two for the cation maps). If the value at a site is 1.0, the label displayed is 1. These instances must be edited manually by typing a ".0" after the number for all values meeting this description. Finally, MapInfo® substitutes zeroes for nulls when the MapInfo® table is created. Therefore, sites with null values display a zero instead of no label. These instances must also be edited manually by deleting the label. Before deleting a label, first verify that the value is actually null by reviewing the record for the specific site in the Access™ table created for the map.

Maps are saved in MapInfo® as a "Workspace" by selecting "Save Workspace" under the "File" menu option, and when final, exported as Enhanced Metafiles by selecting "Save Window As…" under the "File" menu item. Figure 2 shows an example of a quarterly mean concentration map.

**Figure 2** Quarterly Map Example for $SO_2$ (Q2 2001)

### 6.1.3 **Concentration Trends**

Trends in analyte atmospheric concentrations are produced each quarter. Trends for the quarter of interest are reported for the years 1990 through the current year. For example, the Q2 2001 Report contains second quarter mean concentrations for each year from 1990 through 2001. Only data from the 34-site sub-network of eastern reference sites are considered for inclusion. As with the mean concentration maps, preparation of quarterly trend graphs requires that 69 percent of the weeks during the quarter must be valid in order to calculate the quarterly mean concentrations used in the graphs. Again, the midpoint of the sample period is used to determine the weeks, quarter, and year assigned to the period. Quarters that do not meet this 69 percent criterion are completed either via interpolation or extrapolation. The interpolation and extrapolation are done manually in Microsoft® Excel™ using cell formulas prior to graphing.

Analyte specific queries similar to those used to create the mean concentration maps are used. As with the map queries, the DRYCHEM_DAYS table in *castnet_working* is used in the SQL Pass Through Query to correctly time-weight each sample included in the mean. In addition, the SITE_OPS table is joined with the DRYCHEM and DRYCHEM_DAYS tables. The presence of a "y" in the "continuous" field of the SITE_OPS table is used to designate sub-network sites for inclusion in the statistics. The following is an example of the query used to calculate mean

quarterly $SO_2$ concentrations. Again, these queries are set up as SQL Pass Through Queries in the Access™ database created to support the quarterly report:

```
SELECT
   drychem_report.site_id,
   DATEPART(qq,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) as
quarter,
   DATEPART(yy,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) as
year,
   100.0*(drychem_days.SO2_total_days)/(drychem_days.total_days) as pct_so2,
   avg_so2 =
      CASE
         WHEN 100.0*(drychem_days.SO2_total_days)/(drychem_days.total_days) > 69
         THEN (SUM(((0.667*nso4)+wso2)*(convert(float(8),dateoff-
dateon))/(drychem_days.SO2_total_days)))
         ELSE null
      END
FROM
   (castnet_working.dbo.drychem_report INNER JOIN castnet_working.dbo.drychem_days ON
   (castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id
AND
   DATEPART(qq,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) =
drychem_days.quarter AND
   DATEPART(yy,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) =
drychem_days.year))
   INNER JOIN castnet.dbo.site_ops ON (castnet_working.dbo.drychem_report.site_id =
castnet.dbo.site_ops.site_id)
WHERE
   (
   (DATEPART(yy,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))) >=
1990) AND
   ((nso4_f is null) OR (nso4_f='U') OR (nso4_f='L') OR (nso4_f='R') OR (nso4_f='#') OR
(nso4_f='S')) AND
   ((wso2_f is null) OR (wso2_f='U') OR (wso2_f='L') OR (wso2_f='R') OR (wso2_f='#') OR
(wso2_f='S')) AND
   ((flow_volume_f is null) OR (flow_volume_f ='L')) AND
   (continuous = 'y')
   )
GROUP BY
   drychem_report.site_id,
   DATEPART(qq,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))),
   DATEPART(yy,(CONVERT(datetime,((CONVERT(real,dateoff)+CONVERT(real,dateon))/2)))),
   drychem_days.total_days,
   drychem_days.SO2_total_days
```

SQL Pass Through Queries like the one above are then joined in a query with the SITE-YEAR-QUARTERS table, which must be included in the Access™ database. The purpose of this table is to list all possible quarters and years for each site. A right "JOIN" or left "JOIN" must be set up so that **all** records in the SITE-YEAR-QUARTERS table are included in the query output. This allows for placeholders to be inserted for quarters with no record present in the DRYCHEM_REPORT table. Use a "Make-Table" query to create a new table combining all of the quarterly means by site. Records are sorted by site_id, quarter, and year. Before the means are calculated, records must be inserted into the SITE-YEAR-QUARTERS table for the current quarter for all sites in the sub-network (i.e., 34 records are added each quarter).

**Table 1** Sample Insert for Site ALH157 for Q2 2001.

| site_id | quarter | year |
|---|---|---|
| ALH157 | 2 | 2001 |

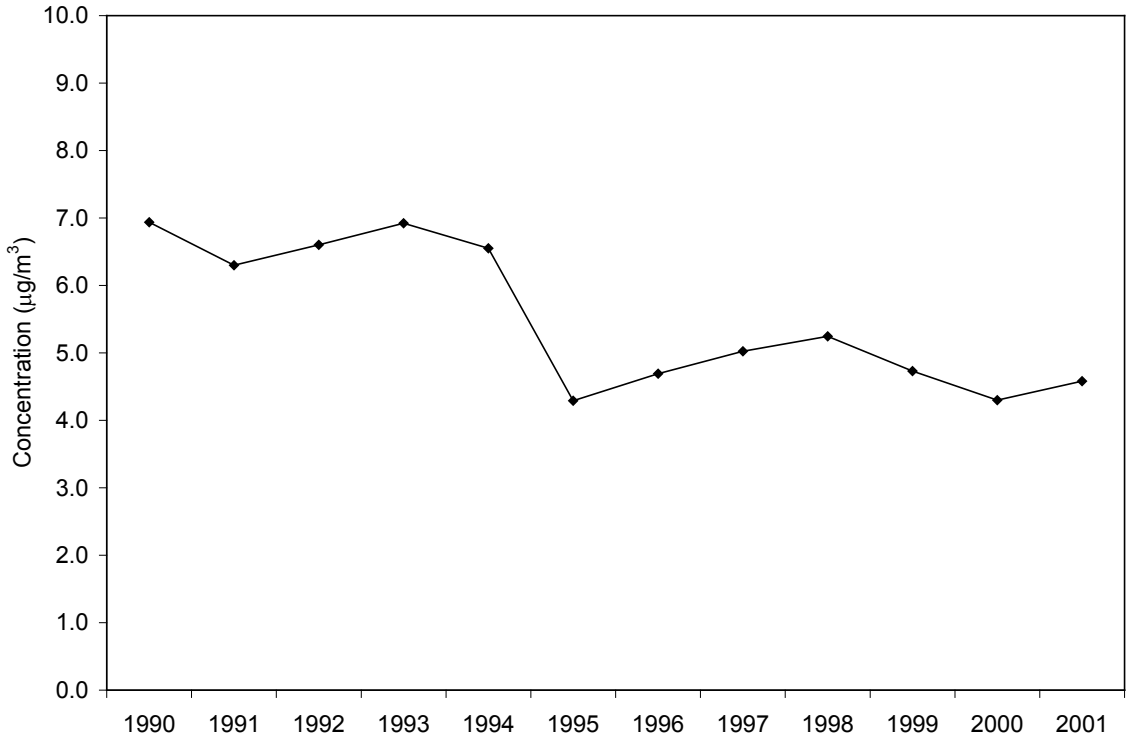
The results of the query are copied and pasted into Microsoft® Excel™ and sorted by site_id, quarter, and year. Missing values are identified and replaced by either interpolation (if values for surrounding years are valid) or extrapolation (if the missing quarterly mean is at the beginning or end of the period). Extrapolation is accomplished by copying and pasting the closest valid quarterly value while interpolation requires averaging the two surrounding valid means. After values for missing quarters are interpolated or extrapolated in Excel™, copy and paste the replaced values into the Access™ data table and average the values by quarter and year for the target quarter. The end result is a series of values for the specific quarter for each year since 1990.

**Table 2** Example of the Completed Concentration Trends Aggregation Process

| quarter | year | avg_hno3 | avg_nh4 | avg_no3 | Avg_so2 | avg_so4 | avg_totno3 |
|---|---|---|---|---|---|---|---|
| 2 | 1990 | 2.446 | 1.900 | 0.717 | 6.893 | 6.098 | 3.123 |
| 2 | 1991 | 2.433 | 2.073 | 0.745 | 6.279 | 6.671 | 3.137 |
| 2 | 1992 | 2.418 | 1.972 | 0.871 | 6.525 | 5.925 | 3.251 |
| 2 | 1993 | 2.281 | 1.789 | 0.739 | 6.776 | 5.468 | 2.983 |
| 2 | 1994 | 2.323 | 1.725 | 0.799 | 6.052 | 5.407 | 3.079 |
| 2 | 1995 | 2.322 | 1.635 | 0.801 | 4.223 | 4.813 | 3.085 |
| 2 | 1996 | 3.248 | 2.655 | 0.703 | 5.657 | 8.373 | 3.900 |
| 2 | 1997 | 2.110 | 1.504 | 0.937 | 5.013 | 4.173 | 3.013 |
| 2 | 1998 | 2.181 | 1.622 | 0.737 | 5.075 | 4.849 | 2.884 |
| 2 | 1999 | 2.463 | 1.587 | 0.809 | 4.700 | 4.731 | 3.231 |
| 2 | 2000 | 2.085 | 1.577 | 0.805 | 4.276 | 4.593 | 2.851 |
| 2 | 2001 | 2.149 | 1.709 | 0.784 | 4.516 | 5.080 | 2.898 |

These values are then plotted in Excel™ using the "Line" graph option. The Y-axis label [i.e., "Concentration ($\mu g/m^3$)"] and the axis tick mark values are set to size 14 in the Arial font. Y-axis labels are scaled with a zero set for the minimum and with a maximum that roughly centers the line in the middle of the scale. Figure 3 depicts an example of a trend graph for $SO_2$.

**Figure 3** Example of a Trend Graph for $SO_2$ (Q2 2001)




## 6.2 Quarterly Reports: Ozone

The second, third, and fourth quarter reports include two maps created from analysis of the ozone ($O_3$) 1-hour concentrations measured at most CASTNET sites. Due to low concentrations and inactive ozone seasons, no ozone figures are included in the first quarter report. Ozone statistics are calculated for the year-to-date as of the end of the quarter being reported. For example, fourth quarter maps show ozone analyses representing the entire year, not just the fourth quarter.

### 6.2.1 Preparation of the Ozone Data Set

As with the dry chemistry analysis, the ozone data set for the quarter being reported is generally not complete. Therefore, data still undergoing validation must be combined with Level 3 validated data to create the necessary data set. This is most easily accomplished using an Access™ database. First, link the METDATA table (in *castnet*) with the METDATA_L2 and METDATA_L1 (in *castnet_working*) tables. Since the record for a specific site and hour can only exist in one of these tables at one time, simply create a new table in the Access™ database and populate it with all relevant records for the time period of interest. For example, the ozone analyses in the second quarter report require hourly concentrations for January 1, 00:00 through June 30, 23:00. Insert all of the records from the three linked tables that fall between those dates into the new table.

### 6.2.2 **Fourth Highest Daily Maximum 8-Hour Concentrations**

Another map that is consistently created for quarterly reports shows the fourth highest daily maximum 8-hour $O_3$ concentration for each site (Figure 4). These values are calculated using a SQL script (Attachment B). Previously, those values were calculated using a SAS® program created by a CASTNET statistical data analyst (see Attachment C). The details of the calculation are given in *National 8-Hour Primary and Secondary Ambient Air Quality Standards* (EPA, 1997).

Specifications for this map are the same as for quarterly maps described in previous subsections. Labels are 10 point Arial Narrow font and are affixed to each site.

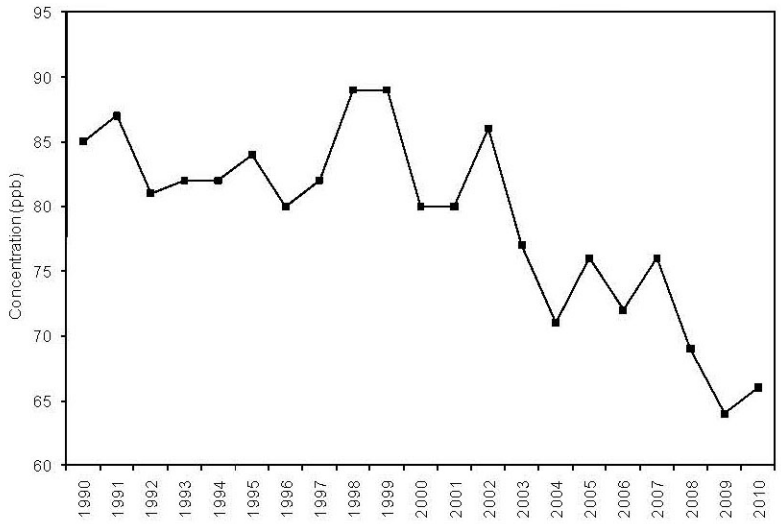
**Figure 4** Example of Fourth Highest Daily Maximum 8-Hour $O_3$ Concentrations (Q2 2001)

### 6.2.3 **Trends in Fourth Highest Daily Maximum Concentrations**

Trends in fourth highest daily maximum 8-hour $O_3$ concentrations are produced for second through fourth quarters. Due to low concentrations and inactive ozone seasons, no ozone figures are included in the first quarter report. Ozone statistics are calculated for the year-to-date as of the end of the quarter being reported. For example, fourth quarter trend graphs show ozone analyses representing the entire year, not just the fourth quarter. Trends for the quarter of interest

are reported for the years 1990 through the current year. For example, the Q2 2010 Report contains fourth highest daily concentrations for each year from 1990 through the second quarter of 2010. Only data from the 34-site sub-network of eastern reference sites are considered for inclusion. Values are calculated using a SQL script (Attachment B). Details of the calculation are given in *National 8-Hour Primary and Secondary Ambient Air Quality Standards* (EPA, 1997). These values are then plotted in Excel™ using the "Line" graph option. The Y-axis label [i.e., "Concentration (ppb)"] and the axis tick mark values are set to size 14 in the Arial font.

**Figure 5** Example of Fourth Highest Daily Maximum 8-Hour $O_3$ Concentrations (Q2 2010)




## 6.3 Quarterly Reports: Quality Assurance

### 6.3.1 Dry Chemistry Percent Completeness Statistics

Included with the other roles data management personnel play in preparing the quarterly report is calculation of percent completeness statistics for the following dry chemistry analytes. The DRYCHEM table field name for each filter type and its associated analyte(s) follow in parentheses:

- Teflon® $SO_4^{2-}$ (tso4)
- Teflon® $NO_3^-$ (tno3)
- Teflon® $NH_4^+$ (tnh4)
- Teflon® Cations $Ca^{2+}$, $K^+$, $Mg^{2+}$, $Na^+$ (ca, k, mg, na)
- Nylon $HNO_3$ (nhno3)
- Nylon $SO_4^{2-}$ (nso4)
- Whatman cellulose $SO_2$ (wso2)

Statistics are computed based on the 13 possible sample weeks assigned to each quarter as indicated by the sample number included in the lab_key. Samples that run for two weeks do not count twice in the denominator for that site. The DRYCHEM_REPORT table in *castnet_working* is joined with the REPORT_GROUP table in *castnet* in order to use the "collection" field, which records the quarter and year of a sample. To calculate a count of the valid samples by site, a query is set up as an SQL Pass Through Query in the database designated for the quarterly report. Each analyte must be calculated with a separate query. To do this, the appropriate field name must be substituted for each analyte. The query in the following example is used to calculate the valid sample count for the $SO_2$ derived from the Whatman filters for Q2 2001. The Whatman $SO_2$ is indicated by wso2 (shown **bolded**). The quarter is selected by the collection criteria, in this case, Q2 2001 (i.e., 2001q2, which is shown **underlined/bolded**):

```
SELECT
   site_id,
   COUNT(wso2) as wso2

FROM
   castnet_working.dbo.drychem_report INNER JOIN castnet.dbo.report_group ON
   (castnet_working.dbo.drychem_report.lab_key = castnet.dbo.report_group.lab_key)
WHERE
   (collection = '2001q2') AND
   (wso2_f is null OR wso2_f in ('U','L','R','#','S')) AND
   ((flow_volume_f is null) OR (flow_volume_f ='L'))
GROUP BY
   site_id
ORDER BY
   site_id
```

The results of the query are copied and pasted into an Excel™ spreadsheet. After counts for all of the analytes are calculated separately and grouped in the Excel™ spreadsheet, the counts are divided by 13 and then multiplied by 100 to give the percent completeness for the quarter. Special consideration is given to those cases in which a site began operation during the quarter or was intentionally shut down for a move or other major, planned refurbishment. In either case, the denominator of the equation is reduced from 13 to the number of possible weeks samples could have run. For example, site IRL141 began operating during third quarter 2001. The first sample was collected for Week 29. As no samples were possible for Weeks 27 and 28, the percent completeness for the quarter was calculated by dividing the counts by 11 instead of 13.

**Table 3** An example of one row from the final table:

| Site ID | Teflon® $SO_4^{2-}$ | Teflon® $NO_3^-$ | Teflon® $NH_4^+$ | Teflon® Minor Cations | Nylon $HNO_3$ | Nylon $SO_4^{2-}$ | Whatman $SO_2$ |
|---|---|---|---|---|---|---|---|
| IRL141 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

### 6.3.2 **Analysis of Collocated Filter Pack Samples**

Precision estimates for CASTNET dry deposition filter pack sampling are presented in each quarterly report as the mean absolute relative percent difference (MARPD) of the concentrations measured at two independent, collocated sites. The analytes with their associated DRYCHEM fields are shown below:

- $SO_4^{2-}$ = tso4
- $NO_3^-$ = tno3
- $NH_4^+$ = tnh4
- $Ca^{2+}$ = ca
- $Mg^{2+}$ = mg
- $Na^+$ = na
- $K^+$ = k
- $HNO_3$ = nhno3
- $SO_2$ = (0.667*nso4)+wso2
- Total $NO_3^-$ = tno3+(0.9841*nhno3)

Along with the MARPD, the mean for the primary site, the mean for the collocated site, and the mean absolute difference (MAD) for the quarter are displayed.

**Table 6** Precision Analysis at Collocated Sites Table Example (Q2 2001)

| MCK131/231 | $SO_4^{2-}$ | $NO_3^-$ | $NH_4^+$ | $Ca^{2+}$ | $Mg^{2+}$ | $Na^+$ | $K^+$ | $HNO_3$ | $SO_2$ | Total $NO_3^-$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $\overline{X}$ | 5.98 | 1.21 | 2.24 | 0.36 | 0.07 | 0.16 | 0.09 | 2.59 | 4.85 | 3.76 |
| $\overline{Y}$ | 5.98 | 1.31 | 2.27 | 0.40 | 0.07 | 0.22 | 0.09 | 2.59 | 4.95 | 3.86 |
| *MAD* | 0.20 | 0.14 | 0.08 | 0.04 | 0.01 | 0.06 | 0.01 | 0.16 | 0.32 | 0.27 |
| *MARPD* | 3.65 | 14.60 | 3.72 | 11.28 | 8.84 | 22.07 | 6.61 | 6.66 | 8.65 | 7.87 |

The formula for MAD is as follows:

$$MAD = Average\left(\left|X - Y\right|\right)$$

The formula for MARPD is as follows:

$$MARPD = Average\left[200 * \frac{(/X - Y/)}{(X + Y)}\right]$$

In order for values from a sample week to be included in the calculation, samples for both the primary and collocated sites must be valid and have approximately the same duration. Otherwise, that week is excluded from all calculations for both the primary and collocated sites. Historically, these calculations were performed in Excel™. They can now be performed using the Dry Chemistry Collocated Stats function in the CASTNET Data Management System Application as described in Section 6.5.8 of the CASTNET Data Management System Application User Manual, Data Operations SOP 3.

## 6.4 Annual Report

Figure types and specifications in the annual report change from year-to-year. As a result, only an overview of the types of data analyses routinely performed in support of the report are provided in this section. Examples of maps and graphs depicted in this section come from the CASTNET 2000 Annual Report (MACTEC, 2002).

### 6.4.1 Concentrations of Sulfur and Nitrogen Species and Cations

#### 6.4.1.1 Concentration Maps

Although the types of data displayed in the annual report chapter titled, "Atmospheric Concentrations" are similar to those displayed in a quarterly report, the source of the data is different. Data for the annual report come from the VW_MODEL_OUTPUT_ANN view, which contains annual aggregations of the results from the Multi-Layer Model (MLM) calculations. At a minimum, an annual report contains maps of annual average concentrations for each of the following analytes:

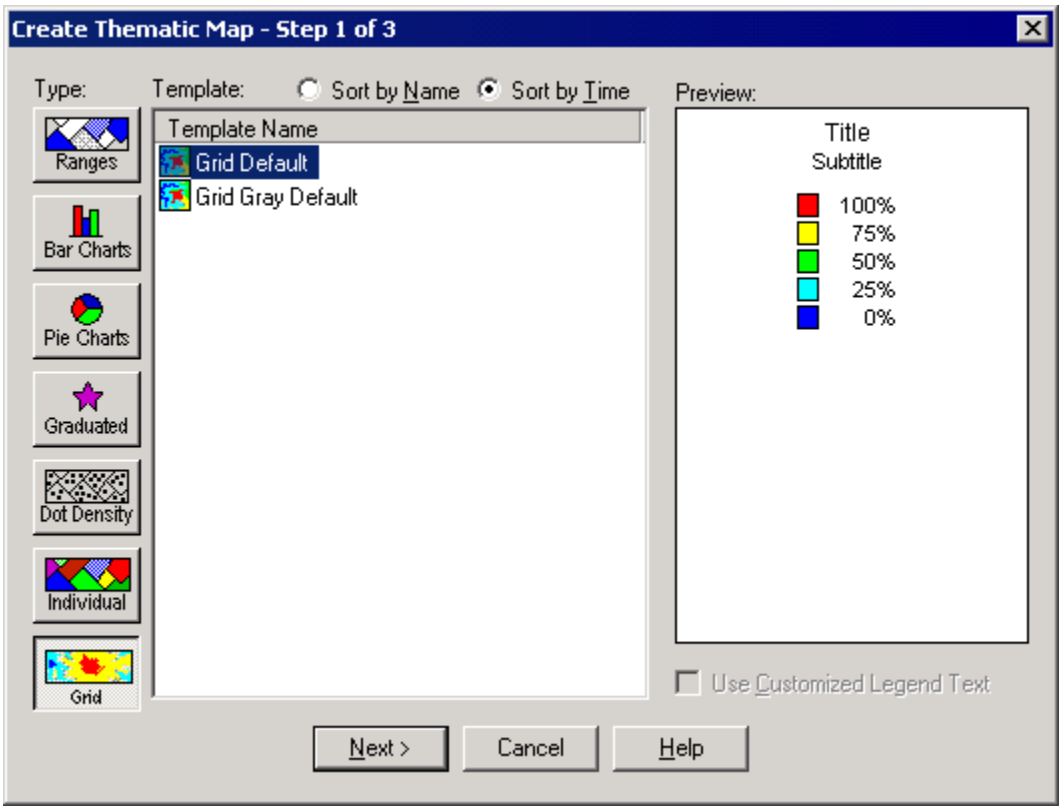
- $SO_2$
- $SO_4^{2-}$
- Total $NO_3^-$ (particulate $NO_3^-$ plus $HNO_3$)
- $NH_4^+$

The following query, set up as an SQL Pass Through Query in the Access™ database designated for the Concentrations Chapter of the annual report, is an example of how to access data (i.e., for year 2000) from the VW_MODEL_OUTPUT_ANN view:

```
SELECT
   castnet_model_arch.dbo.vw_model_output_ann.site_id,
   longitude,
   latitude,
   year,
   so2_conc = CASE WHEN so2_conc_pct >= 70 THEN so2_conc ELSE null END,
   so4_conc = CASE WHEN so4_conc_pct >= 70 THEN so4_conc ELSE null END,
   nh4_conc = CASE WHEN nh4_conc_pct >= 70 THEN nh4_conc ELSE null END,
   totno3_conc = CASE WHEN hno3_conc_pct >= 70 and no3_conc_pct >= 70
      THEN ((0.9841*hno3_conc) + no3_conc) ELSE null END
FROM
   castnet_model_arch.dbo.vw_model_output_ann INNER JOIN castnet.dbo.site ON
   (castnet_model_arch.dbo.vw_model_output_ann.site_id = castnet.dbo.site.site_id)
WHERE
   year = 2000
ORDER BY
   castnet_model_arch.dbo.vw_model_output_ann.site_id
```

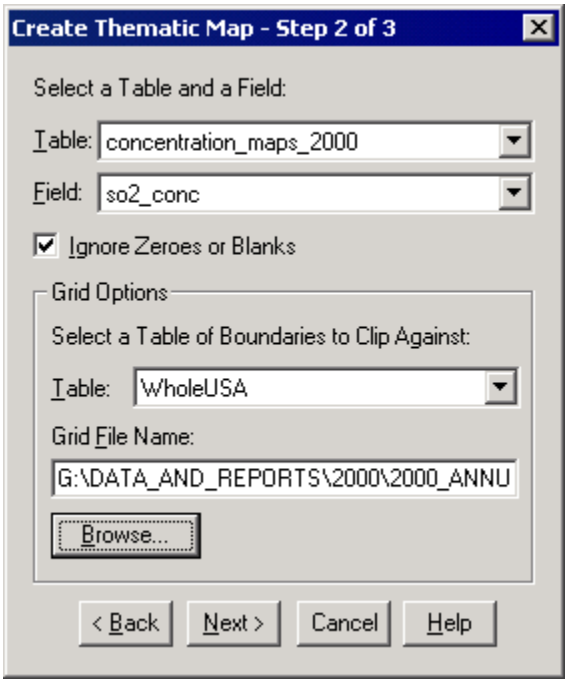
All map and label settings are identical to the settings discussed in Section 6.1.2. Beginning with the CASTNET 2000 Annual Report (MACTEC, 2002), an interpolated grid was constructed using an inverse distance-weighting function as a means of providing psuedo-concentration isopleths on the map. To create the grid, use MapInfo®, and select "Create Thematic Map…" from under the "Map" menu option. This brings up a form (Figure 6), which requires that you select the option "Grid" from the buttons on the left and then choose "Grid Default."

**Figure 6**



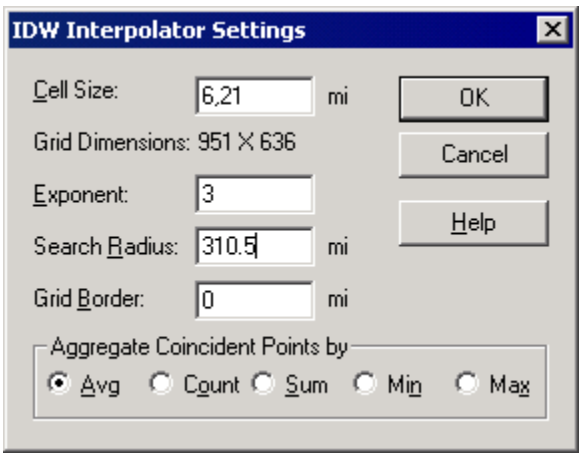

After clicking the "Next" button, the second of three forms appears (Figure 7). Verify that the correct table is selected in the "Table" combo box and then choose the field that the grid represents. Check the box for "Ignore Zeroes or Blanks." Select the "WholeUSA" table as a guide to clip the boundaries of the grid. Finally, select a location for the grid file name. Ideally, this is on a shared server where the file can be accessed from different workstations. If the file is created in a local directory, the workspace is only available to that machine. Click the "Next" button.

**Figure 7**




The third form (Figure 8) appears and provides options for the grid. The cell size is set to 6.21 miles (10 km), the exponent is set to the factor by which concentrations at a site are considered in interpolating a value for the grid, and the search radius is set to 310.5 miles (500 km).

**Figure 8**




Clicking "OK" creates the default grid. Accessing the "Styles…" button from the "Modify Thematic Map" form, selected from the "Map" menu option, allows the user to change colors.

In addition to the grid, the CASTNET 2000 Annual Report (MACTEC, 2002) also included maps of the remote CASTNET sites in Alaska, Hawaii, and the U.S. Virgin Islands. These maps are created via the same methods detailed above except they use the Alaska, Hawaii, and Virgin_Islands tables, respectively.

See the CASTNET 2000 Annual Report (MACTEC, 2002) for examples of the grid and remote site maps.

#### 6.4.1.2 Concentration Box Plots

Box plots are also included in the Concentrations Chapter to show long-term trends in concentrations. They are prepared using Excel. Previously, S-Plus®, a statistical and graphics package was used. Box plots present $10^{th}$, $25^{th}$, $75^{th}$, and $90^{th}$ percentile, mean, and median values (Figure 9). Box plots are shown only for the following analytes:

- $SO_2$
- $SO_4^{2-}$
- Total $NO_3^-$
- $NH_4^+$

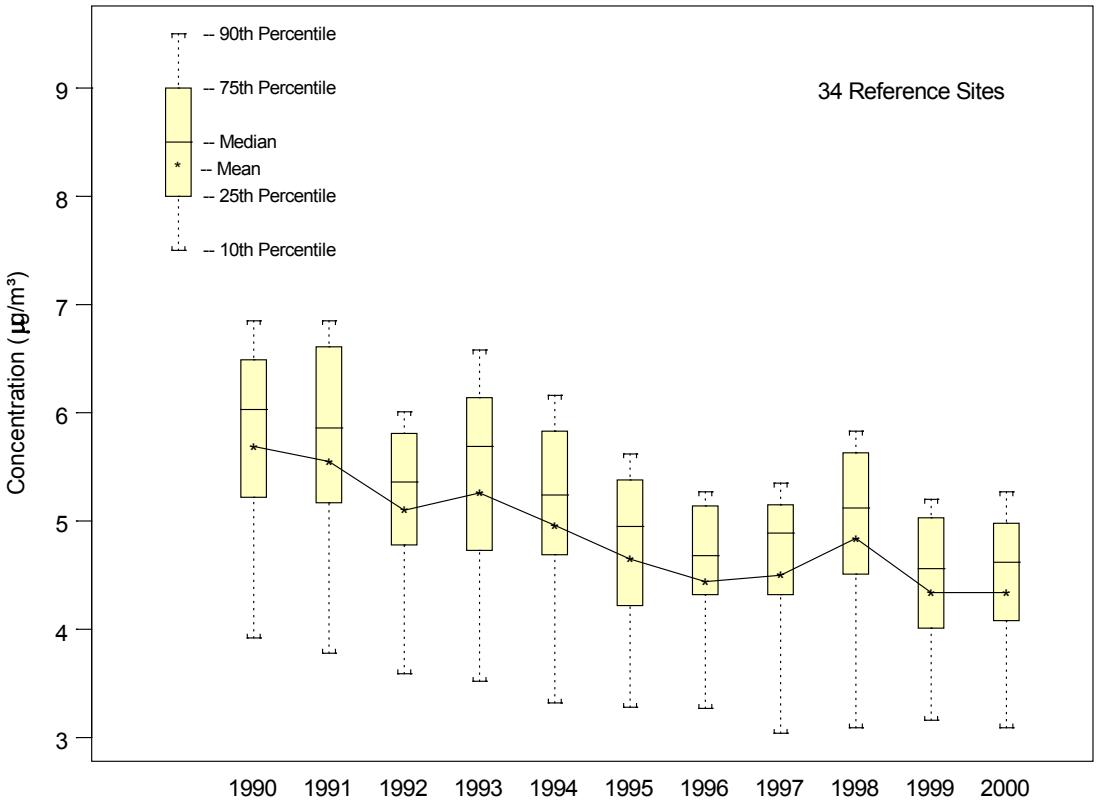
Data for the box plots are queried from the VW_MODEL_OUTPUT_ANN view, which contains quarterly aggregations of atmospheric concentrations. Similar to the line graphs discussed in Section 6.1.3, only sites included in the list of 34 reference sites (designated by continuous = 'y') are included in the aggregations. The following query, set up as a SQL Pass Through Query in the Access™ database designated for this chapter of the annual report, is used to gather the data for the box plots:

```
SELECT
   castnet_model_arch.dbo.vw_model_output_qtr.site_id,
   quarter,
   year,
   so2_conc = CASE WHEN so2_conc_pct >= 70 THEN so2_conc ELSE null END,
   so4_conc = CASE WHEN so4_conc_pct >= 70 THEN so4_conc ELSE null END,
   nh4_conc = CASE WHEN nh4_conc_pct >= 70 THEN nh4_conc ELSE null END,
   totno3_conc = CASE WHEN hno3_conc_pct >= 70 and no3_conc_pct >= 70
      THEN ((0.9841*hno3_conc) + no3_conc) ELSE null END
FROM
   castnet_model_arch.dbo.vw_model_output_qtr INNER JOIN castnet.dbo.site_ops ON
   (castnet_model_arch.dbo.vw_model_output_qtr.site_id = castnet.dbo.site_ops.site_id)
WHERE
   continuous = 'y' and
   year between 1990 and 2000
ORDER BY
   castnet_model_arch.dbo.vw_model_output_qtr.site_id, quarter, year
```

The data analyst must verify that a value is provided for each quarter. Therefore, values are interpolated or extrapolated for missing or invalid quarters. This process is the same as described in Section 6.1.3. Values are interpolated or extrapolated from the values for the same quarter in neighboring years. For example, the second quarter 1996 value is interpolated from the second

quarter 1995 and the second quarter 1997 values. The second quarter 1990 value is extrapolated from the second quarter 1991 value.

**Figure 9** Example of the box plots typically included in an annual report. This box plot is for $SO_4^{2-}$.




## 6.4.2 Deposition of Sulfur and Nitrogen

### 6.4.2.1 Deposition Maps

Similar to the concentration maps discussed in Section 6.4.1.1, deposition maps for the chapter titled, "Deposition of Sulfur and Nitrogen" (Deposition Chapter) are created from data in the VELAN table and from a table of interpolated wet deposition values. The VW_MODEL_OUTPUT_ANN view contains annual aggregations of the results of the MLM calculations. The wet deposition values represent a combination of historical CASTNET wet deposition data and National Atmospheric Deposition Program/National Trends Network (NADP/NTN) wet deposition data. For CASTNET sites where concentrations in precipitation were measured prior to January 1999 (when responsibility for wet deposition monitoring activities at CASTNET sites was transferred to NADP/NTN), those values are used in the data set. For time periods following January 1999 or for sites where no wet concentrations were measured, values are obtained from a grid of concentration estimates derived from available NADP/NTN sites using an inverse distance weighting function. Estimated concentrations are

multiplied by the precipitation measured at the CASTNET site to provide an estimate of wet deposition. Currently, the EPA technical monitor prepares the wet deposition data set for the annual report and then delivers it to AMEC for use in the annual report.

At a minimum, simulations for each of the following analytes and types of deposition are produced. Units for all maps are kilograms per hectare (kg/ha):

- Dry $SO_2$ deposition (as sulfur)
- Dry $SO_4^{2-}$ deposition (as sulfur)
- Total dry sulfur deposition ($SO_2 + SO_4^{2-}$)
- Percentage of total dry sulfur deposition from $SO_2$
- Wet $SO_4^{2-}$ deposition (as sulfur)
- Total (dry + wet) sulfur deposition
- Dry $HNO_3$ deposition (as nitrogen)
- Dry $NO_3^-$ deposition (as nitrogen)
- Dry $NH_4^+$ deposition (as nitrogen)
- Total dry nitrogen deposition ($HNO_3 + NO_3^- + NH_4^+$)
- Total wet nitrogen deposition ($NO_3^- + NH_4^+$)
- Total (dry + wet) nitrogen deposition.

Maps are usually produced for:

- Dry sulfur deposition
- Total (wet + dry) sulfur deposition
- Dry nitrogen deposition
- Total (wet + dry) nitrogen deposition

The following query is an example of how to access data, in this case for year 2000, from the VW_MODEL_OUTPUT_ANN and WET_DEPOSITION tables. The query uses a linked VW_MODEL_OUTPUT_ANN view (dbo_velan) and a linked SITE table (dbo_site). Also, because this is an Access™ query, IIF statements are used in place of CASE statements:

```
SELECT
   dbo_velan.site_id,
   dbo_site.longitude,
   dbo_site.latitude,
   dbo_velan.year,
   IIf(dbo_velan.so2_flux_pct>70,dbo_velan.so2_flux*0.5006,Null) AS dry_so2_s,
   IIf(dbo_velan.so4_flux_pct>70,dbo_velan.so4_flux*0.3339,Null) AS dry_so4_s,
   IIf(dbo_velan.hno3_flux_pct>70,dbo_velan.hno3_flux*0.2224,Null) AS dry_hno3_n,
   IIf(dbo_velan.no3_flux_pct>70,dbo_velan.no3_flux*0.226,Null) AS dry_no3_n,
   IIf(dbo_velan.nh4_flux_pct>70,dbo_velan.nh4_flux*0.7765,Null) AS dry_nh4_n,
   wet_deposition.SO4_D_S AS wet_so4_s,
   wet_deposition.NO3_D_N AS wet_no3_n,
   wet_deposition.NH4_D_N AS wet_nh4_n
FROM
   (dbo_velan INNER JOIN wet_deposition ON (dbo_velan.year = wet_deposition.YEAR) AND
   (dbo_velan.site_id = wet_deposition.SITE_ID)) INNER JOIN dbo_site ON
```

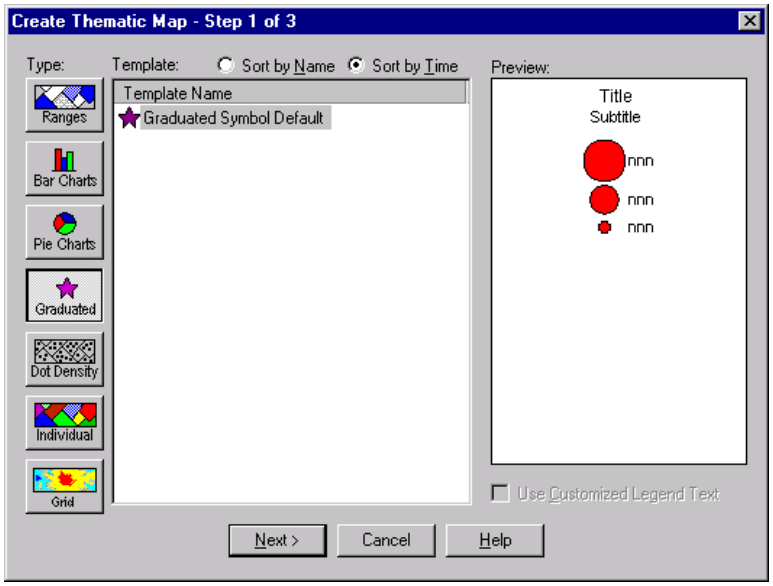
```
   dbo_velan.site_id = dbo_site.site_id
WHERE
   dbo_velan.year=2000;
```

The following query combines analytes and can be used to create the table for making the Chapter 3 maps:

```
SELECT
   site_id,
   longitude,
   latitude,
   dry_so2_s+dry_so4_s AS dry_total_s,
   dry_so2_s,
   dry_so4_s,
   wet_so4_s,
   dry_so2_s+dry_so4_s+wet_so4_s AS final_s,
   dry_hno3_n+dry_no3_n+dry_nh4_n AS dry_total_n,
   dry_hno3_n,
   dry_no3_n,
   dry_nh4_n,
   wet_no3_n+wet_nh4_n AS wet_total_n,
   dry_hno3_n+dry_no3_n+dry_nh4_n+wet_no3_n+wet_nh4_n AS final_n
FROM
   [all analytes for maps];
```

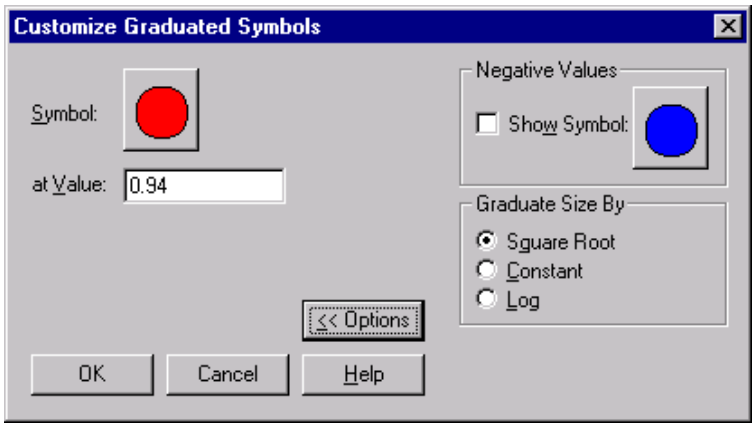
Map and label settings are identical to the settings discussed in Section 6.1.2. For the 2000 Annual Report (MACTEC, 2002), graduated symbols were used in addition to the labels showing the deposition values. To create graduated symbols using MapInfo®, select "Create Thematic Map…" from under the "Map" menu option. This brings up a form (Figure 10), which requires that you select the option "Graduated" from the buttons on the left and then chose "Graduated Symbol Default."

**Figure 10**



Selecting the "Next" button loads the next form. On that form (Step 2 of 3), select the field to be represented by the symbol (i.e., dry_total_s) and check the box "Ignore Zeroes and Blanks." Click the "Next" button. Clicking the "Legend" button in Step 3 of 3 permits the user to modify the legend. Clicking the "Settings" button brings up the following form (Figure 11), which allows for customization of the symbol used. See the CASTNET 2000 Annual Report (MACTEC, 2002) for examples of the graduated symbol maps.

**Figure 11**




### 6.4.2.2 Deposition Box Plots

Box plots are also included in the Deposition Chapter to show long-term trends in deposition. They are prepared using Excel. Box plots present 10$^{th}$, 25$^{th}$, 75$^{th}$, and 90$^{th}$ percentile, mean, and median values. Box plots are shown for dry sulfur, total sulfur (dry + wet), dry nitrogen and total nitrogen (dry + wet) deposition. An example of a deposition box plot graph is shown in Figure 12.

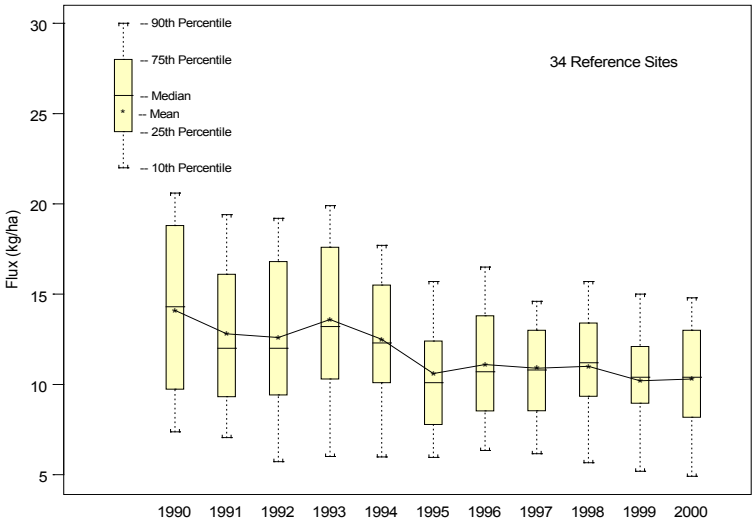
Data for the box plots are queried from the VW_MODEL_OUTPUT_ANN view, which contains annual aggregations of dry depositions. As with the line graphs discussed in Section 3.3, only sites included in the list of 34 reference sites (designated by continuous = 'y' in the SITE_OPS table) are included in the aggregations. The following query is used to gather the data for the box plots. As described in Section 6.4.1.2, dbo_velan is the linked VW_MODEL_OUTPUT_ANN view, wet_deposition is the table of wet deposition values prepared by EPA, and dbo_site_ops is the linked SITE_OPS table:

```
SELECT
   dbo_velan.site_id,
   dbo_velan.year,
   IIf(dbo_velan.so2_flux_pct>=70,dbo_velan.so2_flux*0.5006,Null) AS dry_so2_s,
   IIf(dbo_velan.so4_flux_pct>=70,dbo_velan.so4_flux*0.3339,Null) AS dry_so4_s,
   IIf(dbo_velan.no3_flux_pct>=70,dbo_velan.no3_flux*0.226,Null) AS dry_no3_n,
   IIf(dbo_velan.hno3_flux_pct>=70,dbo_velan.hno3_flux*0.2224,Null) AS dry_hno3_n,
   IIf(dbo_velan.nh4_flux_pct>=70,dbo_velan.nh4_flux*0.7765,Null) AS dry_nh4_n,
   wet_deposition.SO4_D_S AS so4_wet_s, wet_deposition.NO3_D_N AS no3_wet_n,
   wet_deposition.NH4_D_N AS nh4_wet_n INTO [dry and wet dep for trends]
FROM
   (dbo_velan INNER JOIN dbo_site_ops ON dbo_velan.site_id = dbo_site_ops.site_id)
   INNER JOIN wet_deposition ON (dbo_site_ops.site_id = wet_deposition.SITE_ID) AND
   (dbo_velan.year = wet_deposition.YEAR)
WHERE
   (((dbo_velan.year) Between 1990 And 2000) AND ((dbo_site_ops.continuous)="y"));


SELECT
   site_id,
   year,
   dry_so2_s+dry_so4_s+so4_wet_s AS total_s,
   dry_no3_n+dry_hno3_n+dry_nh4_n+no3_wet_n+nh4_wet_n AS total_n
FROM
   [dry and wet dep for trends];
```

The data analyst must verify that a value is provided for each year for all components. As a result, values are interpolated or extrapolated for missing or invalid years. The following query is then used to combine the contributions from separate analytes into total sulfur and total nitrogen deposition:

**Figure 12** Example of the box plots typically included in the Deposition Chapter. This box plot is for total sulfur deposition.




### 6.4.3 **Ozone Concentrations**

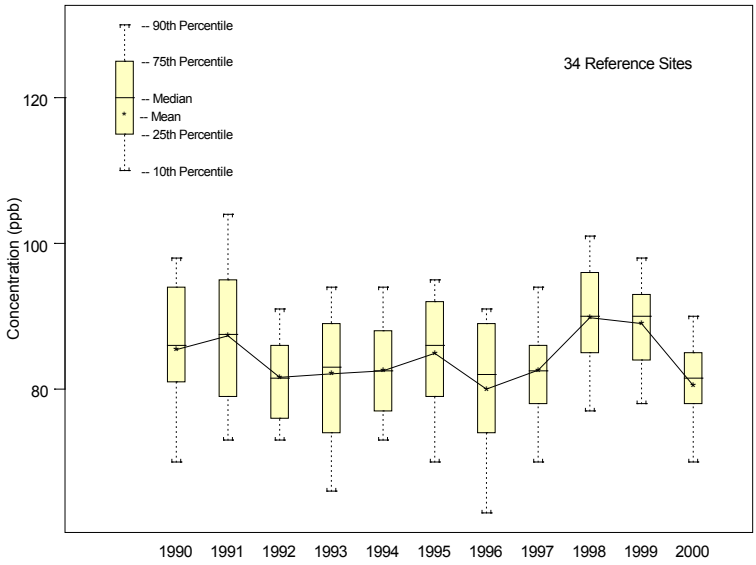
Analyses presented in the chapter titled, "Ozone Concentrations" (Ozone Concentrations Chapter) are very similar to those contained in the second, third, and fourth quarter reports. Please see Section 6.2.2 for a detailed description of the preparation of ozone maps for the quarterly reports. The following is a description of the differences and additions necessary to complete the figures for the annual report. The annual report includes the map depicting the Fourth Highest Daily Maximum 8-Hour $O_3$ Concentrations (ppb) for current year and most recent three years.

This map is identical to the map described in Section 6.2.2, with the exception that the map presenting the fourth highest daily maximum 8-hour $O_3$ concentrations is gridded and shaded, and remote sites are displayed. For a description of the processes used to create the grid and remote site maps, see Section 6.4.1.1.

Boxplots are presented to show long-term trends in ozone concentrations specifically, Fourth Highest Daily Maximum 8-Hour $O_3$ Concentrations – Eastern United States

Data and figures are prepared using Excel®. Box plots present $10^{th}$, $25^{th}$, $75^{th}$, and $90^{th}$ percentile, mean, and median values. Only sites included in the list of 34 reference sites (designated by continuous = 'y' in the SITE_OPS table) are included. An example of an ozone box plot is shown in Figure 13.

**Figure 13** Example of the box plots typically included in the Ozone Concentrations Chapter of an annual report. This box plot is for the fourth highest daily maximum 8-hour $O_3$concentrations.




### 6.4.4 **Data Quality**

The chapter on data quality in the annual report has changed dramatically over the past several years and is continually refined to reflect ongoing communication with the EPA technical monitors. As a result, no substantive documentation for preparing the data quality figures or tables is provided in this document. Analyses are typically based on the foundation described in Section 6.3.

## 7.0 REFERENCES

AMEC E&I, Inc. (AMEC). 2011. *Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan, Revision* 8.0. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

MACTEC, Inc. (MACTEC). 2002. *Clean Air Status and Trends Network (CASTNET) 2000 Annual Report.* Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. 68-D-98-112. Gainesville, FL.

MACTEC, Inc. (MACTEC). 2001. *Clean Air Status and Trends Network (CASTNET) Second Quarter 2001 Data Report.* Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. 68-D-98-112. Gainesville, FL.

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U.S. Environmental Protection Agency (EPA). 1997. *National 8-Hour Primary and Secondary Ambient Air Quality Standards for Ozone.* 40 CFR 50, Appendix I.

## 8.0 ATTACHMENTS

Attachment A – Script Used to Create DRYCHEM_DAYS Tables

Attachment B – SQL Script to Create Fourth Highest Daily Maximum Ozone Concentrations

Attachment C – SAS Program to Create Fourth Highest Daily Maximum Ozone Concentrations

Attachment D – SQL Script for the Calculation of SUM06 Values

Attachment E – SAS® Program for the Calculation of SUM06 Values

Attachment F – REG1 SAS Dataset Required by SAS® Programs
Detailed in Attachments B and C

Attachment G – REG2 SAS Dataset Required by SAS® Programs
Detailed in Attachments B and C

# ATTACHMENT A
# Script Used to Create DRYCHEM_DAYS Tables

```
PRINT 'DRYCHEM_DAYS table creation process!'
PRINT 'Deleting records from table DRYCHEM_DAYS'
DELETE FROM castnet_working.dbo.drychem_days
GO
PRINT 'Inserting Records into DRYCHEM_DAYS'
INSERT INTO
   castnet_working.dbo.drychem_days
SELECT
   site_id,
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) as quarter,
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) as year,
   actual_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END,
   total_days =
   CASE
      WHEN datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = 3 AND
           datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) in
(1988,1994)
      THEN 14 * 7.0
      WHEN datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = 4 AND
           datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) in
(1993,1999)
      THEN 14 * 7.0
      WHEN datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = 1 AND
           datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) in
(1994)
      THEN 12 * 7.0
      ELSE 13 * 7.0
   END,
   NULL as SO2_total_days,
   NULL as SO4_total_days,
   NULL as HNO3_total_days,
   NULL as NO3_total_days,
   NULL as NH4_total_days,
   NULL as TOTNO3_total_days,
   NULL as Ca_total_days,
   NULL as K_total_days,
   NULL as Mg_total_days,
   NULL as Na_total_days
FROM
   castnet_working.dbo.drychem_report
GROUP BY
   site_id,
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))),
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2))))
GO
PRINT 'Updating total_days field'
UPDATE castnet_working.dbo.drychem_days
SET total_days = actual_days
WHERE total_days < actual_days
GO
PRINT 'Creating table SO2_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   SO2_total_days =
```

```
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END
INTO
   castnet_temp.dbo.SO2_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
   ((nso4_f is null) OR (nso4_f='U') OR (nso4_f='L') OR (nso4_f='R') OR (nso4_f='#') OR (nso4_f='S'))
AND
   ((wso2_f is null) OR (wso2_f='U') OR (wso2_f='L') OR (wso2_f='R') OR (wso2_f='#') OR (wso2_f='S'))
AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating SO2_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.SO2_total_days = castnet_temp.dbo.SO2_temp.SO2_total_days
FROM
   castnet_temp.dbo.SO2_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.SO2_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.SO2_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
   castnet_temp.dbo.SO2_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where SO2_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.SO2_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
   castnet_working.dbo.drychem_days.SO2_total_days IS NULL
GO
PRINT 'Dropping table SO2_TEMP'
DROP TABLE castnet_temp.dbo.SO2_temp
GO
PRINT 'Creating table SO4_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   SO4_total_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END
INTO
   castnet_temp.dbo.SO4_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
```

```
   ((tso4_f is null) OR (tso4_f='U') OR (tso4_f='L') OR (tso4_f='R') OR (tso4_f='#') OR (tso4_f='S'))
AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating SO4_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.SO4_total_days = castnet_temp.dbo.SO4_temp.SO4_total_days
FROM
   castnet_temp.dbo.SO4_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.SO4_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.SO4_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
   castnet_temp.dbo.SO4_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where SO4_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.SO4_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
   castnet_working.dbo.drychem_days.SO4_total_days IS NULL
GO
PRINT 'Dropping table SO4_TEMP'
DROP TABLE castnet_temp.dbo.SO4_temp
GO
PRINT 'Creating table HNO3_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   HNO3_total_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END
INTO
   castnet_temp.dbo.HNO3_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
   ((nhno3_f is null) OR (nhno3_f='U') OR (nhno3_f='L') OR (nhno3_f='R') OR (nhno3_f='#') OR
(nhno3_f='S')) AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating HNO3_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.HNO3_total_days = castnet_temp.dbo.HNO3_temp.HNO3_total_days
FROM
```

```
   castnet_temp.dbo.HNO3_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.HNO3_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.HNO3_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
   castnet_temp.dbo.HNO3_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where HNO3_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.HNO3_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
   castnet_working.dbo.drychem_days.HNO3_total_days IS NULL
GO
PRINT 'Dropping table HNO3_TEMP'
DROP TABLE castnet_temp.dbo.HNO3_temp
GO
PRINT 'Creating table NO3_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   NO3_total_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END
INTO
   castnet_temp.dbo.NO3_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
   ((tno3_f is null) OR (tno3_f='U') OR (tno3_f='L') OR (tno3_f='R') OR (tno3_f='#') OR (tno3_f='S'))
AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating NO3_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.NO3_total_days = castnet_temp.dbo.NO3_temp.NO3_total_days
FROM
   castnet_temp.dbo.NO3_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.NO3_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.NO3_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
   castnet_temp.dbo.NO3_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where NO3_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.NO3_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
```

```
   castnet_working.dbo.drychem_days.NO3_total_days IS NULL
GO
PRINT 'Dropping table NO3_TEMP'
DROP TABLE castnet_temp.dbo.NO3_temp
GO
PRINT 'Creating table NH4_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   NH4_total_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END
INTO
   castnet_temp.dbo.NH4_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
   ((tnh4_f is null) OR (tnh4_f='U') OR (tnh4_f='L') OR (tnh4_f='R') OR (tnh4_f='#') OR (tnh4_f='S'))
AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating NH4_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.NH4_total_days = castnet_temp.dbo.NH4_temp.NH4_total_days
FROM
   castnet_temp.dbo.NH4_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.NH4_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.NH4_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
   castnet_temp.dbo.NH4_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where NH4_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.NH4_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
   castnet_working.dbo.drychem_days.NH4_total_days IS NULL
GO
PRINT 'Dropping table NH4_TEMP'
DROP TABLE castnet_temp.dbo.NH4_temp
GO
PRINT 'Creating table TOTNO3_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   TOTNO3_total_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
```

```
   END
INTO
   castnet_temp.dbo.TOTNO3_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
   ((tno3_f is null) OR (tno3_f='U') OR (tno3_f='L') OR (tno3_f='R') OR (tno3_f='#') OR (tno3_f='S'))
AND
   ((nhno3_f is null) OR (nhno3_f='U') OR (nhno3_f='L') OR (nhno3_f='R') OR (nhno3_f='#') OR
(nhno3_f='S')) AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating TOTNO3_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.TOTNO3_total_days =
castnet_temp.dbo.TOTNO3_temp.TOTNO3_total_days
FROM
   castnet_temp.dbo.TOTNO3_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.TOTNO3_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.TOTNO3_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
   castnet_temp.dbo.TOTNO3_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where TOTNO3_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.TOTNO3_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
   castnet_working.dbo.drychem_days.TOTNO3_total_days IS NULL
GO
PRINT 'Dropping table TOTNO3_TEMP'
DROP TABLE castnet_temp.dbo.TOTNO3_temp
GO
PRINT 'Creating table Ca_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   Ca_total_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END
INTO
   castnet_temp.dbo.Ca_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
   ((ca_f is null) OR (ca_f='U') OR (ca_f='L') OR (ca_f='R') OR (ca_f='#') OR (ca_f='S')) AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
```

```
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating Ca_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.Ca_total_days = castnet_temp.dbo.Ca_temp.Ca_total_days
FROM
   castnet_temp.dbo.Ca_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.Ca_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.Ca_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
   castnet_temp.dbo.Ca_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where Ca_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.Ca_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
   castnet_working.dbo.drychem_days.Ca_total_days IS NULL
GO
PRINT 'Dropping table Ca_TEMP'
DROP TABLE castnet_temp.dbo.Ca_temp
GO
PRINT 'Creating table K_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   K_total_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END
INTO
   castnet_temp.dbo.K_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
   ((k_f is null) OR (k_f='U') OR (k_f='L') OR (k_f='R') OR (k_f='#') OR (k_f='S')) AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating K_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.K_total_days = castnet_temp.dbo.K_temp.K_total_days
FROM
   castnet_temp.dbo.K_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.K_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.K_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
```

```
   castnet_temp.dbo.K_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where K_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.K_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
   castnet_working.dbo.drychem_days.K_total_days IS NULL
GO
PRINT 'Dropping table K_TEMP'
DROP TABLE castnet_temp.dbo.K_temp
GO
PRINT 'Creating table Mg_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   Mg_total_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END
INTO
   castnet_temp.dbo.Mg_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
   ((mg_f is null) OR (mg_f='U') OR (mg_f='L') OR (mg_f='R') OR (mg_f='#') OR (mg_f='S')) AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating Mg_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.Mg_total_days = castnet_temp.dbo.Mg_temp.Mg_total_days
FROM
   castnet_temp.dbo.Mg_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.Mg_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.Mg_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
   castnet_temp.dbo.Mg_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where Mg_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.Mg_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
   castnet_working.dbo.drychem_days.Mg_total_days IS NULL
GO
PRINT 'Dropping table Mg_TEMP'
DROP TABLE castnet_temp.dbo.Mg_temp
GO
```

```
PRINT 'Creating table Na_TEMP'
SELECT
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year,
   Na_total_days =
   CASE
       WHEN SUM(convert(float(8),dateoff-dateon)) IS NOT NULL
       THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
   END
INTO
   castnet_temp.dbo.Na_temp
FROM
   castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
   castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
   datepart(qq,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = quarter AND
   datepart(yy,(convert(datetime,((convert(real,dateoff)+convert(real,dateon))/2)))) = year
WHERE
   ((na_f is null) OR (na_f='U') OR (na_f='L') OR (na_f='R') OR (na_f='#') OR (na_f='S')) AND
   ((flow_volume_f is null) or (flow_volume_f ='L'))
GROUP BY
   castnet_working.dbo.drychem_days.site_id,
   castnet_working.dbo.drychem_days.quarter,
   castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating Na_total_days DRYCHEM_DAYS'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.Na_total_days = castnet_temp.dbo.Na_temp.Na_total_days
FROM
   castnet_temp.dbo.Na_temp, castnet_working.dbo.drychem_days
WHERE
   castnet_temp.dbo.Na_temp.site_id = castnet_working.dbo.drychem_days.site_id AND
   castnet_temp.dbo.Na_temp.quarter = castnet_working.dbo.drychem_days.quarter AND
   castnet_temp.dbo.Na_temp.year = castnet_working.dbo.drychem_days.year
GO
PRINT 'Updating DRYCHEM_DAYS where Na_total_days is null'
UPDATE
   castnet_working.dbo.drychem_days
SET
   castnet_working.dbo.drychem_days.Na_total_days = 0.0
FROM
   castnet_working.dbo.drychem_days
WHERE
   castnet_working.dbo.drychem_days.Na_total_days IS NULL
GO
PRINT 'Dropping table Na_TEMP'
DROP TABLE castnet_temp.dbo.Na_temp
PRINT 'DONE!'
```

# ATTACHMENT B
# SQL Script to Create Fourth Highest Daily Maximum Ozone Concentrations

```
PRINT 'BEGIN ROLLING 8 AVG PROCESS - DROPPING TABLES'
DROP TABLE castnet_temp.dbo.ozone_temp
GO
DROP TABLE castnet_temp.dbo.ozone_dates
GO
DROP TABLE castnet_temp.dbo.ozone_8hr
GO
DROP TABLE castnet_temp.dbo.ozone_dmax
GO
DROP TABLE castnet_temp.dbo.ozone_8hr_rank
GO
PRINT 'CREATE TABLE ozone_temp'
CREATE TABLE castnet_temp.dbo.ozone_temp
(
PRIMARY KEY (site_id, date_time),
site_id varchar(6) NOT NULL,
date_time datetime NOT NULL,
ozone real,
ozone_f varchar(1)
)
GO
PRINT 'SELECT relevant ozone records'
INSERT INTO castnet_temp.dbo.ozone_temp
SELECT site_id,
date_time,
ozone,
ozone_f
FROM castnet.dbo.metdata
WHERE date_time BETWEEN '1/1/04' AND '12/31/04 23:00'
GO
INSERT INTO castnet_temp.dbo.ozone_temp
SELECT a.site_id,
a.date_time,
a.ozone,
a.ozone_f
FROM castnet_working.dbo.metdata_l2 a LEFT JOIN castnet_temp.dbo.ozone_temp b ON
a.site_id = b.site_id AND
a.date_time = b.date_time
WHERE a.date_time BETWEEN '1/1/04' AND '12/31/04 23:00' AND
b.site_id IS NULL
GO
PRINT 'Set OZONE = 0 where < 0 and valid'
UPDATE castnet_temp.dbo.ozone_temp
SET ozone = 0
WHERE ozone < 0 AND
(ozone_f IS NULL OR ozone_f IN ('<','_','^','S'))
GO
PRINT 'TRUNCATE OZONE concentrations'
UPDATE castnet_temp.dbo.ozone_temp
SET ozone = ROUND(ozone, 0, 1)
GO
PRINT 'Set invalid concentrations to null'
UPDATE castnet_temp.dbo.ozone_temp
SET ozone = NULL
WHERE ozone_f IN ('B','C','D','F','I','M','P')
GO
PRINT 'CREATE TABLE ozone_dates'
CREATE TABLE castnet_temp.dbo.ozone_dates
(
PRIMARY KEY (start_date),
start_date smalldatetime NOT NULL,
end_date smalldatetime NOT NULL
```

```
)
GO
PRINT 'INSERT values into ozone_dates'
INSERT INTO castnet_temp.dbo.ozone_dates
SELECT date_time, date_time + 7.0/24
FROM castnet_temp.dbo.ozone_temp
WHERE site_id = 'PSU106'
GO
PRINT 'CREATE TABLE ozone_8hr'
CREATE TABLE castnet_temp.dbo.ozone_8hr
(
PRIMARY KEY (site_id, start_date),
site_id varchar(6) NOT NULL,
start_date smalldatetime NOT NULL,
end_date smalldatetime NOT NULL,
ozone_8hr real,
ozone_8hr_ct int,
ozone_8hr_f varchar(7)
)
GO
PRINT 'INSERT 8 hr ozone averages'
INSERT INTO castnet_temp.dbo.ozone_8hr
SELECT
site_id,
start_date,
end_date,
AVG(ozone),
COUNT(ozone),
ozone_8hr_f =
   CASE
      WHEN MAX(ozone) >= 80 AND COUNT(ozone) < 6 THEN 'FIX'
      WHEN MAX(ozone) < 80 AND COUNT(ozone) < 6 THEN 'DONTFIX'
      WHEN MAX(ozone) IS NULL THEN 'DONTFIX'
      ELSE NULL
   END
FROM castnet_temp.dbo.ozone_temp INNER JOIN castnet_temp.dbo.ozone_dates ON
date_time BETWEEN start_date AND end_date
GROUP BY site_id, start_date, end_date
GO
PRINT 'TRUNCATE 8 hr averages'
UPDATE castnet_temp.dbo.ozone_8hr
SET ozone_8hr = ROUND(ozone_8hr, 0, 1)
GO
PRINT 'UPDATE ozone where flag = FIX'
UPDATE castnet_temp.dbo.ozone_temp
SET ozone = 10
FROM castnet_temp.dbo.ozone_temp a, castnet_temp.dbo.ozone_8hr b
WHERE a.site_id = b.site_id AND
a.date_time BETWEEN b.start_date AND b.end_date AND
ozone_8hr_f = 'FIX' AND
ozone IS NULL
GO
PRINT 'INSERT fix into ozone_fix'
SELECT c.site_id, c.start_date, AVG(ozone) AS ozone_8hr, COUNT(ozone) AS ozone_8hr_ct
INTO castnet_temp.dbo.ozone_fix
FROM (castnet_temp.dbo.ozone_temp a INNER JOIN castnet_temp.dbo.ozone_dates b ON
date_time BETWEEN start_date AND end_date) INNER JOIN castnet_temp.dbo.ozone_8hr c ON
a.site_id = c.site_id AND
b.start_date = c.start_date
WHERE  ozone_8hr_f = 'FIX'
GROUP BY c.site_id, c.start_date, c.end_date
GO
PRINT 'UPDATE ozone_8hr where flag = FIX'
UPDATE a
SET a.ozone_8hr = b.ozone_8hr,
a.ozone_8hr_ct = b.ozone_8hr_ct
FROM castnet_temp.dbo.ozone_8hr a, castnet_temp.dbo.ozone_fix b
WHERE a.site_id = b.site_id AND
a.start_date = b.start_date
```

```
GO
PRINT 'DROP TABLE ozone_fix'
DROP TABLE castnet_temp.dbo.ozone_fix
GO
PRINT 'UPDATE flag where 8 hr >= 80 and flag = FIX'
UPDATE castnet_temp.dbo.ozone_8hr
SET ozone_8hr_f = 'USEIT'
WHERE ozone_8hr_f = 'FIX' AND
ozone_8hr >= 80
GO
PRINT 'DELETE records where flag in (DONTFIX,FIX)'
DELETE FROM castnet_temp.dbo.ozone_8hr WHERE ozone_8hr_f IN ('DONTFIX','FIX')
GO
PRINT 'DENOTE records outside state ozone seasons'
UPDATE a
SET ozone_8hr_f = 'DELETE'
FROM (castnet_temp.dbo.ozone_8hr a INNER JOIN castnet.dbo.site b ON a.site_id = b.site_id) INNER
JOIN castnet_temp.dbo.ozone_seasons c ON
b.state = c.state
WHERE start_date < CONVERT(datetime,
CONVERT(varchar,beg_month)+'/'+CONVERT(varchar,beg_day)+'/'+CONVERT(varchar,datepart(yy,start_dat
e))) OR
start_date > CONVERT(datetime,
CONVERT(varchar,end_month)+'/'+CONVERT(varchar,end_day)+'/'+CONVERT(varchar,datepart(yy,start_dat
e))+' 23:00')
GO
PRINT 'DELETE records outside state ozone seasons'
DELETE FROM castnet_temp.dbo.ozone_8hr WHERE ozone_8hr_f = 'DELETE'
GO
PRINT 'CREATE TABLE ozone_dmax'
CREATE TABLE castnet_temp.dbo.ozone_dmax
(
PRIMARY KEY (site_id, yr, jday),
site_id varchar(6) NOT NULL,
yr int NOT NULL,
jday int NOT NULL,
min_date_time datetime,
dmax_8hr int,
dmax_8hr_ct int
)
GO
PRINT 'INSERT daily max values'
INSERT INTO castnet_temp.dbo.ozone_dmax
SELECT
site_id,
DATEPART(yy, start_date),
DATEPART(dy, start_date),
MIN(start_date),
MAX(ozone_8hr),
COUNT(ozone_8hr)
FROM castnet_temp.dbo.ozone_8hr
GROUP BY site_id, DATEPART(yy, start_date), DATEPART(dy, start_date)
ORDER BY site_id, DATEPART(yy, start_date), DATEPART(dy, start_date)
GO
PRINT 'Check completeness of daily max 8hr value'
UPDATE castnet_temp.dbo.ozone_dmax
SET dmax_8hr = NULL
WHERE dmax_8hr < 85 AND dmax_8hr_ct < 18
GO
PRINT 'CREATE TABLE ozone_8hr_rank'
CREATE TABLE castnet_temp.dbo.ozone_8hr_rank
(
PRIMARY KEY (site_id, yr, rank),
site_id varchar(6) NOT NULL,
yr int NOT NULL,
rank int NOT NULL,
max_8hr_value int,
date_time datetime
)
```

```
GO
PRINT 'INSERT 1st high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT site_id, yr, 1 AS rank, MAX(dmax_8hr), NULL AS date_time
FROM castnet_temp.dbo.ozone_dmax
GROUP BY site_id, yr
GO
PRINT 'UPDATE 1st high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b
WHERE a.site_id = b.site_id AND
a.yr = b.yr AND
a.max_8hr_value = b.dmax_8hr
GO
PRINT 'INSERT 2nd high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT a.site_id, a.yr, 2 AS rank, MAX(a.dmax_8hr), NULL AS date_time
FROM castnet_temp.dbo.ozone_dmax a,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) b
WHERE a.site_id = b.site_id AND
a.min_date_time <> b.date_time
GROUP BY a.site_id, a.yr
ORDER BY a.site_id, a.yr
GO
PRINT 'UPDATE 2nd high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) c
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.max_8hr_value = b.dmax_8hr AND
rank = 2 AND
b.min_date_time <> c.date_time
GO
PRINT 'INSERT 3rd high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT a.site_id, a.yr, 3 AS rank, MAX(a.dmax_8hr), NULL AS date_time
FROM castnet_temp.dbo.ozone_dmax a,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) b,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) c
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.min_date_time <> b.date_time AND
a.min_date_time <> c.date_time
GROUP BY a.site_id, a.yr
ORDER BY a.site_id, a.yr
GO
PRINT 'UPDATE 3rd high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) c,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) d
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.max_8hr_value = b.dmax_8hr AND
rank = 3 AND
b.min_date_time <> c.date_time  AND
b.min_date_time <> d.date_time
GO
PRINT 'INSERT 4th high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT a.site_id, a.yr, 4 AS rank, MAX(a.dmax_8hr), NULL AS date_time
FROM castnet_temp.dbo.ozone_dmax a,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) b,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) c,
```

```
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) d
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.min_date_time <> b.date_time AND
a.min_date_time <> c.date_time AND
a.min_date_time <> d.date_time
GROUP BY a.site_id, a.yr
ORDER BY a.site_id, a.yr
GO
PRINT 'UPDATE 4th high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) c,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) d,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) e
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.max_8hr_value = b.dmax_8hr AND
rank = 4 AND
b.min_date_time <> c.date_time AND
b.min_date_time <> d.date_time AND
b.min_date_time <> e.date_time
GO
PRINT 'INSERT 5th high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT a.site_id, a.yr, 5 AS rank, MAX(a.dmax_8hr), NULL AS date_time
FROM castnet_temp.dbo.ozone_dmax a,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) b,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) c,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) d,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) e
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.min_date_time <> b.date_time AND
a.min_date_time <> c.date_time AND
a.min_date_time <> d.date_time AND
a.min_date_time <> e.date_time
GROUP BY a.site_id, a.yr
ORDER BY a.site_id, a.yr
GO
PRINT 'UPDATE 5th high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) c,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) d,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) e,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) f
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.max_8hr_value = b.dmax_8hr AND
rank = 5 AND
b.min_date_time <> c.date_time AND
b.min_date_time <> d.date_time AND
b.min_date_time <> e.date_time AND
b.min_date_time <> f.date_time
GO
PRINT 'INSERT 6th high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT a.site_id, a.yr, 6 AS rank, MAX(a.dmax_8hr), NULL AS date_time
```

```
FROM castnet_temp.dbo.ozone_dmax a,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) b,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) c,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) d,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) e,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) f
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.min_date_time <> b.date_time AND
a.min_date_time <> c.date_time AND
a.min_date_time <> d.date_time AND
a.min_date_time <> e.date_time AND
a.min_date_time <> f.date_time
GROUP BY a.site_id, a.yr
ORDER BY a.site_id, a.yr
GO
PRINT 'UPDATE 6th high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) c,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) d,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) e,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) f,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) g
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.site_id = g.site_id AND
a.max_8hr_value = b.dmax_8hr AND
rank = 6 AND
b.min_date_time <> c.date_time AND
b.min_date_time <> d.date_time AND
b.min_date_time <> e.date_time AND
b.min_date_time <> f.date_time AND
b.min_date_time <> g.date_time
GO
PRINT 'INSERT 7th high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT a.site_id, a.yr, 7 AS rank, MAX(a.dmax_8hr), NULL AS date_time
FROM castnet_temp.dbo.ozone_dmax a,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) b,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) c,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) d,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) e,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) f,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 6) g
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.site_id = g.site_id AND
a.min_date_time <> b.date_time AND
a.min_date_time <> c.date_time AND
a.min_date_time <> d.date_time AND
a.min_date_time <> e.date_time AND
a.min_date_time <> f.date_time AND
a.min_date_time <> g.date_time
GROUP BY a.site_id, a.yr
ORDER BY a.site_id, a.yr
GO
PRINT 'UPDATE 7th high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
```

```
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) c,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) d,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) e,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) f,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) g,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 6) h
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.site_id = g.site_id AND
a.site_id = h.site_id AND
a.max_8hr_value = b.dmax_8hr AND
rank = 7 AND
b.min_date_time <> c.date_time AND
b.min_date_time <> d.date_time AND
b.min_date_time <> e.date_time AND
b.min_date_time <> f.date_time AND
b.min_date_time <> g.date_time AND
b.min_date_time <> h.date_time
GO
PRINT 'INSERT 8th high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT a.site_id, a.yr, 8 AS rank, MAX(a.dmax_8hr), NULL AS date_time
FROM castnet_temp.dbo.ozone_dmax a,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) b,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) c,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) d,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) e,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) f,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 6) g,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 7) h
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.site_id = g.site_id AND
a.site_id = h.site_id AND
a.min_date_time <> b.date_time AND
a.min_date_time <> c.date_time AND
a.min_date_time <> d.date_time AND
a.min_date_time <> e.date_time AND
a.min_date_time <> f.date_time AND
a.min_date_time <> g.date_time AND
a.min_date_time <> h.date_time
GROUP BY a.site_id, a.yr
ORDER BY a.site_id, a.yr
GO
PRINT 'UPDATE 8th high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) c,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) d,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) e,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) f,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) g,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 6) h,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 7) i
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.site_id = g.site_id AND
```

```
a.site_id = h.site_id AND
a.site_id = i.site_id AND
a.max_8hr_value = b.dmax_8hr AND
rank = 8 AND
b.min_date_time <> c.date_time AND
b.min_date_time <> d.date_time AND
b.min_date_time <> e.date_time AND
b.min_date_time <> f.date_time AND
b.min_date_time <> g.date_time AND
b.min_date_time <> h.date_time AND
b.min_date_time <> i.date_time
GO
PRINT 'INSERT 9th high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT a.site_id, a.yr, 9 AS rank, MAX(a.dmax_8hr), NULL AS date_time
FROM castnet_temp.dbo.ozone_dmax a,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) b,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) c,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) d,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) e,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) f,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 6) g,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 7) h,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 8) i
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.site_id = g.site_id AND
a.site_id = h.site_id AND
a.site_id = i.site_id AND
a.min_date_time <> b.date_time AND
a.min_date_time <> c.date_time AND
a.min_date_time <> d.date_time AND
a.min_date_time <> e.date_time AND
a.min_date_time <> f.date_time AND
a.min_date_time <> g.date_time AND
a.min_date_time <> h.date_time AND
a.min_date_time <> i.date_time
GROUP BY a.site_id, a.yr
ORDER BY a.site_id, a.yr
GO
PRINT 'UPDATE 9th high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) c,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) d,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) e,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) f,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) g,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 6) h,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 7) i,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 8) j
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.site_id = g.site_id AND
a.site_id = h.site_id AND
a.site_id = i.site_id AND
a.site_id = j.site_id AND
a.max_8hr_value = b.dmax_8hr AND
rank = 9 AND
b.min_date_time <> c.date_time AND
b.min_date_time <> d.date_time AND
b.min_date_time <> e.date_time AND
```

```
b.min_date_time <> f.date_time AND
b.min_date_time <> g.date_time AND
b.min_date_time <> h.date_time AND
b.min_date_time <> i.date_time AND
b.min_date_time <> j.date_time
GO
PRINT 'INSERT 10th high ozone daily max'
INSERT INTO castnet_temp.dbo.ozone_8hr_rank
SELECT a.site_id, a.yr, 10 AS rank, MAX(a.dmax_8hr), NULL AS date_time
FROM castnet_temp.dbo.ozone_dmax a,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) b,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) c,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) d,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) e,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) f,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 6) g,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 7) h,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 8) i,
(SELECT * FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 9) j
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.site_id = g.site_id AND
a.site_id = h.site_id AND
a.site_id = i.site_id AND
a.site_id = j.site_id AND
a.min_date_time <> b.date_time AND
a.min_date_time <> c.date_time AND
a.min_date_time <> d.date_time AND
a.min_date_time <> e.date_time AND
a.min_date_time <> f.date_time AND
a.min_date_time <> g.date_time AND
a.min_date_time <> h.date_time AND
a.min_date_time <> i.date_time AND
a.min_date_time <> j.date_time
GROUP BY a.site_id, a.yr
ORDER BY a.site_id, a.yr
GO
PRINT 'UPDATE 10th high date_time'
UPDATE castnet_temp.dbo.ozone_8hr_rank
SET date_time = min_date_time
FROM castnet_temp.dbo.ozone_8hr_rank a, castnet_temp.dbo.ozone_dmax b,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 1) c,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 2) d,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 3) e,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 4) f,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 5) g,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 6) h,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 7) i,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 8) j,
(SELECT site_id, date_time FROM castnet_temp.dbo.ozone_8hr_rank WHERE rank = 9) k
WHERE a.site_id = b.site_id AND
a.site_id = c.site_id AND
a.site_id = d.site_id AND
a.site_id = e.site_id AND
a.site_id = f.site_id AND
a.site_id = g.site_id AND
a.site_id = h.site_id AND
a.site_id = i.site_id AND
a.site_id = j.site_id AND
a.site_id = k.site_id AND
a.max_8hr_value = b.dmax_8hr AND
rank = 10 AND
b.min_date_time <> c.date_time AND
b.min_date_time <> d.date_time AND
b.min_date_time <> e.date_time AND
b.min_date_time <> f.date_time AND
```

```
b.min_date_time <> g.date_time AND
b.min_date_time <> h.date_time AND
b.min_date_time <> i.date_time AND
b.min_date_time <> j.date_time AND
b.min_date_time <> k.date_time
GO
PRINT 'DONE!'
```

# ATTACHMENT C
## SAS Program to Create Fourth Highest Daily Maximum Ozone Concentrations

**Note:** The SAS® Datasets REG1 and REG2 referred to the header of the program are provided in Attachments D and E, respectively.

```
/*

SAS Program Name:  Rolling8.SAS

Written By:                Laurie Hamilton and Mary Burnett

Program Purpose:       To calculate the fourth highest daily maximum rolling 8-hour average ozone
                       concentration for a given year

Input Variables:   DATE_TIME (date and time), OZONE (ozone concentration in ppb),
                       OZONE_F (ozone flag), SITE_ID (site ID such as EGB181) from Access file, and
                       REG1 and REG2 SAS datasets

*/

* Resets page number to 1 for printing purposes;

options pageno=1;

* Subdirectory where Access file containing ozone data is located and where all
  SAS datasets will be stored;

libname rolling8 'c:\castnet';

* Create SITENUM variable from SITE_ID variable for sorting purposes;
* Set negative, nonmissing ozone concentrations to zero;
* Truncate the ozone concentration;
* If ozone flag is B, C, D, F, I, or M, then set the ozone concentration to
  missing;

proc import out=rolling8.imported_ozone2001
  datatable="ozone2001" dbms=access97 replace;
  database="c:\castnet\ozone2001.mdb";
  run;

data rolling8.ozone2001;
  set rolling8.imported_ozone2001;
  sitenum=substr(site_id,4,3);
  if ozone<0 and ozone ne . then ozone=0;
  ozone=int(ozone);
  if ozone_f in ('B' 'C' 'D' 'F' 'I' 'M') then ozone=.;
  hour=hour(round(date_time));
  run;

* Rename and reformat date_time to date, keep minimum number of variables
  required, convert ppb to ppm, and then sort the temporary ozone file, tempoz;

data tempoz (keep=sitenum date hour ozone);
  format date mmddyy9.;
  set rolling8.ozone2001;
  date=date_time;
  ozone=ozone/1000;
  run;

proc sort data=tempoz;
  by sitenum date hour;
  run;
```

```
* Create permanent datasets, roll8 and lt6valid;

data rolling8.roll8 (keep=sitenum begdate beghour roll8 validn
                rename=(beghour=hour begdate=date))
     rolling8.lt6valid (keep=sitenum begdate beghour validn holdoz1-holdoz8);

 format begdate mmddyy8. holddt1-holddt8 mmddyy8.;

 length holdhr1-holdhr8 $2 holdoz1-holdoz8 8 holddt1-holddt8 8 beghour $2;

 set tempoz;

 by sitenum;

 retain holdhr1-holdhr8 holdoz1-holdoz8 holddt1-holddt8 count;

 array ahour holdhr1-holdhr8;
 array aoz holdoz1-holdoz8;
 array adate holddt1-holddt8;

 validn=0;
 beghour=' ';
 calcroll=.;
 roll8=.;
 totoz=0;

 if first.sitenum then do;
        do i=1 to 8;
           ahour[i]=' ';
           aoz[i]=.;
           adate[i]=.;
        end;
        count=0;
        count=count+1;
        ahour[count]=hour;
        aoz[count]=ozone;
        adate[count]=date;
   end;

     else do;
          count=count+1;

          if 2 le count le 7 then do;
             ahour[count]=hour;
             aoz[count]=ozone;
             adate[count]=date;
          end;

          else do;
               ahour[8]=hour;
               aoz[8]=ozone;
               adate[8]=date;
               do i=1 to 8;
                  if aoz[i] ne . then validn=validn+1;
               end;

               if validn lt 6 then do;
                  calcroll=.;
                  roll8=.;
                  beghour=ahour[1];
                  begdate=adate[1];
               end;

               else do;
```

```
                    do i=1 to 8;
                       if aoz[i] ne . then totoz=totoz+aoz[i];
                    end;

                    calcroll=totoz/validn;
                    beghour=ahour[1];
                    begdate=adate[1];
                end;

                roll8=int(1000*calcroll)/1000;
                output rolling8.roll8;
                if validn lt 6 then output rolling8.lt6valid;
                do i=1 to 7;
                   ahour[i]=ahour[i+1];
                   adate[i]=adate[i+1];
                   aoz[i]=aoz[i+1];
                end;
                ahour[8]=' ';
                aoz[8]= .;
                adate[8]= .;

          end;
    end;
 run;

data rolling8.lt6overd (drop=flag);
  set rolling8.lt6valid;
  array aoz holdoz1-holdoz8;
  do i=1 to 8;
    if aoz[i] ge 0.08 then flag='*';
  end;
  if flag='*' then output;
  run;

data rolling8.fixlt6;
  set rolling8.lt6over;
  array aoz holdoz1-holdoz8;
  do i=1 to 8;
    if aoz[i]=. then aoz[i]=0.001;
  end;
  totoz=sum(holdoz1,holdoz2,holdoz3,holdoz4,holdoz5,holdoz6,holdoz7,holdoz8);
  calcroll=totoz/8;
  roll8=int(1000*calcroll)/1000;
  if roll8 ge 0.08 then fixflag='*';
  run;

data rolling8.keepme;
 set rolling8.fixlt6;
 if fixflag='*';
 run;

proc print;
 title1 'Less than 6 valid hours, but rolling 8 with half min DL substituted for
         missing is 8';
 title2 'These (dataset keepme) need to be combined with dataset roll8';
 var sitenum begdate beghour holdoz1-holdoz8 totoz validn roll8;
 run;

proc sort data=rolling8.roll8;
  by sitenum;
  run;

proc sort data=rolling8.reg1;
  by sitenum;
  run;
```

```
data rolling8.roll82 oops;
  merge rolling8.reg1 (in=inreg) rolling8.roll8 (in=inroll);
  by sitenum;
  if inroll then output rolling8.roll82;
  if inroll and not inreg then output oops;
  run;

proc freq data=oops;
  title 'Missing State Codes';
  tables sitenum;
  run;

proc sort data=rolling8.roll82;
  by stcode;
  run;

proc sort data=rolling8.reg2;
  by stcode;
  run;

data temproll oops;
  merge rolling8.reg2 (in=inreg) rolling8.roll82 (in=inroll);
  by stcode;
  if inroll then output temproll;
  if inroll and not inreg then output oops;
  run;

proc freq data=oops;
  title 'States without ozone seasons';
  tables stcode;
  run;

data tempall1 (drop=begmon endmon);
  set temproll;
  month=month(date);
  year=year(date);
  if begmon le month le endmon then output;
  run;

data tempwi ok;
  set tempall1;
  if stcode='WI' then output tempwi;
  else output ok;
  run;

data tempwi2 oops2;
  set tempwi;
  if 5 le month le 9 then output tempwi2;
  else do;
    if month=4 then do;
       if day(date) ge 15 then output tempwi2;
       else delete;
    end;
    else if month=10 then do;
       if day(date) gt 15 then delete;
       else output tempwi2;
    end;
    else output oops2;
  end;
  run;

proc print data=oops2;
  title 'Wisconsin';
  run;
```

```
data rolling8.roll83;
  set ok tempwi2;
  run;

proc sort data=rolling8.roll83;
  by sitenum year month;
  run;
proc datasets;
  delete ok tempwi2 tempwi tempoz;
  run;

data check1 (keep=sitenum stcode year firstmon) check2 (keep=sitenum stcode year
                  lastmon);
  set rolling8.roll83;
  by sitenum year;
  if first.year then do;
     firstmon=month;
     output check1;
  end;
  else if last.year then do;
     lastmon=month;
     output check2;
  end;
  run;

data both;
  merge check1 check2;
  by sitenum year;
  run;

proc print uniform data=both;
  title 'First and Last Months of Ozone Seasons';
  var stcode firstmon lastmon;
  by sitenum year;
  id sitenum year;
  run;

data temp;
  set rolling8.roll83;
  year=year(date);
  run;

proc sort data=temp out=tempsort;
  by sitenum year date;
  run;

proc means data=tempsort noprint max n nmiss;
  by sitenum year date;
  id stcode region;
  var roll8;
  output out=rolling8.daymax2 max=daymax n=validn nmiss=nmiss;
  run;

data rolling8.daymax2 rolling8.dmchck2;
  set rolling8.daymax2 (drop=_type_ _freq_);
  year=year(date);
  if validn lt 18 and daymax ge 0.085 then output rolling8.dmchck2;
  if validn lt 18 and daymax lt 0.085 then daymax=.;
  output rolling8.daymax2;
  run;

proc print uniform data=rolling8.dmchck2;
  title 'Valid N < 18 and Daily Max >= 0.085';
  run;
```

```
data temp;
  set rolling8.daymax2;
  run;

proc sort data=temp out=tempsort;
  by sitenum year descending daymax;
  run;

data rolling8.high4th;
  set tempsort;
  by sitenum year;
  retain count;
  if first.year then count=1;
  else do;
    if count=3 then do;
       high4th=daymax;
       count=count+1;
       output;
    end;
  else count=count+1;
  end;
  run;

proc print data=rolling8.high4th;
  title1 'All Ozone Data (Using Truncated Data)';
  title2 'Fourth Highest Daily Maximum Rolling 8-Hour Average Ozone
          Concentration';
  var stcode sitenum date validn high4th;
  run;

* Put SITE_ID variable back into dataset;

data temp (keep=sitenum site_id dummy);
  set rolling8.ozone2001;
  dummy=1;
  run;

proc sort;
  by sitenum site_id;
  run;

proc means noprint;
  var dummy;
  by sitenum site_id;
  output out=reassign n=n;
  run;

data reassign (keep=sitenum site_id);
  set reassign;
  run;

proc sort;
  by sitenum;
  run;

proc sort data=rolling8.high4th;
  by sitenum;
  run;

data combo (keep=site_id date high4th);
  format site_id $6. date mmddyy8. high4th 9.;
  merge reassign rolling8.high4th (in=inh);
  by sitenum;
  if inh;
```

```
  high4th=high4th*1000;
  run;

proc sort data=combo;
  by site_id;
  run;

* Export results into Excel;

proc dbload dbms=Excel data=combo;
  path='c:\rolling8\High4th_2001.xls';
  putnames yes;
  limit=0;
  load;
  run;
```

# ATTACHMENT D
# SQL Script for the Calculation of SUM06 Values

```
drop table castnet_temp.dbo.sum06_day
drop table castnet_temp.dbo.sum06_day_ct
drop table castnet_temp.dbo.sum06_day_all
drop table castnet_temp.dbo.sum06_month
drop table castnet_temp.dbo.sum06_month_fixed
drop table castnet_temp.dbo.ozone_sum06_temp
go
create table castnet_temp.dbo.sum06_day
(
PRIMARY KEY(site_id,year,month,day),
site_id            varchar(6),
year               int,
month              int,
day                int,
ozone_sum06        real
)
go
insert into castnet_temp.dbo.sum06_day
select
a.site_id,
datepart(yy,date_time),
datepart(m,date_time),
datepart(dd,date_time),
sum(ROUND(ozone, 0, 1))/1000
from (castnet.dbo.ozone a INNER JOIN castnet.dbo.site b ON a.site_id = b.site_id) INNER JOIN
castnet_temp.dbo.ozone_seasons c ON
b.state = c.state
where date_time between '1/1/05' and '12/31/05 23:00' and ozone >= 60 and
(ozone_f is null or ozone_f in ('<','_','^','S')) and
datepart(hh,date_time) between 8 and 19 and
date_time between CONVERT(datetime,
CONVERT(varchar,beg_month)+'/'+CONVERT(varchar,beg_day)+'/'+CONVERT(varchar,datepart(yy,date_time)))
and
CONVERT(datetime,
CONVERT(varchar,end_month)+'/'+CONVERT(varchar,end_day)+'/'+CONVERT(varchar,datepart(yy,date_time))+'
23:00')
group by a.site_id,
datepart(yy,date_time),
datepart(m,date_time),
datepart(dd,date_time)
go
create table castnet_temp.dbo.sum06_day_ct
(
PRIMARY KEY(site_id,year,month,day),
site_id            varchar(6),
year               int,
month              int,
day                int,
valid_records      int
)
go
insert into castnet_temp.dbo.sum06_day_ct
select
a.site_id,
datepart(yy,date_time),
datepart(m,date_time),
datepart(dd,date_time),
count(*)
from (castnet.dbo.ozone a INNER JOIN castnet.dbo.site b ON a.site_id = b.site_id) INNER JOIN
castnet_temp.dbo.ozone_seasons c ON
```

```
b.state = c.state
where date_time between '1/1/05' and '12/31/05 23:00' and
(ozone_f is null or ozone_f in ('<','_','^','S')) and
datepart(hh,date_time) between 8 and 19 and
date_time between CONVERT(datetime,
CONVERT(varchar,beg_month)+'/'+CONVERT(varchar,beg_day)+'/'+CONVERT(varchar,datepart(yy,date_time)))
and
CONVERT(datetime,
CONVERT(varchar,end_month)+'/'+CONVERT(varchar,end_day)+'/'+CONVERT(varchar,datepart(yy,date_time))+'
23:00')
group by a.site_id,
datepart(yy,date_time),
datepart(m,date_time),
datepart(dd,date_time)
go
create table castnet_temp.dbo.sum06_day_all
(
PRIMARY KEY(site_id,year,month,day),
site_id            varchar(6),
year               int,
month              int,
day                int,
records            int
)
go
insert into castnet_temp.dbo.sum06_day_all
select
a.site_id,
datepart(yy,date_time),
datepart(m,date_time),
datepart(dd,date_time),
count(*)
from (castnet.dbo.ozone a INNER JOIN castnet.dbo.site b ON a.site_id = b.site_id) INNER JOIN
castnet_temp.dbo.ozone_seasons c ON
b.state = c.state
where date_time between '1/1/05' and '12/31/05 23:00' and datepart(hh,date_time) between 8 and 19 and
date_time between CONVERT(datetime,
CONVERT(varchar,beg_month)+'/'+CONVERT(varchar,beg_day)+'/'+CONVERT(varchar,datepart(yy,date_time)))
and
CONVERT(datetime,
CONVERT(varchar,end_month)+'/'+CONVERT(varchar,end_day)+'/'+CONVERT(varchar,datepart(yy,date_time))+'
23:00')
group by a.site_id,
datepart(yy,date_time),
datepart(m,date_time),
datepart(dd,date_time)
go
create table castnet_temp.dbo.sum06_month
(
PRIMARY KEY(site_id,year,month),
site_id            varchar(6),
year               int,
month              int,
ozone_sum06        real,
valid_days         int,
valid_hours        int
)
go
insert into castnet_temp.dbo.sum06_month
select
a.site_id,
a.year,
a.month,
sum(ozone_sum06),
count(*),
```

```
sum(valid_records)
from (castnet_temp.dbo.sum06_day_all a left join castnet_temp.dbo.sum06_day b on
a.site_id = b.site_id and
a.year = b.year and
a.month = b.month and
a.day = b.day) left join castnet_temp.dbo.sum06_day_ct c on
a.site_id = c.site_id and
a.year = c.year and
a.month = c.month and
a.day = c.day
group by a.site_id, a.year, a.month
go
create table castnet_temp.dbo.sum06_month_fixed
(
PRIMARY KEY(site_id,year,month),
site_id            varchar(6),
year               int,
month              int,
ozone_sum06_fix    real,
pct_month real
)
go
insert into castnet_temp.dbo.sum06_month_fixed
select
a.site_id,
a.year,
a.month,
ozone_sum06*hours/valid_hours,
1.0*valid_days/days
from castnet_temp.dbo.sum06_month a inner join
(select site_id, year, month, count(*) as days, sum(records) as hours
from castnet_temp.dbo.sum06_day_all group by site_id, year, month) b on
a.site_id = b.site_id and
a.year = b.year and
a.month = b.month
go
create table castnet_temp.dbo.ozone_sum06_temp
(
PRIMARY KEY(site_id,year,beginning_month,end_month),
site_id            varchar(6),
year               int,
beginning_month    int,
end_month int,
ozone_sum06        real,
valid_months       int
)
go
PRINT 'Insert records for Jan - Mar'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 1 and end_month >= 3) and
month between 1 and 3 and
pct_month >= 0.7
group by site_id, year
go
```

```
PRINT 'Insert records for Feb - Apr'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 2 and end_month >= 4) and
month between 2 and 4 and
pct_month >= 0.7
group by site_id, year
go
PRINT 'Insert records for Mar - May'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 3 and end_month >= 5) and
month between 3 and 5 and
pct_month >= 0.7
group by site_id, year
go
PRINT 'Insert records for Apr - Jun'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 4 and end_month >= 6) and
month between 4 and 6 and
pct_month >= 0.7
group by site_id, year
go
PRINT 'Insert records for May - Jul'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
```

```
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 5 and end_month >= 7) and
month between 5 and 7 and
pct_month >= 0.7
group by site_id, year
go
PRINT 'Insert records for Jun - Aug'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 6 and end_month >= 8) and
month between 6 and 8 and
pct_month >= 0.7
group by site_id, year
go
PRINT 'Insert records for Jul - Sep'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 7 and end_month >= 9) and
month between 7 and 9 and
pct_month >= 0.7
group by site_id, year
go
PRINT 'Insert records for Aug - Oct'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 8 and end_month >= 10) and
month between 8 and 10 and
pct_month >= 0.7
group by site_id, year
go
PRINT 'Insert records for Sep - Nov'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
```

```
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 9 and end_month >= 11) and
month between 9 and 11 and
pct_month >= 0.7
group by site_id, year
PRINT 'Insert records for Oct - Dec'
insert into castnet_temp.dbo.ozone_sum06_temp
select
site_id,
year,
min(month),
max(month),
ozone_sum06 =
case when sum(ozone_sum06_fix) is null then 0 else sum(ozone_sum06_fix) end,
count(*)
from castnet_temp.dbo.sum06_month_fixed
where site_id in (select site_id from castnet.dbo.site a inner join castnet_temp.dbo.ozone_seasons b
on
a.state = b.state where beg_month <= 10 and end_month >= 12) and
month between 10 and 12 and
pct_month >= 0.7
                                        group by site_id, year
```

# ATTACHMENT E
# SAS® Program for the Calculation of SUM06 Values

**Note:** The SAS® Datasets REG1 and REG2 referred to the header of the program are provided in Attachments D and E, respectively.

```
/*
SAS Program Name:  SUM06.SAS
Written By:                Laurie Hamilton and Mary Burnett
Program Purpose:       To calculate the maximum annual 3-month rolling SUM06

Note:    Monthly sums adjusted for missing data and rolling sum set to missing if at least one month
                       is missing
Input Variables:       Ozone data from Rolling8.SAS program, REG1 and REG2 files
*/

* Resets page number to 1 for printing purposes;

options pageno=1;

* Subdirectory where SAS dataset file containing ozone data is located
  and where all SAS datasets created in this program will be stored;

libname sum06 'c:\castnet';

* Create SITENUM variable from SITE_ID variable for sorting purposes,
  create MONTH variable from DATE_TIME variable, extract pertinent data
  for SUM06 calculations (between 8 a.m. and 8 p.m.);

data sum06.sum06data;
  set sum06.ozone2001;
  sitenum=substr(site_id,4,3);
  month=month(date_time);
  if hour>=8 and hour<=19;
  run;

* Attach state codes to data;

proc sort data=sum06.reg1;
```

```
  by sitenum;
  run;

proc sort data=sum06.sum06data;
  by sitenum;
  run;

data sum06.sum06data;
  merge sum06.sum06data (in=inm) sum06.reg1;
  by sitenum;
  if inm;
  run;

* Attach beginning and ending months of ozone seasons to ozone data;

proc sort data=sum06.reg2;
  by stcode;
  run;

proc sort data=sum06.sum06data;
  by stcode;
  run;

data sum06.sum06data;
  merge sum06.sum06data (in=inm) sum06.reg2;
  by stcode;
  if inm;
  run;

* Create DAY variable from DATE_TIME variable, eliminate data that
  falls outside of ozone season with special care taken for Wisconsin;

data sum06.sum06data;
  set sum06.sum06data;
  day=day(date_time);
  if month<begmon or month>endmon then delete;
  if stcode='WI' and month=4 and day<15 then delete;
  if stcode='WI' and month=10 and day>15 then delete;
  run;
```

```
* Set negative, nonmissing ozone concentrations to zero, truncate the
  ozone concentration, and set the ozone concentration to missing if
  the ozone flag is B, C, D, F, I, or M;

data sum06.sum06data;
  set sum06.sum06data;
  if ozone<0 and ozone ne . then ozone=0;
  ozone=int(ozone);
  if ozone_f in ('B' 'C' 'D' 'F' 'I' 'M') then ozone=.;
  run;

* Extract year from data;

data sum06.sum06data;
  set sum06.sum06data;
  year=year(date_time);
  run;

* Rename dataset and subset years if running multiple years of data;

data sum06.year2001;
  set sum06.sum06data;
  run;

%macro dataset (yearyear, sum06yy);

* Extract data where ozone is greater than or equal to 60 and set all
  data less than 60 to 0, keep only pertinent variables;

data temp (keep=sitenum year month ge60 ozone);
  set sum06.&yearyear;
  if ozone ge 60 then ge60=ozone;
  else ge60=0;
  run;

proc sort;
  by sitenum month;
  run;
```

```
proc means noprint;
  var ge60 ozone;
  by sitenum month;
  id year;
  output out=tempstat sum=ge60ua dummy1 n=dummy2 validn
                      nmiss=dummy3 nmiss;
  run;

data sum06.&sum06yy (keep=sitenum year month ge60ua ge60adj totrecs
                          validn scalfact);
  set tempstat;
  totrecs=validn+nmiss;
  scalfact=totrecs/validn;
  ge60adj=ge60ua*scalfact;
  run;

proc print;
  by sitenum;
  id sitenum;
  run;

%mend dataset;

%dataset(year2001,sum0601);

%macro dataset(sum06yy,rollyy);

data temp (rename=(ge60adj=ge06adj));
  set sum06.&sum06yy;
  ge60adj=ge60adj/1000;
  run;

data sum06.&rollyy (keep=sitenum year janmar06 febapr06 marmay06
                         aprjun06 mayjul06 junaug06 julsep06 augoct06
                         sepnov06 octdec06);
  set temp;
  by sitenum month;
  length jan06 feb06 mar06 apr06 may06 jun06 jul06 aug06 sep06 oct06
```

```
       nov06 dec06 8;
retain jan06 feb06 mar06 apr06 may06 jun06 jul06 aug06 sep06 oct06
       nov06 dec06 8;
array amon06 jan06 feb06 mar06 apr06 may06 jun06 jul06 aug06 sep06
       oct06 nov06 dec06;
array aroll06 janmar06 febapr06 marmay06 aprjun06 mayjul06 junaug06
      julsep06 augoct06 sepnov06 octdec06;
if first.sitenum then do;
do i=1 to 12;
   amon06[i]=.;
  end;
do i=1 to 10;
   aroll06[i]=.;
  end;
end;
if month=1 then do;
   jan06=ge06adj;
 end;
else if month=2 then do;
   feb06=ge06adj;
 end;
else if month=3 then do;
   mar06=ge06adj;
 end;
else if month=4 then do;
   apr06=ge06adj;
 end;
else if month=5 then do;
   may06=ge06adj;
 end;
else if month=6 then do;
   jun06=ge06adj;
 end;
else if month=7 then do;
   jul06=ge06adj;
 end;
else if month=8 then do;
   aug06=ge06adj;
 end;
```

```
  else if month=9 then do;
     sep06=ge06adj;
   end;
  else if month=10 then do;
     oct06=ge06adj;
   end;
  else if month=11 then do;
     nov06=ge06adj;
   end;
  else if month=12 then do;
     dec06=ge06adj;
   end;

  if last.sitenum then do;
     do i=1 to 10;
        if amon06[i]=. or amon06[i+1]=. or amon06[i+2]=. then do;
           aroll06[i]=.;
     end;
     else do;
        aroll06[i]=amon06[i]+amon06[i+1]+amon06[i+2];
     end;
   end;
   output;
   end;
  run;

proc print;
  var year sitenum janmar06 febapr06 marmay06 aprjun06 mayjul06
      junaug06 julsep06 augoct06 sepnov06 octdec06;
  run;

%mend dataset;

%dataset(sum0601,roll01);

proc sort data=sum06.rptdata;
  by sitenum year descending value;
  run;
```

```
data sum06.max;
  set sum06.rptdata;
  by sitenum year;
  if first.year then output;
  run;

proc print;
  by sitenum;
  id sitenum;
  var year montype value;
  format value 7.1;
  title1 'Maximum Annual 3-Month Rolling SUM06 (ppm)';
  run;

data sum06.rptdata (keep=sitenum year montype monsort value);
  set sum06.roll01;

  montype='JanMar';
  value=janmar06;
  monsort=1;
  output;

  montype='FebApr';
  value=febapr06;
  monsort=2;
  output;

  montype='MarMay';
  value=marmay06;
  monsort=3;
  output;

  montype='AprJun';
  value=aprjun06;
  monsort=4;
  output;

  montype='MayJul';
  value=mayjul06;
```

```
  monsort=5;
  output;

  montype='JunAug';
  value=junaug06;
  monsort=6;
  output;

  montype='JulSep';
  value=julsep06;
  monsort=7;
  output;

  montype='AugOct';
  value=augoct06;
  monsort=8;
  output;

  montype='SepNov';
  value=sepnov06;
  monsort=9;
  output;

  montype='OctDec';
  value=octdec06;
  monsort=10;
  output;

  run;

proc sort data=sum06.rptdata;
  by sitenum year monsort;
  run;

data temp (keep=sitenum site_id dummy);
  set sum06.sum06data;
  dummy=1;
  run;
```

```
proc sort;
  by sitenum site_id;
  run;

proc means noprint;
  var dummy;
  by sitenum site_id;
  output out=temp2 n=n;
  run;

data temp2 (keep=sitenum site_id);
  set temp2;
  run;

proc sort;
  by sitenum;
  run;

proc sort data=sum06.max;
  by sitenum;
  run;

data combo (keep=site_id year montype value);
  format site_id $6. year 15.7 montype $6. value 15.7;
  merge temp2 sum06.max (in=inmax);
  by sitenum;
  if inmax;
  run;

* Export SUM06 values from SAS dataset into Excel file;

proc export data=combo
  outfile='c:\castnet\sum06_max_2001.xls'
  dbms=excel2000 replace;
  run;
```

# ATTACHMENT F
# REG1 SAS Dataset Required by SAS® Programs Detailed in Attachments B and C

## REG1 SAS Dataset Required by SAS® Programs Detailed in Attachments B and C

| SITE NUM | STCODE |
|---|---|
| 101 | NC |
| 102 | TN |
| 103 | NY |
| 104 | NY |
| 105 | NY |
| 106 | PA |
| 107 | WV |
| 108 | VA |
| 109 | NH |
| 110 | NY |
| 111 | TN |
| 112 | PA |
| 113 | PA |
| 114 | OH |
| 115 | MI |
| 116 | MD |
| 117 | PA |
| 118 | VA |
| 119 | WV |
| 120 | VA |
| 121 | KY |
| 122 | OH |
| 123 | OH |
| 124 | MI |
| 125 | NC |
| 126 | NC |
| 127 | TN |
| 128 | PA |
| 129 | KY |
| 130 | IL |
| 131 | KY |
| 131 | KY |
| 132 | ME |
| 133 | IN |
| 134 | WI |
| 135 | ME |
| 136 | KY |
| 137 | NC |

## REG1 SAS Dataset Required by SAS® Programs Detailed in Attachments B and C

| SITE NUM | STCODE |
|---|---|
| 138 | IL |
| 139 | MD |
| 140 | IN |
| 141 | FL |
| 142 | NC |
| 144 | NJ |
| 145 | VT |
| 146 | IL |
| 147 | CT |
| 148 | MI |
| 149 | MI |
| 150 | AR |
| 151 | MS |
| 152 | AL |
| 153 | GA |
| 156 | FL |
| 157 | IL |
| 161 | CO |
| 162 | UT |
| 163 | ID |
| 164 | NV |
| 165 | WY |
| 167 | AZ |
| 168 | MT |
| 169 | WY |
| 171 | KY |
| 172 | OH |
| 174 | AZ |
| 175 | NY |
| 181 | CN |
| 184 | KS |
| 185 | OK |
| 187 | NY |
| 206 | CO |
| 207 | WV |
| 214 | OH |
| 228 | PA |
| 231 | KY |
| 235 | ME |
| 253 | GA |
| 256 | FL |
| 257 | IL |
| 263 | ID |

# REG1 SAS Dataset Required by SAS® Programs Detailed in Attachments B and C

| SITE NUM | STCODE |
|---|---|
| 267 | AZ |
| 302 | VA |
| 401 | TX |
| 402 | CA |
| 403 | CA |
| 404 | CA |
| 405 | CO |
| 406 | CO |
| 407 | UT |
| 408 | WY |
| 409 | WA |
| 410 | CA |
| 411 | NV |
| 412 | CA |
| 413 | MN |
| 414 | CA |
| 415 | WA |
| 416 | ME |
| 417 | AK |
| 418 | VA |
| 419 | FL |
| 42 | ND |
| 420 | TN |
| 421 | WA |
| 422 | ND |
| 423 | VI |
| 424 | HI |
| 425 | AK |
| 467 | AZ |
| 468 | MT |
| 474 | AZ |
| 571 | KY |
| 572 | OH |
| 888 | MI |

# ATTACHMENT G
## REG2 SAS Dataset Required by SAS® Programs
## Detailed in Attachments B and C

| STCODE | BEGMON | ENDMON | POSSDAYS |
|---|---|---|---|
| AK | 4 | 10 | 214 |
| AL | 3 | 10 | 245 |
| AR | 3 | 11 | 275 |
| AZ | 1 | 12 | 365 |
| CA | 1 | 12 | 365 |
| CO | 3 | 9 | 214 |
| CT | 4 | 9 | 183 |
| FL | 3 | 10 | 245 |
| GA | 3 | 10 | 245 |
| HI | 1 | 12 | 365 |
| ID | 4 | 10 | 214 |
| IL | 4 | 10 | 214 |
| IN | 4 | 9 | 183 |
| KS | 4 | 10 | 214 |
| KY | 3 | 10 | 245 |
| MD | 4 | 10 | 214 |
| ME | 4 | 9 | 183 |
| MI | 4 | 9 | 183 |
| MN | 4 | 10 | 214 |
| MS | 3 | 10 | 245 |
| MT | 6 | 9 | 122 |
| NC | 4 | 10 | 214 |
| ND | 5 | 9 | 153 |
| NH | 4 | 9 | 183 |
| NJ | 4 | 10 | 214 |
| NV | 1 | 12 | 365 |
| NY | 4 | 10 | 214 |
| OH | 4 | 10 | 214 |
| OK | 3 | 11 | 275 |
| PA | 4 | 10 | 214 |
| SC | 4 | 10 | 214 |
| TN | 3 | 10 | 245 |
| TX | 3 | 10 | 245 |
| UT | 5 | 9 | 153 |
| VA | 4 | 10 | 214 |
| VI | 1 | 12 | 365 |
| VT | 4 | 9 | 183 |
| WA | 5 | 9 | 153 |
| WI | 4 | 10 | 184 |
| WV | 4 | 10 | 214 |
| WY | 4 | 10 | 214 |

# TITLE: DATA DELIVERABLES

Effective Date: 10/30/12

Prepared by: Christopher M. Rogers
Data Management, Analysis, Interpretation, and Reporting Manager

Reviewed by: Marcus O. Stewart
Project QA Manager

Approved by: Holton K. Howell
Project Manager

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|---|---|---|---|
| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Manager | 10/30/12 | |
| MS | QA Mgr. | 10/22/13 | |
| | | | |
| | | | |
| | | | |

# DATA DELIVERABLES

## 1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide consistent guidance to AMEC E&I, Inc. (AMEC) Clean Air Status and Trends Network (CASTNET) Data Management Center (DMC) personnel for delivering data to the U.S. Environmental Protection Agency (EPA) as specified in the CASTNET Quality Assurance Project Plan (QAPP) (AMEC, 2011).

## 2.0 SCOPE

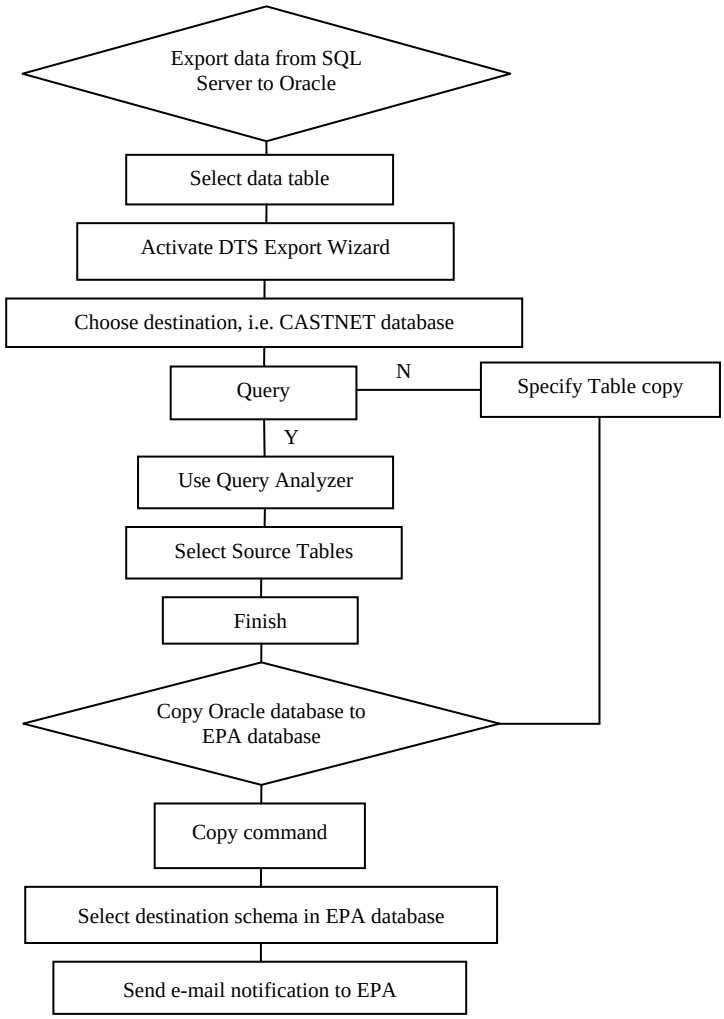
The processes described in this SOP are applicable to the production of contractual CASTNET data deliverables, which are prepared by AMEC for submittal to EPA. This SOP assumes that the user possesses a basic understanding of the SQL Server 7.0 Enterprise Manager.

## 3.0 SUMMARY

This SOP describes the process for routine data submissions to the EPA Oracle database. Appendix A describes the process for separate monthly generation of ozone data files for uploading to the EPA Air Quality System (AQS) data submittal web application. AQS submittals are performed as per instructions in the AQS User Guide.

Preparation of a CASTNET data deliverable for submittal to EPA involves generating files containing specific data records from various tables contained in the CASTNET SQL Server 7.0 database. A general overview of the steps necessary for preparation of a CASTNET data deliverable is depicted in Figure 1. For more information concerning the CASTNET database and its contents, please see the CASTNET QAPP (AMEC, 2011).

**Figure 1** Data Deliverable Submittal Overview




## 3.1 Delivery Schedule

### 3.1.1 Oracle Database Submittals

Specific tables are delivered monthly, quarterly, annually (regular and alternate), and "on change." Table 1 lists all of the data tables submitted to EPA and their delivery frequency.

**Table 1** Data Table Delivery Schedule

| Table Name | Delivery Schedule | | | |
|---|---|---|---|---|
| | **Monthly** | **Quarterly** | **Annually** | **On Change** |
| DRYCHEM | ✓ | | | |
| FILTER_PACK | ✓ | | | |
| GAS_CALIBRATION | ✓ | | | |
| HOURLY_GAS | ✓ | | | |
| METDATA | ✓ | | | |
| CALIBRATION_SUMMARY | | ✓ | | |
| LABDATA | | ✓ | | |
| LABDATA_QC | | ✓ | | |
| SAMPLE_REFERENCE | | ✓ | | |
| SITE_OPERATORS | | ✓ | | |
| EQUIPMENT_INVENTORY | | | ✓ | |
| MODEL_OUTPUT | | | ✓ | |
| MODEL_OUTPUT_WEEK | | | ✓ | |
| ASSUMED_FLOW | | | | ✓ |
| CALIBRATION_CRITERA | | | | ✓ |
| LEAF_ANGLE | | | | ✓ |
| MODEL_VERSION | | | | ✓ |
| PLANT | | | | ✓ |
| PLANT_PROFILE | | | | ✓ |
| SITE_OPS | | | | ✓ |
| SITE_PLANT_DETAIL | | | | ✓ |
| SITE_PLANT_SUMMARY | | | | ✓ |
| SITE_STATUS | | | | ✓ |
| SITE | | | | ✓ |
| SITES_RENAMED | | | | ✓ |

The METDATA, DRYCHEM, and FILTER_PACK tables contain Level 3 validated data for both EPA and National Park Service (NPS)-sponsored sites, and are delivered to EPA by the last day of each month. For the EPA-sponsored sites, the data in these tables span a 6-month period for a specified group of sites. The makeup of each monthly group is determined by the yearly calibration schedule set by AMEC's Field Operations Manager. Approximately 11 sites are included in each calibration group. Since each group of sites is calibrated twice a year, the data for each group are submitted twice a year, 60 days after the end of the month in which that group of sites was calibrated. In order to produce a complete data set for use in preparing the annual report, no calibrations are scheduled in December or June. This results in two "rollover" months (February and August) when no monthly submittal is made. Table 2 provides a list of the EPA-sponsored sites in each group along with the months their data are submitted.

**Table 2** EPA-Sponsored Site Calibration and Validated Data Submittal Schedules

| Group | EPA Sites Calibrated | | | Months Calibrated | Time Period Submitted | Delivery Months |
|---|---|---|---|---|---|---|
| SE-4<br>(6 Sites) | SND152, AL<br>GAS153, GA<br>BFT142, NC | CND125, NC<br>COW137, NC<br>PNF126, NC | | January<br>July | July – December<br>January – June | March<br>September |
| MW-6<br>(6 Sites) | CDZ171, KY<br>CKT136, KY<br>MCK131, KY | MCK231, KY<br>ESP127, TN<br>SPD111, TN | | January<br>July | July – December<br>January – June | March<br>September |
| E-1<br>(8 Sites) | BEL116, MD<br>BWR139, MD<br>WSP144, NJ | CTH110, NY<br>ARE 128, PA<br>PSU106, PA | PED108, VA<br>VPI120, VA | February<br>August | August – January<br>February – July | April<br>October |
| SE-5<br>(4 Sites) | CAD150, AR<br>CVL151, MS | IRL141, FL<br>SUM156, FL | | February<br>August | August – January<br>February – July | April<br>October |
| MW-7<br>(8 Sites) | ALH157, IL<br>BVL130, IL<br>STK138, IL | VIN140, IN<br>DCP114, OH<br>OXF122, OH | QAK172, OH<br>PRK134, WI | March<br>September | September – February<br>March – August | May<br>November |
| W-9<br>(4 Sites) | KNZ184, KS<br>CHE185, OK | SAN189, NE<br>ALC188, TX | | March<br>September | September – February<br>March – August | May<br>November |
| E-2<br>(7 Sites) | ABT147, CT<br>ASH135, ME<br>HOW132, ME | CAT175, NY<br>HWF187, NY<br>WST109, NH | EGB181 ON | April<br>October | October – March<br>April – September | June<br>December |
| MW-8<br>(5 Sites) | SAL133, IN<br>ANA115, MI | UVL124, MI<br>HOX148, MI | | April<br>October | October – March<br>April – September | June<br>December |
| E-3<br>(5 Sites) | KEF112, PA<br>MKG113, PA<br>LRL117, PA | CDR119, WV<br>PAR107, WV | | May<br>November | November – April<br>May – October | July<br>January |
| W-10<br>(6 Sites) | ROM206, CO<br>GTH161, CO<br>PAL190, TX | CNT169, WY<br>PND165, WY | | May<br>November | November – April<br>May – October | July<br>January |

The contents of the METDATA, DRYCHEM, and FILTER_PACK tables differ for NPS-sponsored sites. The NPS data included in these tables span only one month but include all NPS sites. Air Resource Specialists, Inc. (ARS) submits NPS continuous data to the DMC on a monthly basis, approximately 90 days following the end of data collection for that month. The DMC then delivers NPS data to EPA 30 days later, or by 120 days following the end of data collection for that month. No data for NPS sites are delivered to EPA during the two "rollover" months (February and August). However, two months of NPS data are delivered the month following a "rollover" month. Table 3 lists the delivery schedule for NPS continuous and filter pack data.

**Table 3** NPS Data Delivery Schedule

| NPS Data Collection Period | Delivery Month |
|---|---|
| January | May |
| February | June |
| March | July |
| April | September* (delivered with May data) |
| May | September |
| June | October |
| July | November |
| August | December |
| September | January |
| October | March* (delivered with November data) |
| November | March |
| December | April |

**Note:** *No data are delivered to EPA during February or August, the two "rollover" months.

Quarterly submittals are delivered 120 days following the end of the quarter being submitted and coincide with the delivery of quarterly reports. Table 4 shows the delivery schedule for the four quarterly data submittals.

**Table 4** Quarterly Data Submittal Schedule

| Quarter | Time Period Covered | Delivery Date |
|---|---|---|
| First | (January – March) | July 31 |
| Second | (April – June) | October 31 |
| Third | (July – September) | January 31 (of following year) |
| Fourth | (October – December) | April 30 (of following year) |

Two annual submittals are made. First, the two tables associated with the Multi-Layer Model (MLM) output (MODEL_OUTPUT and MODEL_OUTPUT_WEEK) are submitted to coincide with the delivery of the draft annual report on August 15. Second, the EQUIPMENT_INVENTORY table is submitted with the property report 30 days after the end of EPA's fiscal year (i.e., by October 31).

**Table 5** Annual Data Submittal Schedule

| Type of Annual Submittal | Tables Included | Scheduled Delivery |
|---|---|---|
| Annual | MODEL_OUTPUT<br>MODEL_OUTPUT_WEEK | August 15 |
| Fiscal | EQUIPMENT_INVENTORY | October 31 |

The remaining tables in the CASTNET database are designated as "on change." Following a change to the data within them, they are delivered with the next regularly scheduled monthly data submittal.

### 3.1.2 Daily Submittals

In addition to the submittals detailed in Section 6.0, daily submittals of continuous ozone, meteorological (where measured), and precursor gases (where measured) are delivered via automated processes using File Transfer Protocol (FTP). The Data Archiver process creates comma-separated variable (CSV) files containing these data. The Data Archiver runs daily at 1400 and creates the CSV files for the previous day's data.

Three files are created:

- metdata_*yyyymmdd*.csv – meteorological and ozone data for day indicated in file name,
- hourly_gas_*yyyymmdd*.csv – precursor gas data for day indicated in file name, and
- metdata_transfer_*yyyymmdd*.csv – records transferred in the other files.

The CSV files are populated with data that have been screened using outlier criteria to flag data with potential quality issues. The Metdata FTP Uploader automated process runs daily at 1800 and put these files on ftp://upload.ftp.gov/incoming/castnet/data. There is no login required for the FTP site. However, no files are visible on the site.

Both the Data Archiver and Metdata FTP Uploader were written in ASP.NET and are monitored by the Data Management, Analysis, Interpretation, and Reporting Manager (DMAIRM) using an automated email that shows that the process completed successfully and a status dashboard in iCASTNET that tracks the history of the automated processes.

EPA gets the files from their FTP site and has automated processes that load the data into their Oracle schemas. Performance of this load is monitored by EPA using automated emails, which are forwarded to AMEC.

### 3.1.3 AQS Submittals

Submittals to AQS are made on a monthly basis using the tool documented in Appendix A of this SOP. Data for one month for all sites actively monitoring ozone according to 40CFR Part 58 protocols are delivered no later than 90 days after the end of the monitoring month. For example, data for July are delivered by the end of October. Data submitted have undergone validation and quality assurance (QA) review as documented in Section 4.0 of the QAPP.

Occasionally, further validation actions are required based on results from semi-annual site visits or further data review. When this occurs, an update submittal is prepared. Data for the complete month for the site-month in question are posted to AQS, and the original submittal is overwritten.

## 4.0 MATERIALS

Laptop or personal computer
Microsoft SQL Server
Oracle 11g
Permissions and access to utilized databases

## 5.0 SAFETY

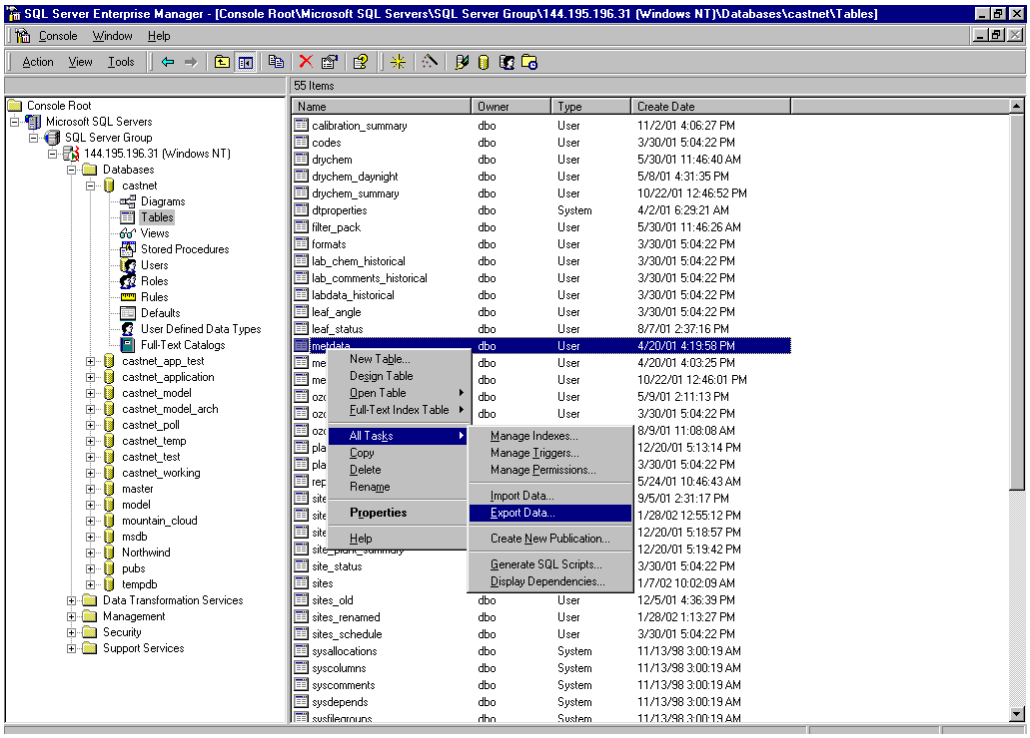
The same level of care and caution should be exercised while using the laptop/computer as would be taken when using any electrically powered device. Keep all cords out of walkways. If needed, use appropriately rated extension cords and surge protectors, and do not overload the electrical circuit. Keep liquids and food away from the computer and keyboard.

Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using the computer. Take breaks regularly to allow muscles to relax and to promote blood flow, including standing up, briefly walking around the room, and stretching to counteract the repetitive motion activities and extended periods of sitting.

## 6.0 PROCEDURE

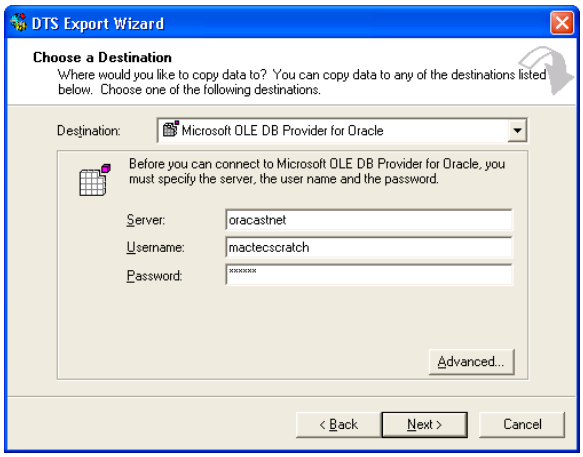
Data submittals are delivered to EPA via database-to-database transfer. Data are exported from AMEC's SQL Server 7.0 database into AMEC's Oracle 11g database and then copied into EPA's Oracle 11g database. Data are exported from SQL Server 7.0 to Oracle using SQL Server 7.0's Data Transformation Services (DTS) data export function. As shown in Figure 2, to access the DTS functions, right click on any table name in the SQL Server Enterprise Manager display, select "All Tasks," then "Export Data." This will activate the DTS Export Wizard.

**Figure 2** Accessing DTS Functions



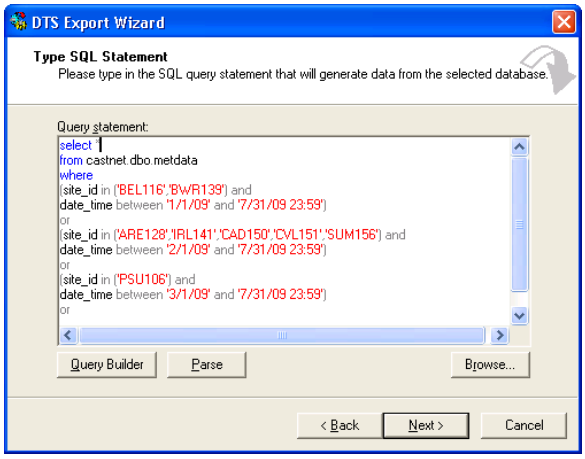

The data source is defined in the first step of the DTS Export Wizard, which is labeled, “Choose a Data Source.” For this process, the CASTNET database will always be the source. The next step is to “Choose a Destination” (Figure 3). Select “Microsoft OLE DB Provider for Oracle” from the “Destination” combo box. Enter the server, username, and password for the AMEC Oracle server and click “Next.”

**Figure 3** DTS Export Wizard – Choose a Destination



The third step, labeled “Specify Table Copy or Query,” asks the user to either copy an entire table to the file or to use a query to specify the records to extract. In most cases, it is necessary to use a query to access specific records from the table in question. Selecting the query option brings up the following form (Figure 4), “Type SQL Statement.”

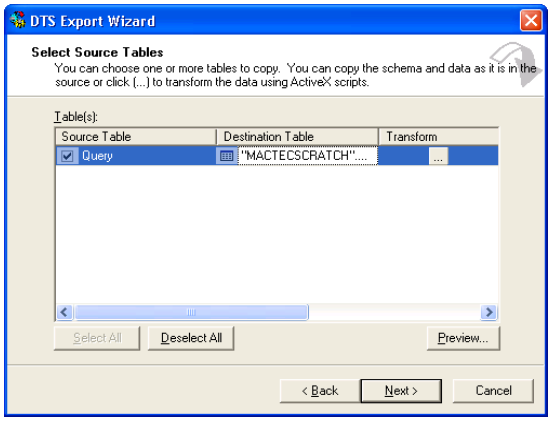
**Figure 4** Query Statement Form




The query typed into the “Query statement” box determines the records to be exported into the text file. It must consist of correct SQL syntax, and it should first be tested using the SQL Server 7.0 “Query Analyzer” tool to verify that its output matches the requirements of the data submittal. The Query Analyzer provides an interface that allows the user to access data tables using SQL queries.

As shown in Figure 5, the next step is “Select Source Tables.” From the “Destination Table” combo box, select the correct Oracle table and click “Next.” For the next step, “Save, Schedule, and Replicate Package,” accept the defaults and click “Next.” Finally, click “Finish” to begin the records transfer. Once the transfer is complete, note the number of records transferred.

**Figure 5** Selecting the Source Table



Once the data are in Oracle, a copy command is used to copy the data from the AMEC Oracle database to the EPA Oracle database. Figure 6 is an example of a copy command for the METDATA table:

**Figure 6** Example of Copy Command for Data Transfer between Oracle Databases

```
copy from mactecscratch/xxxxxx@cnettest to
castnetupdate/xxxxxx@camd10g append castnetupdate.metdata
using
select * from mactecscratch.metdata_update;
```

The "xxxxxx" represents the password for each database for the user specified in the command. One copy command is used for each table transferred. There are two destination schemas in EPA's database: CASTNETSCRATCH (for appends) and CASTNETUPDATE (for updates). For regular submittals, all tables are submitted to CASTNETSCRATCH with the exception of METDATA, HOURLY_GAS, and SITE_OPERATORS.

The results of the copy commands are logged into a file to show the results of each command. The log shows the number of records transferred for each table. The log file is maintained as part of the documentation for the submittal.

For each table transferred, a record is added to the TABLE_UPDATE table in the relevant EPA Oracle database schema. There is a TABLE_UPDATE table for each schema. Records in TABLE_UPDATE provide the record count for each table and a description of the contents. TABLE_UPDATE records are transferred using a copy command.

## 6.1 Database Updates

Updates to previously submitted database records are delivered to EPA with the next scheduled monthly submittal. These updates may result from additional quality control (QC) findings, resubmittals from ARS, or general table cleanup. Updates are delivered via database transfer in an identical manner as the other submittals described in Section 4.0. All updates are submitted to EPA's CASTNETUPDATE schema.

When updates have been sent to EPA, they are recorded in a Microsoft Excel spreadsheet named "resubmittal.xls" together with a description of what necessitated the update. Table 6 presents an example of the type of record used to document a database update.

**Table 6** Example of Resubmittal Excel Spreadsheet

| Table | Update | Records Affected | Date Updated | Submitted to EPA? | Date Submitted | Description |
|---|---|---|---|---|---|---|
| lab_comments | Samples 0828001-89, 0829001-89, 0830001-89 | 3 | 4/23/09 | yes | 4/29/09 | further QC of atm concentrations |

## 6.2 Deliverable Quality Assurance

### 6.2.1 Dry Chemistry Concentrations

QA review of the records in the DRYCHEM table follows the procedures specified in Section 4.3.5, Laboratory or Discrete Data Validation, of the CASTNET QAPP (AMEC, 2011). Before a submittal is initiated, the QA Manager performs a final review of the calculated values following import of the Level 3 flow data into the METDATA table. After acceptance by the AMEC CASTNET QA Manager, the DRYCHEM records are ready for submittal to EPA.

### 6.2.2 Continuous Data

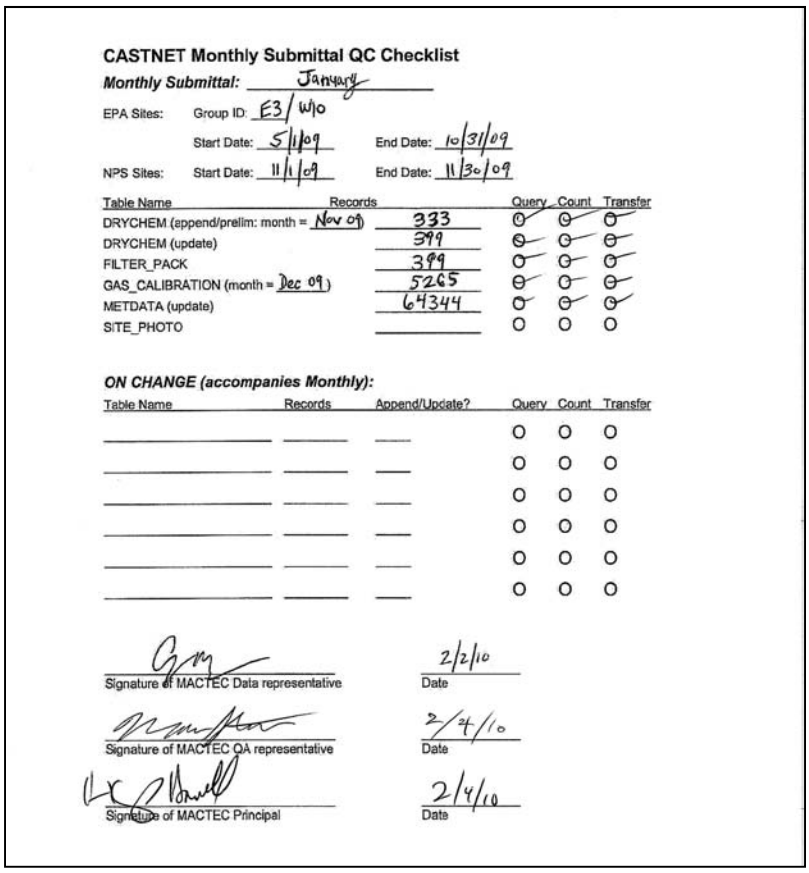
Following completion of Level 3 validation, the QA Manager reviews the continuous data to be submitted using the tools in the CASTNET Data Management System Application (CDMSA). All calibration failures and the resulting changes to the data are reviewed. In general, the QA Manager utilizes all of the tools available to the data validators to verify their work.

Continuous data from NPS-sponsored sites are accepted as validated at Level 3. The DMAIRM or his designee verifies that the correct number of records was included in the submittal from ARS and compares the results from a checksum query to verify that the data were correctly transmitted.

### 6.2.3 Verification of Deliverable Contents

At each stage during the creation of the deliverable, the DMAIRM or his designee must verify that the correct number of records is being submitted. To assist in this QC process, a submittal checklist is used. Figure 7 provides an example of a submittal checklist.

**Figure 7** Example of a Submittal Checklist



**CASTNET Monthly Submittal QC Checklist**

***Monthly Submittal:*** January

EPA Sites: Group ID: E3/W10
Start Date: 5/1/09 End Date: 10/31/09

NPS Sites: Start Date: 11/1/09 End Date: 11/30/09

| Table Name | Records | Query | Count | Transfer |
|---|---|---|---|---|
| DRYCHEM (append/prelim: month = Nov 09) | 333 | ✓ | ✓ | ✓ |
| DRYCHEM (update) | 399 | ✓ | ✓ | ✓ |
| FILTER_PACK | 399 | ✓ | ✓ | ✓ |
| GAS_CALIBRATION (month = Dec 09) | 5265 | ✓ | ✓ | ✓ |
| METDATA (update) | 64344 | ✓ | ✓ | ✓ |
| SITE_PHOTO | | O | O | O |

***ON CHANGE (accompanies Monthly):***

| Table Name | Records | Append/Update? | Query | Count | Transfer |
|---|---|---|---|---|---|
| | | | O | O | O |
| | | | O | O | O |
| | | | O | O | O |
| | | | O | O | O |
| | | | O | O | O |
| | | | O | O | O |

Signature of MACTEC Data representative — Date: 2/2/10

Signature of MACTEC QA representative — Date: 2/4/10

Signature of MACTEC Principal — Date: 2/4/10

The name of the submittal is written on the line (e.g., January 2010). At the completion of each step, the appropriate box is checked to signify that it was successfully completed. After the submittal is complete and the record counts have been filled out, the checklist should be signed by the DMAIRM or his designee and sent as part of the submittal package to the QA Manager for approval. The following is a complete list of the contents of the submittal package, which exists as a WinZip archive file:

1) Table-specific query used to extract data from SQL Server
2) Log file showing results of copy commands
3) Scan of signed submittal checklist
4) Excel file with TABLE_UPDATE records
5) Excel file with DRYCHEM records (to allow for review of concentrations at local conditions)
6) Draft e-mail to EPA (see Section 8.0)

The QA Manager completes the submittal checklist by verifying the record counts for each table and reviewing all associated documentation. The QA Manager and Project Manager sign the completed checklist, which is then filed.

### 6.3 E-mail Documentation of Submittal

Notification of the submittal is sent via e-mail to relevant EPA employees including the Project Officer, Technical Advisor, and Technical Monitor (database support). The e-mail documents the contents of the submittal. The Technical Monitor processes the submittal and confirms the successful loading of the data by replying to the submittal documentation e-mail. An example of the submittal documentation email is provided in Attachment A (Section 8.0).

## 7.0 REFERENCES

AMEC E&I, Inc. (AMEC). 2011. *Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan, Revision* 8.0. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

## 8.0 ATTACHMENTS

Attachment A – Example of E-mail Documentation

# ATTACHMENT A
## Example of E-mail Documentation

From: Rogers, Christopher
Sent: Wednesday, November 04, 2009 2:45 PM
To: Rogers, Christopher; 'Cohen.Michael@epamail.epa.gov';
'Lear.Gary@epamail.epa.gov'; 'Lee.Brian@epa.gov'; 'Melissa Rury'
Cc: Stewart, Marcus; Howell, Kemp
Subject: October 2009 and Q2 2009 data submittals

Michael,

Today, I loaded the October 2009 and Q2 2009 data submittals into your CASTNETUPDATE and CASTNETSCRATCH schemas. I entered corresponding records into the TABLE_UPDATE tables.

Notes:
1) This submittal includes sites from groups E1 (East 1) and SE5 (Southeast 5).

Thanks,
Chris

Here is a summary of what has been loaded:

Appends:

CALIBRATION_SUMMARY - 60 records
(Q2 2009)

DRYCHEM - 334 records
(Group E1, SE5 data submittal for Feb 2008 - Jul 2009, NPS data submittal for Jun 2009.)

FILTER_PACK - 334 records
(Group E1, SE5 data submittal for Feb 2008 - Jul 2009, NPS data submittal for Jun 2009.)

GAS_CALIBRATION - 5286 records
(Sep 2009)

LABDATA - 13772 records
(Q2 2009)

LABDATA_QC - 5921 records
(Q2 2009)

SAMPLE_REFERENCE - 3373 records
(Q2 2009)

Updates:

METDATA - 53568 records
(Group E1, SE5 data submittal for Feb 2008 - Jul 2009, NPS data submittal for Jun 2009.)

SITE_OPERATOR - 106 records
(current as 11/1/09)

## 9.0 APPENDIX

EPA AQS Ozone Data File Generator SOP

# APPENDIX A

## AMEC E&I, Inc.
## EPA AQS Ozone Data File Generator SOP

## 1.0 INTRODUCTION

This Microsoft Access application creates pipe "|" delimited text files of ozone raw data, accuracy data, and precision data. These files will be used to upload data in batch format to the EPA Air Quality Subsystem (AQS) application. The data is retrieved from AMEC's GNVCASTNET Microsoft SQL Server database, to which this application is linked.

This application utilizes a tab control, which has three tab or pages. The first tab is used to generate Raw Data text files, the second tab is used to generate Accuracy Data text files, and the third tab is used to generate Precision Data text files.

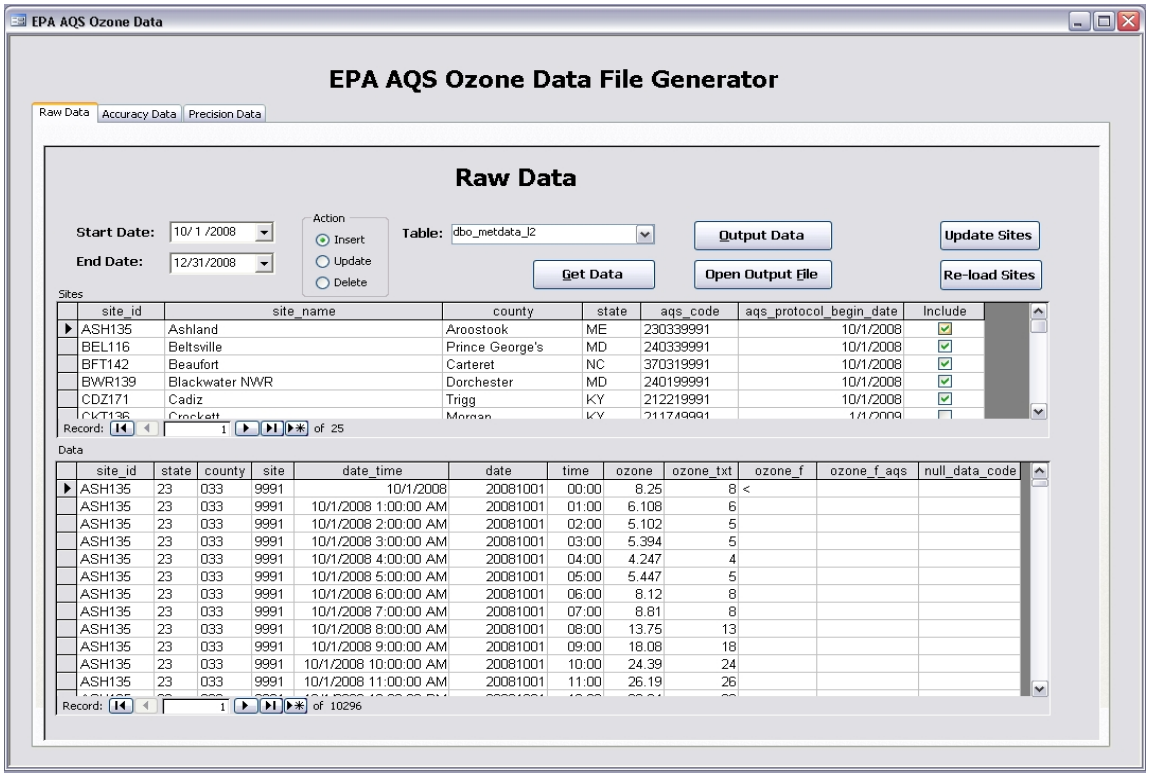
This SOP describes file generation. The resultant files are subsequently uploaded via the EPA AQS Web application (http://www.epa.gov/ttn/airs/airsaqs/aqsweb/) as per the instruction listed in the AQS User Guide (http://www.epa.gov/ttn/airs/airsaqs/manuals/AQSUserGuide.pdf).

## 2.0 OZONE RAW DATA

### 2.1 Ozone Raw Data Form

The Ozone Raw Data form is shown in Figure 2-1.

**Figure 2-1.** Ozone Raw Data Form



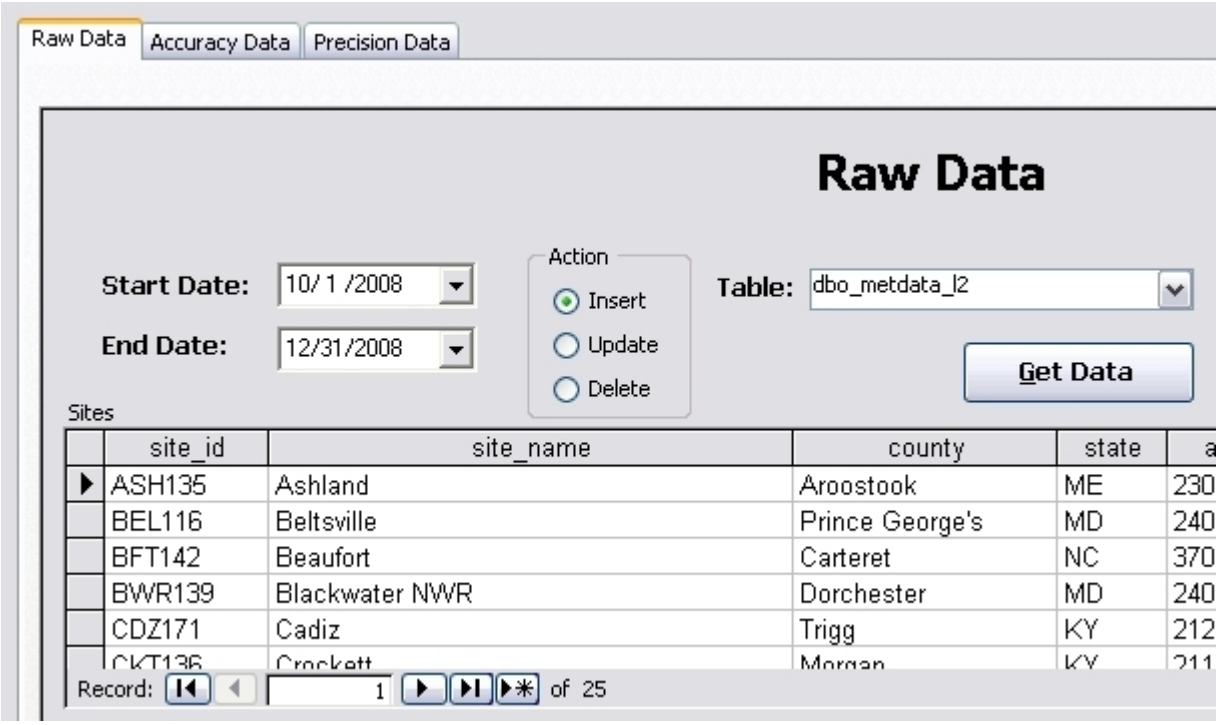
## 2.2 Date, Record Action, and Data Source Selection

The desired date range is selected first, as seen in Figure 2-2. The record Action Indicator is then selected; the action may be an Insert, Update, or Delete operation. The source of the ozone raw data is selected from the Table combo box. This combo box will list the following SQL Server linked tables:

- dbo_metdata_l1 (the castnet_working.metdata_l1 table)
- dbo_metdata_l2 (the castnet_working.metdata_l2 table)
- Union dbo_metdata_l1 & l2 (a union of these two tables)
- The vwMetDataRaw view (this performs a union of raw data in the castnet_datalink.metdata_raw and castnet_loggernet.metdata_raw tables)

The default selection is the castnet_working.metdata_l2 table.

**Figure 2-2.** Ozone Raw Data Form – Upper Left Section




## 2.3 Site Selection

On the right side of the sites list is a column labeled Include, as seen in Figure 2-3. The sites desired for data retrieval are selected by checking the boxes in this column. The Include checkbox selections are retained even after the application is closed, unless the Re-load Sites button is clicked, as discussed in the next section.

## 2.4 Site List Update and Re-Load

The site list for all three forms is provided from a local table. The data in this table is retrieved with an inner join query of the castnet.site and castnet.aqs_sites tables, where in the first table the agency field is 'EPA', and the active field indicates ozone. The Update Sites button updates the following fields in the local sites list from the castnet.aqs_sites table: site_name, aqs_code, and aqs_protocol_begin_date. The Include checkbox selections will not be altered.

If there are additions or deletions of sites from the castnet.site table, or if the agency or active field values change, clicking the Re-load Sites buttons will clear the local sites table and re-load it with the current sites data. In this case, the Include checkbox selections will be cleared as well.

## 2.5 Data Retrieval and Text File Generation

The Get Data button is used to retrieve data for the selected sites and date range. The data is displayed in the lower half of the form, as seen in Figure 2-4. The Output Data button creates the raw data text file.

**Figure 2-3.** Ozone Raw Data Form – Upper Right Section

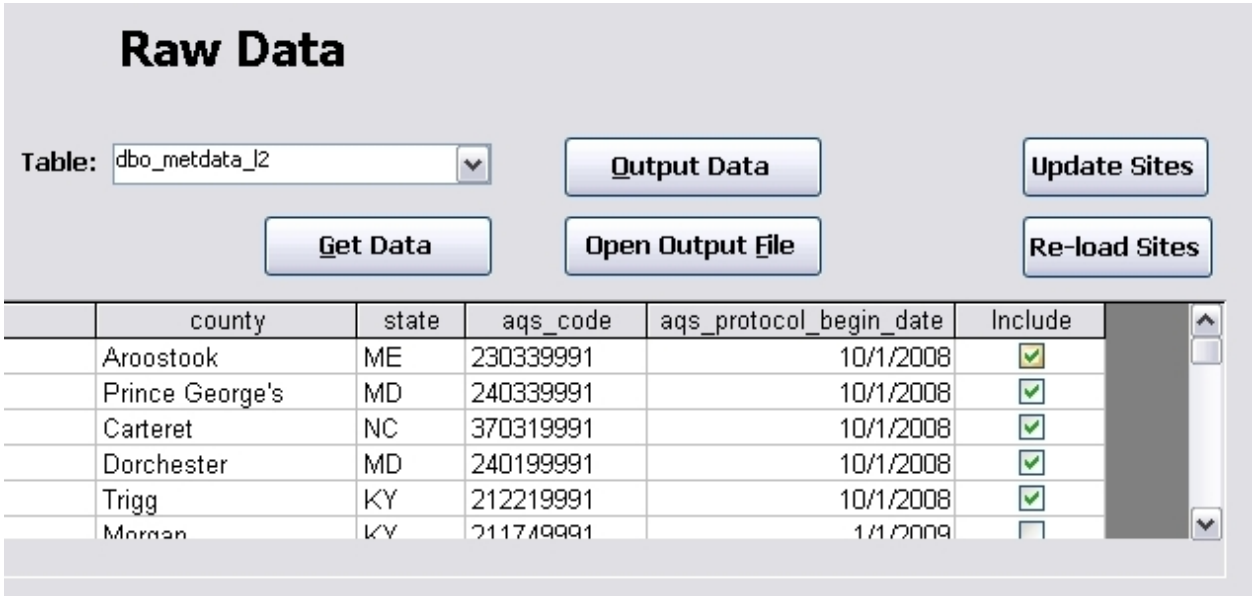


**Figure 2-4.** Ozone Raw Data Form – Lower Section

Data

| site_id | state | county | site | date_time | date | time | ozone | ozone_txt | ozone_f | ozone_f_aqs | null_data_code |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ASH135 | 23 | 033 | 9991 | 10/1/2008 | 20081001 | 00:00 | 8.25 | 8 | < | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 1:00:00 AM | 20081001 | 01:00 | 6.108 | 6 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 2:00:00 AM | 20081001 | 02:00 | 5.102 | 5 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 3:00:00 AM | 20081001 | 03:00 | 5.394 | 5 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 4:00:00 AM | 20081001 | 04:00 | 4.247 | 4 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 5:00:00 AM | 20081001 | 05:00 | 5.447 | 5 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 6:00:00 AM | 20081001 | 06:00 | 8.12 | 8 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 7:00:00 AM | 20081001 | 07:00 | 8.81 | 8 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 8:00:00 AM | 20081001 | 08:00 | 13.75 | 13 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 9:00:00 AM | 20081001 | 09:00 | 18.08 | 18 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 10:00:00 AM | 20081001 | 10:00 | 24.39 | 24 | | | |
| ASH135 | 23 | 033 | 9991 | 10/1/2008 11:00:00 AM | 20081001 | 11:00 | 26.19 | 26 | | | |

Record: 1 of 10296

## 2.6 Output Text File Review

The Open Output File button opens the text file for review in Notepad, as seen in Figure 2-5.

**Figure 2-5.** Ozone Raw Data Output Text File

ozone_data.txt - Notepad

File Edit Format View Help

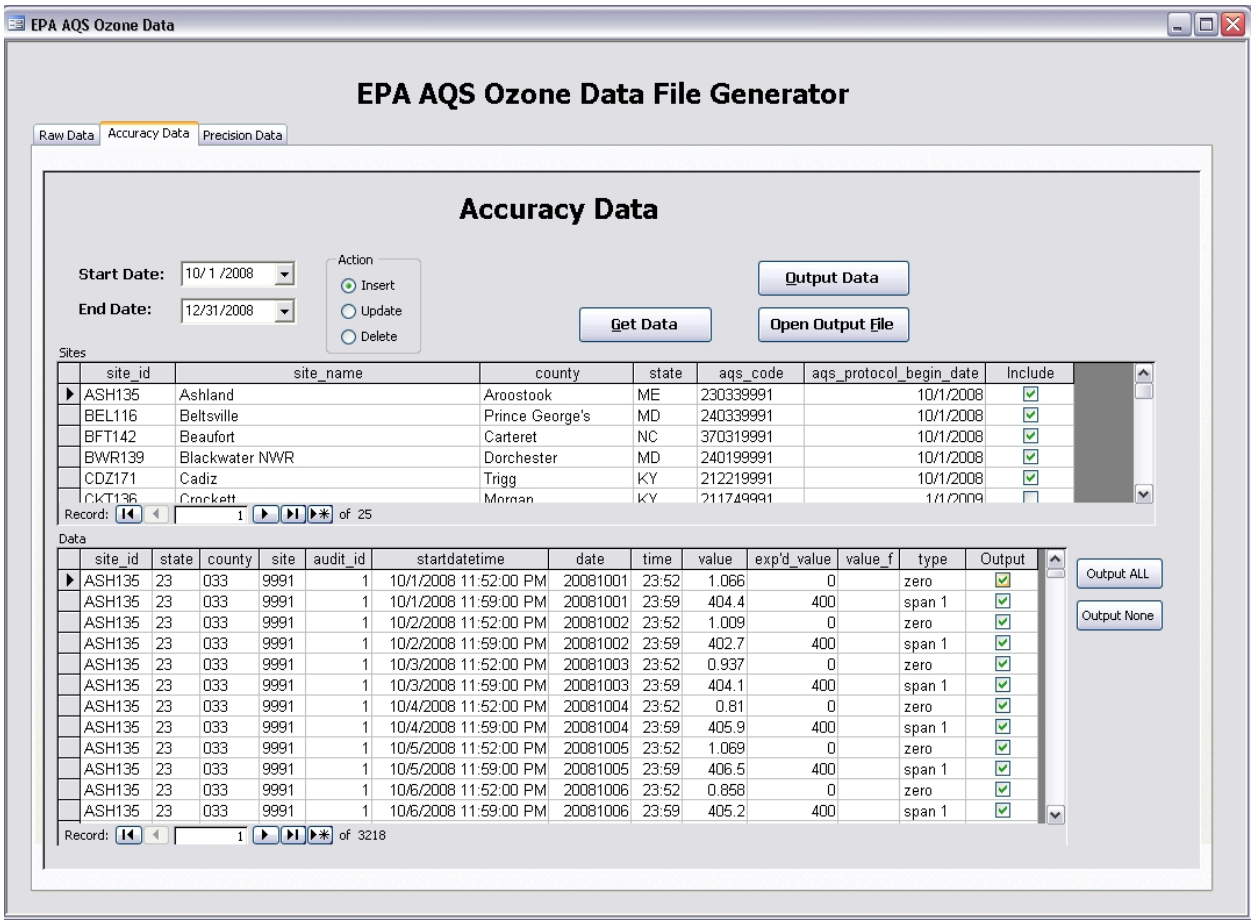
```
RD|I|23|033|9991|44201|1|1|008|047|20081001|00:00|8|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|01:00|6|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|02:00|5|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|03:00|5|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|04:00|4|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|05:00|5|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|06:00|8|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|07:00|8|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|08:00|13|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|09:00|18|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|10:00|24|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|11:00|26|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|12:00|26|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|13:00|26|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|14:00|23|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|15:00|19|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|16:00|16|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|17:00|15|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|18:00|14|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|19:00|15|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|20:00|16|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|21:00|16|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|22:00|17|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081001|23:00|17|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|00:00|24|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|01:00|24|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|02:00|22|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|03:00|21|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|04:00|20|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|05:00|20|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|06:00|18|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|07:00|18|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|08:00|17|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|09:00|18|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|10:00|17|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|11:00|16|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|12:00|16|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|13:00|17|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|14:00|23|||||||||||||
RD|I|23|033|9991|44201|1|1|008|047|20081002|15:00|21|||||||||||||
```

# 3.0 OZONE ACCURACY DATA

## 3.1 Ozone Accuracy Data Form

The Ozone Accuracy Data form is shown in Figure 3-1. Creation of the Accuracy Data text file is similar to creation of the Raw Data text file.

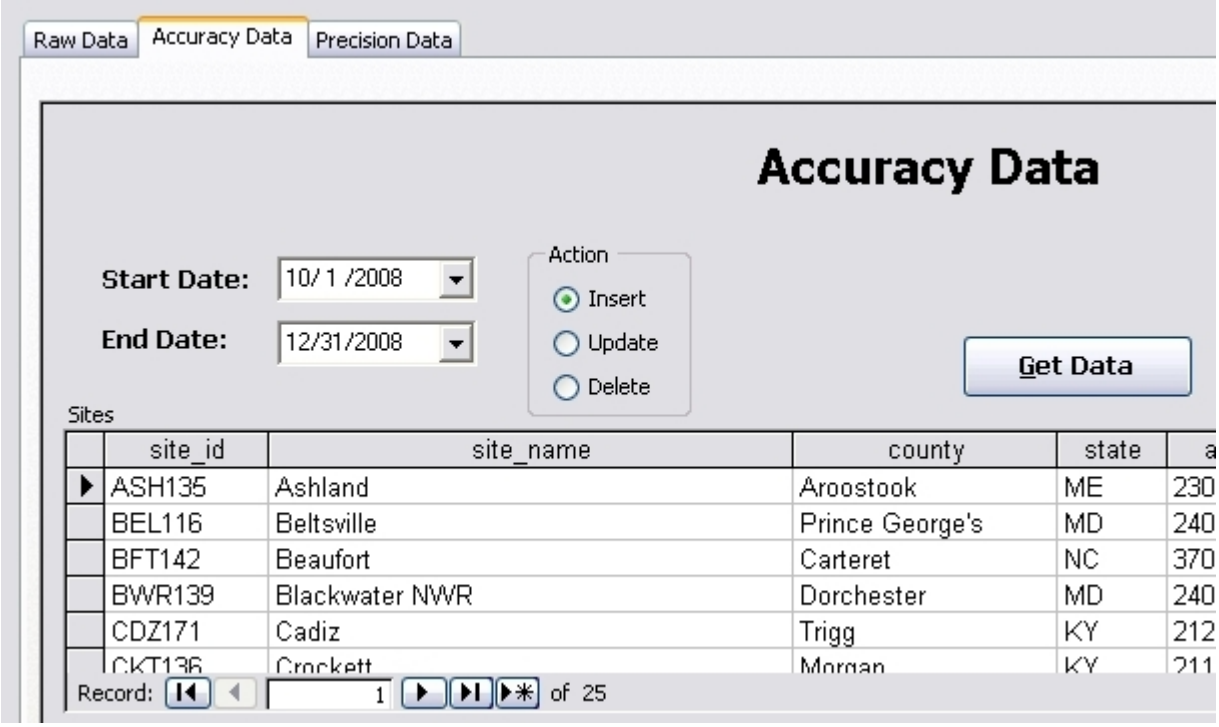
**Figure 3-1.** Ozone Accuracy Data Form




## 3.2 Date and Record Action Selection

The desired data range is selected first, as seen in Figure 3-2. Next the record Action Indicator is selected; the action may be an Insert, Update, or Delete operation. The source of the ozone accuracy data is the castnet_loggernet.cal_raw table.

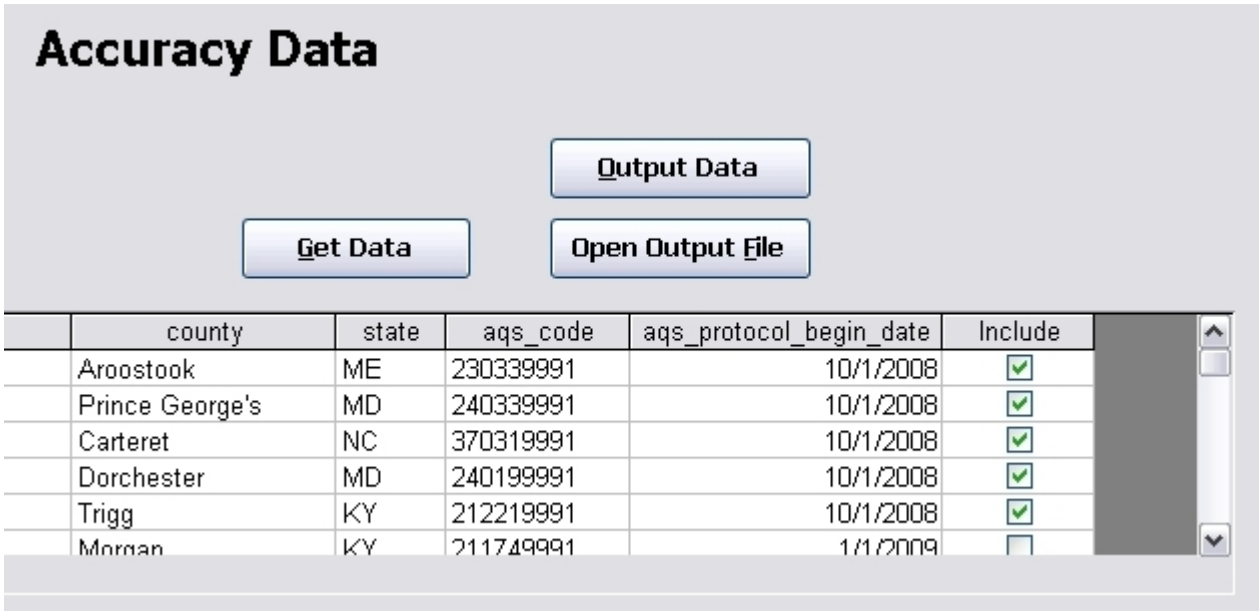
**Figure 3-2.** Ozone Accuracy Data Form – Upper Left Section




## 3.3 Site Selection

On the right side of the sites list is a column labeled Include, as seen in Figure 3-3. The sites desired for data retrieval are selected by checking the boxes in this column.

**Figure 3-3.** Ozone Accuracy Data Form – Upper Right Section



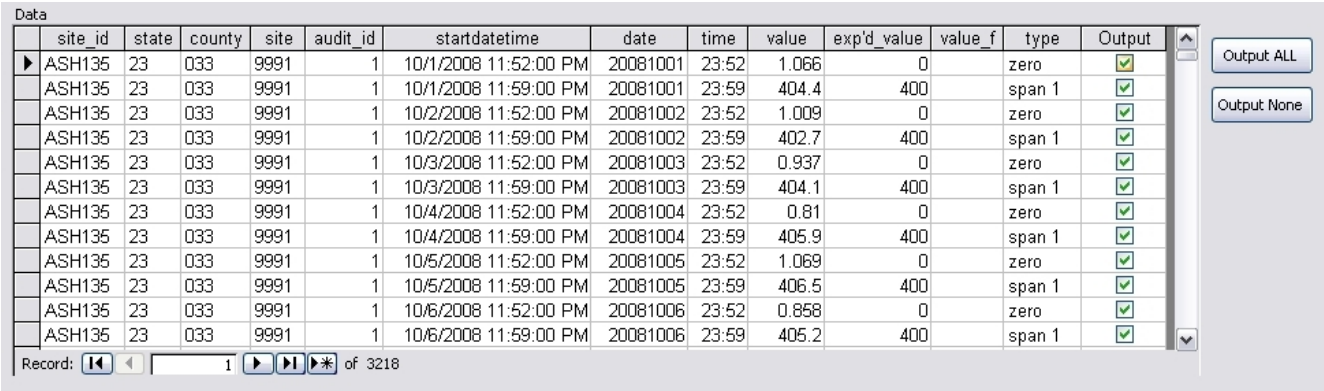
## 3.4 Data Retrieval

The Get Data button is used to retrieve data for the selected sites and date range. The data is displayed in the lower half of the form, as seen in Figure 3-4.

## 3.5 Record Selection and Text File Generation

On the right side of the data section is a column labeled Output. This column is used to select the data records which will be output to the text file. There are two buttons to aid in selecting the records: Output All and Output None, which select all or none of the records, respectively. The Output Data button creates the accuracy data text file.

**Figure 3-4.** Ozone Accuracy Data Form – Lower Section


Data

| site_id | state | county | site | audit_id | startdatetime | date | time | value | exp'd_value | value_f | type | Output |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASH135 | 23 | 033 | 9991 | 1 | 10/1/2008 11:52:00 PM | 20081001 | 23:52 | 1.066 | 0 | | zero | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/1/2008 11:59:00 PM | 20081001 | 23:59 | 404.4 | 400 | | span 1 | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/2/2008 11:52:00 PM | 20081002 | 23:52 | 1.009 | 0 | | zero | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/2/2008 11:59:00 PM | 20081002 | 23:59 | 402.7 | 400 | | span 1 | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/3/2008 11:52:00 PM | 20081003 | 23:52 | 0.937 | 0 | | zero | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/3/2008 11:59:00 PM | 20081003 | 23:59 | 404.1 | 400 | | span 1 | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/4/2008 11:52:00 PM | 20081004 | 23:52 | 0.81 | 0 | | zero | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/4/2008 11:59:00 PM | 20081004 | 23:59 | 405.9 | 400 | | span 1 | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/5/2008 11:52:00 PM | 20081005 | 23:52 | 1.069 | 0 | | zero | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/5/2008 11:59:00 PM | 20081005 | 23:59 | 406.5 | 400 | | span 1 | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/6/2008 11:52:00 PM | 20081006 | 23:52 | 0.858 | 0 | | zero | ☑ |
| ASH135 | 23 | 033 | 9991 | 1 | 10/6/2008 11:59:00 PM | 20081006 | 23:59 | 405.2 | 400 | | span 1 | ☑ |

Record: 1 of 3218

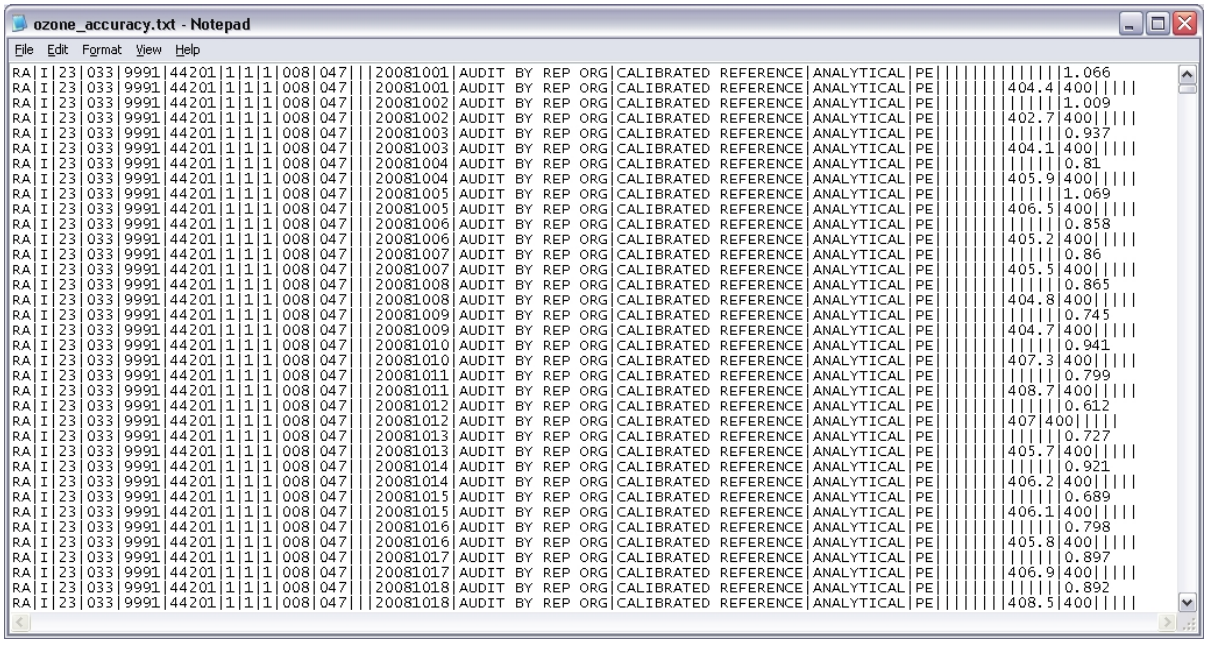
Output ALL

Output None

## 3.6 Output Text File Review

The Open Output File button opens the text file for review in Notepad, as seen in Figure 3-5.

**Figure 3-5.** Ozone Accuracy Data Output Text File


ozone_accuracy.txt - Notepad

File Edit Format View Help

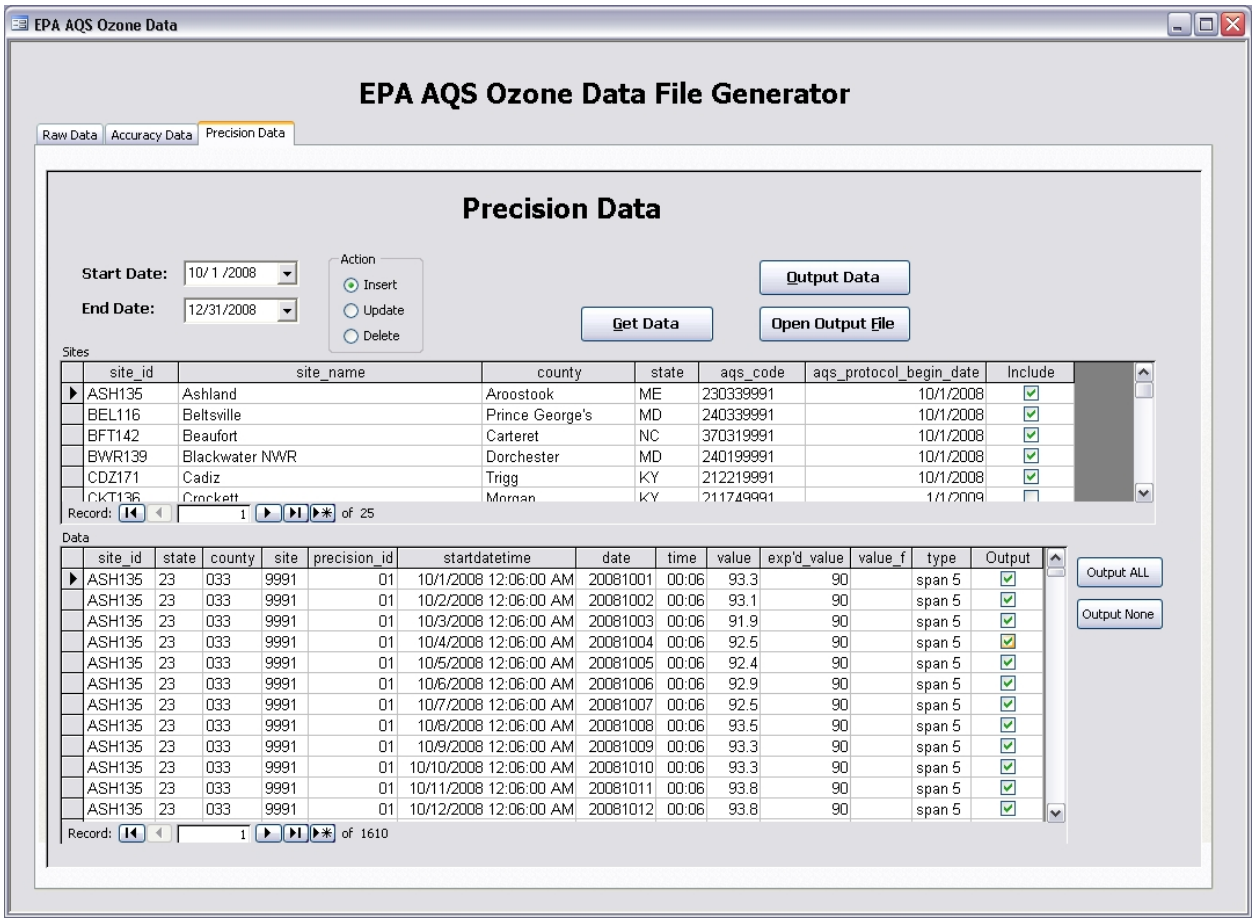
```
RA|I|23|033|9991|44201|1|1|1|008|047|||20081001|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||||1.066
RA|I|23|033|9991|44201|1|1|1|008|047|||20081001|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||404.4|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081002|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||1.009
RA|I|23|033|9991|44201|1|1|1|008|047|||20081002|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||402.7|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081003|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.937
RA|I|23|033|9991|44201|1|1|1|008|047|||20081003|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||404.1|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081004|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.81
RA|I|23|033|9991|44201|1|1|1|008|047|||20081004|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||405.9|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081005|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||1.069
RA|I|23|033|9991|44201|1|1|1|008|047|||20081005|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||406.5|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081006|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.858
RA|I|23|033|9991|44201|1|1|1|008|047|||20081006|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||405.2|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081007|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.86
RA|I|23|033|9991|44201|1|1|1|008|047|||20081007|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||405.5|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081008|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.865
RA|I|23|033|9991|44201|1|1|1|008|047|||20081008|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||404.8|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081009|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.745
RA|I|23|033|9991|44201|1|1|1|008|047|||20081009|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||404.7|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081010|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.941
RA|I|23|033|9991|44201|1|1|1|008|047|||20081010|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||407.3|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081011|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.799
RA|I|23|033|9991|44201|1|1|1|008|047|||20081011|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||408.7|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081012|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.612
RA|I|23|033|9991|44201|1|1|1|008|047|||20081012|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||407|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081013|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.727
RA|I|23|033|9991|44201|1|1|1|008|047|||20081013|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||405.7|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081014|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.921
RA|I|23|033|9991|44201|1|1|1|008|047|||20081014|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||406.2|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081015|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.689
RA|I|23|033|9991|44201|1|1|1|008|047|||20081015|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||406.1|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081016|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.798
RA|I|23|033|9991|44201|1|1|1|008|047|||20081016|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||405.8|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081017|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.897
RA|I|23|033|9991|44201|1|1|1|008|047|||20081017|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||406.9|400|||||
RA|I|23|033|9991|44201|1|1|1|008|047|||20081018|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||||||0.892
RA|I|23|033|9991|44201|1|1|1|008|047|||20081018|AUDIT BY REP ORG|CALIBRATED REFERENCE|ANALYTICAL|PE||||||408.5|400|||||
```

# 4.0 OZONE PRECISION DATA

## 4.1 Ozone Precision Data Form

The Ozone Precision Data form is shown in Figure 4-1. Creation of the Precision Data text file is very similar to creation of the Accuracy Data text file.

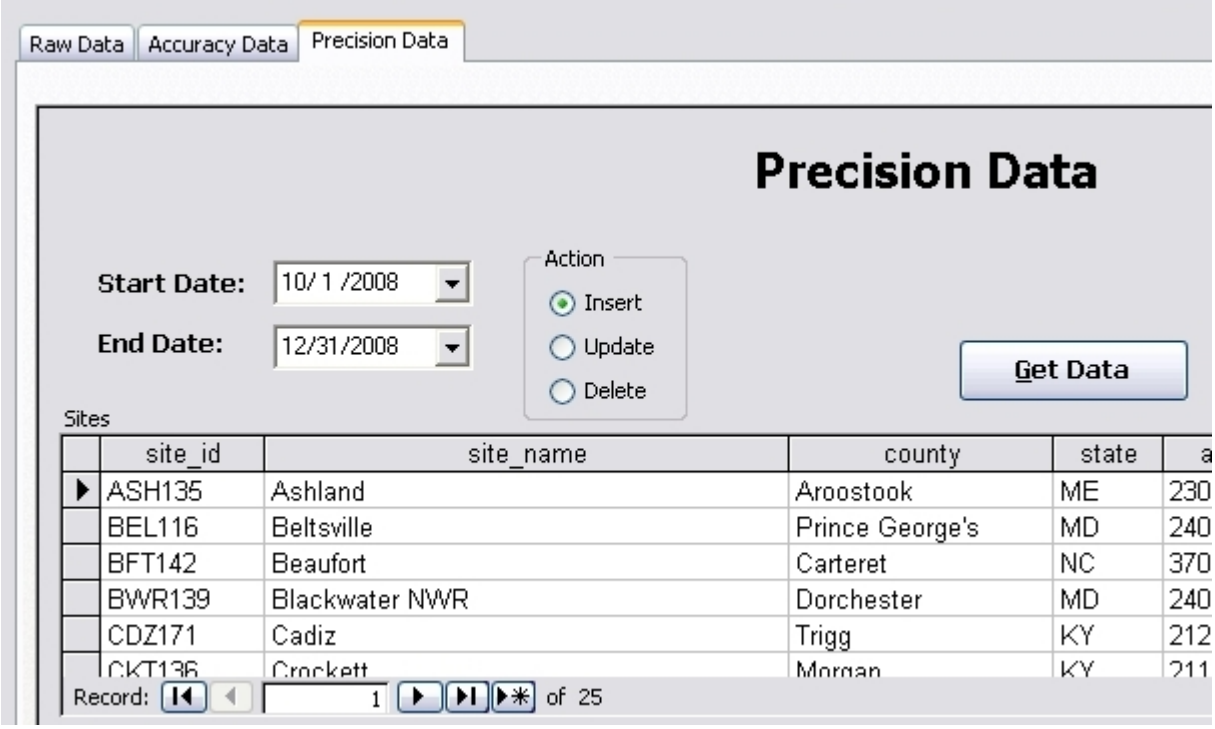
**Figure 4-1.** Ozone Precision Data Form




## 4.2 Date and Record Action Selection

The desired data range is selected first, as seen in Figure 4-2. Next the record Action Indicator is selected; the action may be an Insert, Update, or Delete operation. The source of the ozone precision data is the castnet_loggernet.cal_raw table.

**Figure 4-2.** Ozone Precision Data Form – Upper Left Section



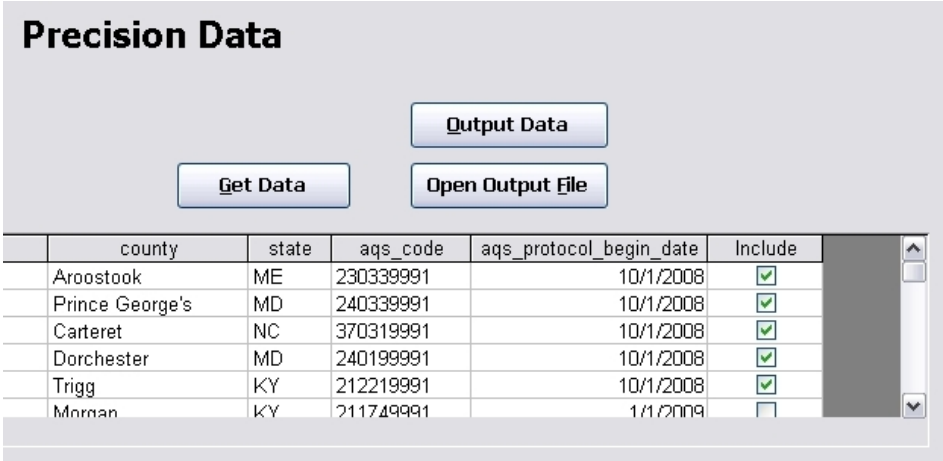

## 4.3 Site Selection

On the right side of the sites list is a column labeled Include, as seen in Figure 4-3. The sites desired for data retrieval are selected by checking the boxes in this column.

## 4.4 Data Retrieval

The Get Data button is used to retrieve data for the selected sites and date range. The data is displayed in the lower half of the form, as seen in Figure 4-4.

**Figure 4-3.** Ozone Precision Data Form – Upper Right Section



## 4.4 Record Selection and Text File Generation

On the right side of the data section is a column labeled Output. This column is used to select the data records which will be output to the text file. There are two buttons to aid in selecting the records: Output All and Output None, which select all or none of the records, respectively. The Output Data button creates the accuracy data text file.

**Figure 4-4.** Ozone Precision Data Form – Lower Section

Data

| site_id | state | county | site | precision_id | startdatetime | date | time | value | exp'd_value | value_f | type | Output |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASH135 | 23 | 033 | 9991 | 01 | 10/1/2008 12:06:00 AM | 20081001 | 00:06 | 93.3 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/2/2008 12:06:00 AM | 20081002 | 00:06 | 93.1 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/3/2008 12:06:00 AM | 20081003 | 00:06 | 91.9 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/4/2008 12:06:00 AM | 20081004 | 00:06 | 92.5 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/5/2008 12:06:00 AM | 20081005 | 00:06 | 92.4 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/6/2008 12:06:00 AM | 20081006 | 00:06 | 92.9 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/7/2008 12:06:00 AM | 20081007 | 00:06 | 92.5 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/8/2008 12:06:00 AM | 20081008 | 00:06 | 93.5 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/9/2008 12:06:00 AM | 20081009 | 00:06 | 93.3 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/10/2008 12:06:00 AM | 20081010 | 00:06 | 93.3 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/11/2008 12:06:00 AM | 20081011 | 00:06 | 93.8 | 90 | | span 5 | ☑ |
| ASH135 | 23 | 033 | 9991 | 01 | 10/12/2008 12:06:00 AM | 20081012 | 00:06 | 93.8 | 90 | | span 5 | ☑ |

Record: 1 of 1610

Output ALL

Output None

## 4.5 Output Text File Review

The Open Output File button opens the text file for review in Notepad, as seen in Figure 4-5.

**Figure 4-5.** Ozone Precision Data Output Text File

ozone_precision.txt - Notepad

File Edit Format View Help

```
RP|I|23|033|9991|44201|1|01|1|008|047|20081001|93.3||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081002|93.1||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081003|91.9||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081004|92.5||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081005|92.4||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081006|92.9||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081007|92.5||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081008|93.5||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081009|93.3||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081010|93.3||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081011|93.8||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081012|93.8||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081013|93||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081014|92.4||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081015|93.6||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081016|93.6||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081017|93.3||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081018|93.6||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081019|93.9||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081020|92.8||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081021|92||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081022|93.4||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081023|94.3||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081024|94.1||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081025|93.7||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081026|93.5||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081027|92.5||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081028|92||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081029|91||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081030|92.2||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081031|93.5||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081101|93||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081102|93.1||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081103|93.4||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081104|93.4||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081105|93.2||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081106|93.7||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081107|93.5||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081108|92.9||90|||
RP|I|23|033|9991|44201|1|01|1|008|047|20081109|93.2||90|||
```

# TITLE: MULTI-LAYER MODEL OPERATION

Effective Date: 11-9-11

Prepared by: Christopher M. Rogers
Data Operations Manager

Reviewed by: Marcus O. Stewart
Project QA Supervisor

Approved by: Holton K. Howell
Project Manager

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| Annual Review | | | |
|---|---|---|---|
| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Mgr | 10/26/12 | |
| MS | QA Mgr | 10/30/14 | |
| MS | QA Mgr | 10/23/15 | |
| | | | |

# MULTI-LAYER MODEL OPERATION

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide consistent guidance to AMEC E&I, Inc. (AMEC) Clean Air Status and Trends Network (CASTNET) Data Management Center (DMC) staff for operating the Multi-Layer Model (MLM) graphical user interface, including all required tables and files as specified in the CASTNET Quality Assurance Project Plan (QAPP) (AMEC, 2011).

## 2.0 SCOPE

These processes apply to running the MLM to calculate estimates of dry deposition.

## 3.0 OPERATING THE PRE-/POST-PROCESSOR INTERFACE

The MLM is used by CASTNET DMC staff to calculate estimates of dry deposition for the following pollutants:

- Ozone ($O_3$)
- Sulfur dioxide ($SO_2$)
- Particulate sulfate ($SO_4^{2-}$)
- Nitric acid ($HNO_3$)
- Particulate nitrate ($NO_3^-$)
- Particulate ammonium ($NH_4^+$)

The MLM is written in FORTRAN and is the latest version in a sequence of inferential models developed by National Oceanic and Atmospheric Association (NOAA) Air Research Laboratory (ARL) and by the U.S. Environmental Protection Agency (EPA) Office of Research and Development (ORD). Further discussion of the MLM can be found in Section 4.0, Data Validation and Usability, of the CASTNET QAPP (AMEC, 2011).

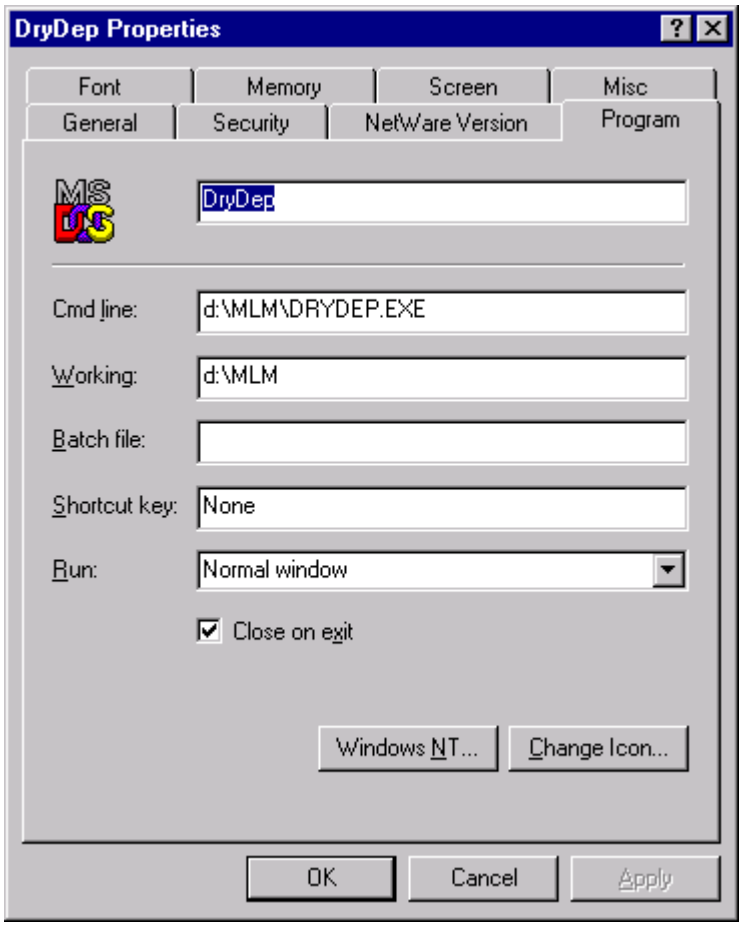
### 3.1 Required Directory and File Set Up

Operation of the MLM requires the existence of five files, all of which must be in the same local directory on the user's computer. These files are listed below:
Drydep.ctl
Drydep.exe
Drydep.pif
WDrydep.exe
WDrydep.mdb

The user should create a root-level directory on a local drive named "mlm." The drive chosen should have ample storage available [~2 gigabytes (GB)] in order to store the site-specific files created during operation. The display name for the Drydep.pif file is Drydep with a Microsoft®

MSDOS icon. If enabled on the workstation, the file extension for the other four files will be visible. The properties of the Drydep.pif file must be customized to point to the correct path for the location of the Drydep.exe program and the location of the working space required for the creation of input and output files. To accomplish this customization, right click on the file and select "Properties." Select the "Program" tab as shown in the following screen capture (Figure 1):

**Figure 1**



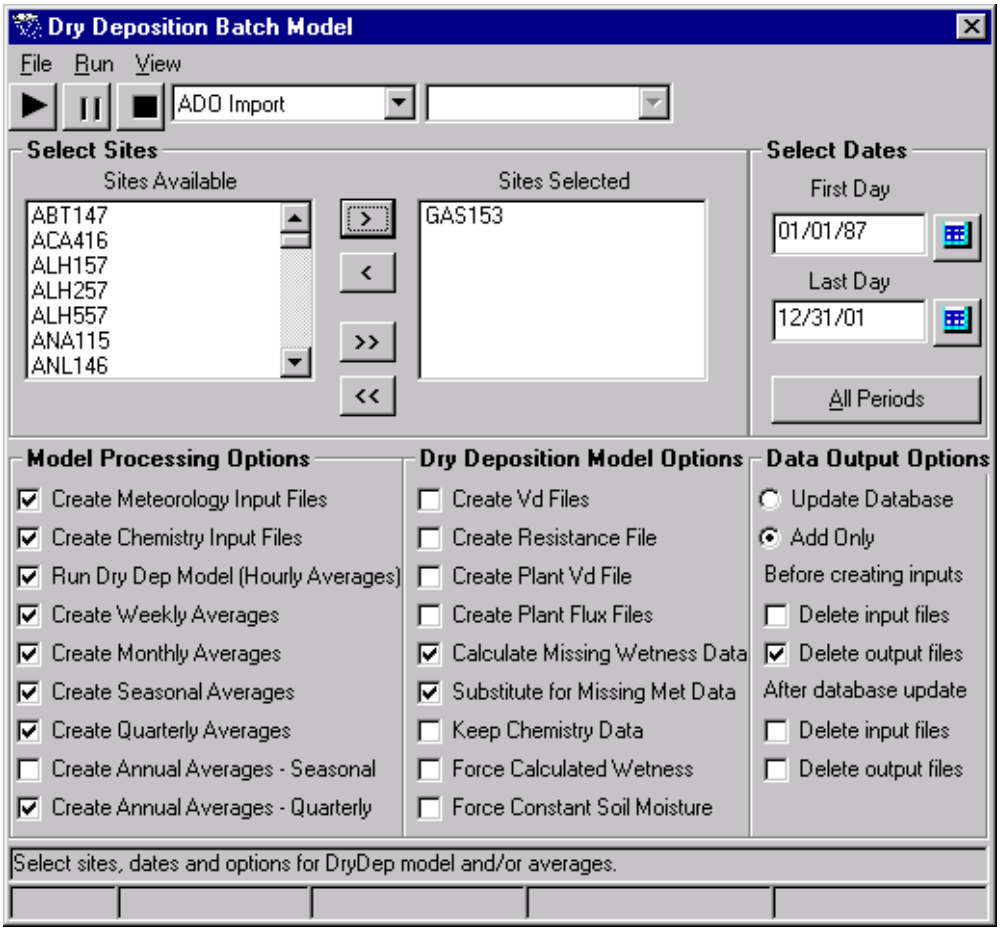

In the field "Cmd line," the full file path for the Drydep.exe file (including file name and extension) should be entered. In the "Working" field, the directory to be used for input and output files should be entered. This directory must be the location of the five files listed above.

### 3.2 Operation of the Wdrydep.exe Graphical User Interface

The MLM is run using the Wdrydep.exe program, a compiled program written in Visual Basic® 6.0. Wdrydep.exe acts as the pre- and post-processor for the model FORTRAN code

contained in the Drydep.exe program. The following screen shot (Figure 2) shows the graphical user interface of Wdrydep.exe.

**Figure 2**




Appropriate inputs for the two combo boxes at the top of the form, the “Sites Available” and “Sites Selected” list boxes, the “Select Dates” date tools, and the “Model Processing Options” section are described in Table 1.

**Table 1**

| Information Entry Point | Description | Type of Entry Required |
|---|---|---|
| Left Combo Box (at top) | Determines whether CASTNET or MADPRO* information is used | ADO Import for CASTNET<br>Cloud for MADPRO |
| Right Combo Box (at top) | Not currently used | N/A |
| **Select Sites:** "Sites Available" List | Sites that can be included for modeling | N/A |
| **Select Sites:** "Sites Selected" List | Sites that have been selected for modeling | Any site for which the user wants to calculate dry deposition. In Figure 2, estimates are to be calculated only for site GAS153. |
| **Select Dates:** "First Day" Text Box | Beginning date for the time period to be modeled. | Start date for the model run in MM/DD/YY format (e.g., for a "samples to date" model run, use 01/01/87). |
| **Select Dates:** "Last Day" Text Box | Ending date for the time period to be modeled. | End date for the model run in MM/DD/YY format (e.g., use 12/31/YY to get the complete year for year YY). |
| **Model Processing Options:** "Create Meteorological Input Files" Box | Accesses the appropriate table for continuous data. | Unless already created, box must be checked. |
| **Model Processing Options:** "Create Chemistry Input Files" Box | Accesses the appropriate table for dry chemistry concentrations. | Unless already created, box must be checked. |
| **Model Processing Options:** "Run Dry Dep Model (Hourly Averages)" Box | Runs the MLM and creates estimates of hourly deposition velocities and fluxes. | Unless user is only creating input files OR aggregating from hourly estimates that already exist, box must be checked. |
| **Model Processing Options:** Aggregation Boxes ("Create Weekly Averages" box through "Create Annual Averages – Quarterly" box) | Create aggregated values for selected time periods. | Check box for specific aggregation period of interest. In order to calculate weekly or monthly values, hourly values must exist. In order to calculate quarterly or seasonal values, weekly values must exist. In order to calculate annual values, the respective seasonal or quarterly values must exist |

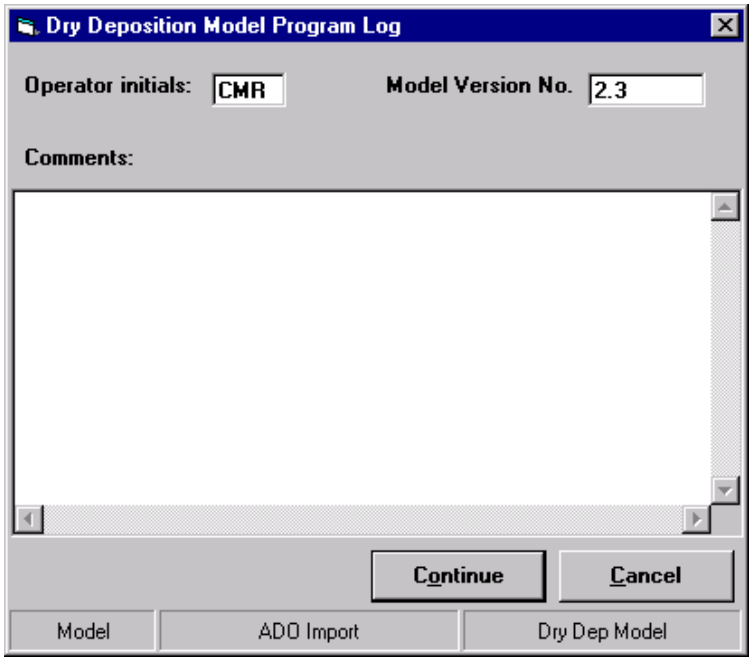
**Note:** * Mountain Acid Deposition Program – Part of CASTNET, reported separately.

The defaults in the "Dry Deposition Model Options" section of Figure 2 are all that are required for most model runs. When the form is displayed, the boxes next to "Calculate Missing Wetness Data" and "Substitute for Missing Met Data" are automatically checked. Other options give the user flexibility to create or keep various processing files that are not needed during typical MLM operation. The MLM normally produces these data during the model run but does not export the data to a file. The remaining boxes in the "Dry Deposition Model Options" section provide options useful during testing or sensitivity studies.

In the "Data Output Options" section of Figure 2, either "Update Database" or "Add Only" can be selected. The default, "Add Only," should be used during normal MLM operation. Before the model is run, the user must confirm that records for the site and time period selected do not already exist in the VELHR table. If records are present, a primary key error will result and a corresponding error message will be generated. For more information on the SQL Server™ 7.0 tables used for data storage by the post-processor, see Section 4.1. Only the "Delete output files" box should be checked in the "Before creating inputs" section. No boxes should be checked in the "After database update" section.

Once all of the required options have been selected, including the sites and time period of the model run, click the "play" button as shown in the upper left hand corner of Figure 2. The following form (Figure 3) is displayed. The user should enter his initials and the version number of the model in the spaces provided. The current version number is identified in the MODEL_VERSION table in the *castnet_model_arch* database. Special comments for the operational log can be inserted into the "Comments" section. Clicking "Continue" will start the MLM calculation process.

**Figure 3**



### 3.3 Contents of the Wdrydep.mdb File

The Wdrydep.mdb file is a Microsoft® Access database that provides the information and settings necessary for the operation of the Wdrydep.exe program. It contains eight data tables. Seven are linked to data tables in the *castnet_model* SQL Server™ 7.0 database, while one is a local data table with preferences specific to that computer. The following list provides the names of these eight tables and, if applicable, their linked table:
AverageSpecifications (linked to MLM_AVERAGE_SPECIFICATIONS)
AverageType (linked to MLM_AVERAGE_TYPE)
DatabaseType (linked to MLM_DATABASE_TYPE)
ExportFileSpecifications (linked to MLM_EXPORT_FILE_SPECIFICATIONS)
ExportQuerySpecifications (linked to MLM_EXPORT_QUERY_SPECIFICATIONS)
ImportFileSpecifications (linked to MLM_IMPORT_FILE_SPECIFICATIONS)
OperatorLog (linked to MLM_OPERATOR_LOG)
UserPreferences

Operation of the Wdrydep.exe does not require changes to any of these tables. Only the CASTNET Data Operations Manager (DOM) or his designee is authorized to make edits to these tables.

### 3.4 Files Created by the MLM Pre-Processor

The Wdrydep.exe program creates multiple files for use by the MLM during calculation of deposition velocities and fluxes. These files are presented in Table 2.

**Table 2**

| File Name | Description |
|---|---|
| [site_id].chm | Chemistry data for each site from DRYCHEM table. One file per site is created to contain atmospheric concentrations for the time period being modeled. Example file: GAS153.chm. |
| [site_id].met | Continuous data for each site from METDATA table. One file per site is created to contain meteorological data for the time period being modeled. Example file: GAS153.met. |
| Lang.sph | Leaf angle data from the LEAF_ANGLE table. |
| Leaf.dat | Plant leaf coverage data from the SITE_PLANT_SUMMARY and SITE_PLANT_DETAIL tables. Recreated for each site as model calculations progress. |
| Nearsite.dat | Contains “nearsites” (if applicable) for the site currently being modeled. Recreated for each site as model calculations progress. |
| Padprof1.20<br>Padprof2.20<br>Padprof3.20 | Canopy data from the PLANT_PROFILE table. Recreated for each site as model calculations progress. |
| Plant.dat | Plant data from the PLANT table. |

| File Name | Description |
|---|---|
| Station.dat | Site information from the VW_SITES_OLD view including longitude, latitude, time zone, and elevation. Recreated for each site as model calculations progress. |

During the calculation process, the MLM also creates several other files. These are listed in Table 3.

**Table 3**

| File Name | Description |
|---|---|
| [site_id].hvf | Report file to contain site information and a layout of the model output. Example file: GAS153.hvf. |
| [site_id].mc | Report file to contain combination of continuous data and atmospheric concentrations in one file. Example file: GAS153.mc. |
| [site_id].vfc | One file per site is created to contain hourly deposition velocity and fluxes output by the model. |

## 4.0 MODEL OUTPUT POST-PROCESSING: TABLES, AGGREGATION SCHEMES, AND REQUIREMENTS

### 4.1 Database Tables Used as Output Destinations

During post-processing, data from the [site_id].vfc file is imported into the database for storage and additional data aggregation. Table 4 displays the six database tables found in the *castnet_model* SQL Server™ 7.0 database that are used as destinations for MLM output.

**Table 4**

| Table Name | Description |
|---|---|
| VELHR | Hourly deposition velocity and flux values from the MLM output. |
| VELWK | Weekly deposition velocity and flux values. Aggregated from VELHR. These values represent aggregations based on a 168 hour week. |
| VELMN | Monthly deposition velocity and flux values. Aggregated from VELHR. These values represent aggregations based on calendar months. |
| VELQR | Quarterly deposition velocity and flux values. Aggregated from VELWK. These values represent aggregations based on calendar quarters. |
| VELSN | Seasonal deposition velocity and flux values. Aggregated from VELWK. These values represent aggregations based on the starting date of each season (e.g., spring, summer, fall, and winter). |
| VELAN | Annual deposition velocity and flux values. Aggregated from either VELQR or VELSN. The typical method for producing annual values uses VELQR (quarterly) values. |

## 4.2 Aggregation Schemes and Completeness Requirements

Table 5 provides the completeness requirements for each aggregation level described in Section 4.1. For more details on the aggregations, see Section 4.0, Data Validation and Usability, of the CASTNET QAPP (AMEC, 2011).

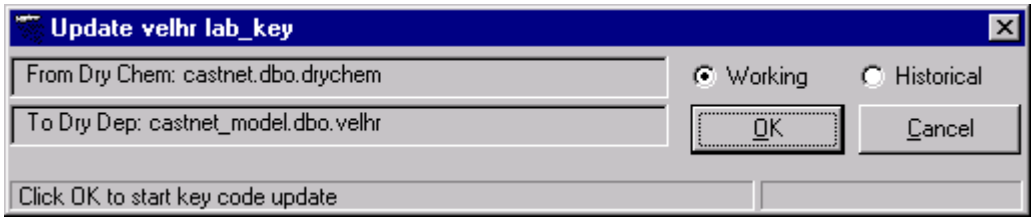
**Table 5**

| Aggregation Level | Completeness Requirement |
|---|---|
| Weekly | 69% of hourly values during the week must be valid. |
| Monthly | 69% of the hourly values during the calendar month must be valid. |
| Quarterly | 69% of the weekly values during the quarter must be valid. This allows quarters with 9 valid weeks out of 13 possible weeks to meet the requirement. |
| Seasonal | 69% of the weekly values during the season must be valid. |
| Annual | 75% of the quarters/seasons during the year must be valid. |

# 5.0 ADDING THE LAB_KEY TO VELHR

One of the requirements for the VELHR table is the inclusion of the analytical sample lab_key designation that documents the atmospheric concentrations used for a specific hourly record. Rather than make significant modifications to either the Drydep.exe or Wdrydep.exe code, a separate program was established to complete this task each time the model is run. The program used is named "Lab_key.exe" and is written in Visual Basic® 6.0. To operate this program (Figure 4), first select either "working" or "historical." Selection of "working" will add the lab_key to the VELHR table in the SQL Server™ 7.0 *castnet_model* database, while selection of "historical" will add the lab_key to the VELHR table in the *castnet_model_arch* database. The name of the table to be updated is shown in the "To Dry Dep" window. The source of the lab_key values shown in the "From Dry Chem" window does not change. Click the "OK" button to begin adding the lab_key values. Records are not updated if the lab_key field already contains a value.

**Figure 4**



## 6.0 REFERENCES

AMEC E&I, Inc. (AMEC). 2011. *Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan, Revision* 8.0. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

## 7.0 ATTACHMENTS

This SOP does not contain attachments.

# TITLE: DATABASE BACKUPS

Effective Date: 11-9-11

Prepared by: Christopher M. Rogers
Data Management, Analysis, Interpretation, and Reporting Manager

Reviewed by: Marcus O. Stewart
Project QA Supervisor

Approved by: Holton K. Howell
Project Manager

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| Annual Review | | | |
|---|---|---|---|
| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Mgr | 10/26/12 | |
| MS | QA Mgr | 10/30/13 | |
| MS | QA Mgr | 10/22/14 | |
| | | | |

# DATABASE BACKUPS

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide consistent guidance to AMEC E&I, Inc. (AMEC) Clean Air Status and Trends Network (CASTNET) Data Management Center (DMC) staff on how to successfully complete the backup procedure for the CASTNET SQL Server™ 7.0 databases as specified in the CASTNET Quality Assurance Project Plan (QAPP) (AMEC, 2011).

## 2.0 SCOPE

These processes apply to the regular backup of the CASTNET database as performed by the CASTNET Data Operations Manager (DOM) or his designee, the only members of the DMC staff who are authorized to perform database backups. This SOP assumes that the user possesses a basic understanding of the SQL Server™ 7.0 Enterprise Manager.

## 3.0 SUMMARY

## 4.0 MATERIALS

## 5.0 SAFETY

The same level of care and caution should be exercised while using the laptop/computer as would be taken when using any electrically powered device. Keep all cords out of walkways. If needed, use appropriately rated extension cords and surge protectors, and do not overload the electrical circuit. Keep liquids and food away from the computer and keyboard.

Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using the computer. Take breaks regularly to allow muscles to relax and to promote blood flow, including standing up, briefly walking around the room, and stretching to counteract the repetitive motion activities and extended periods of sitting.

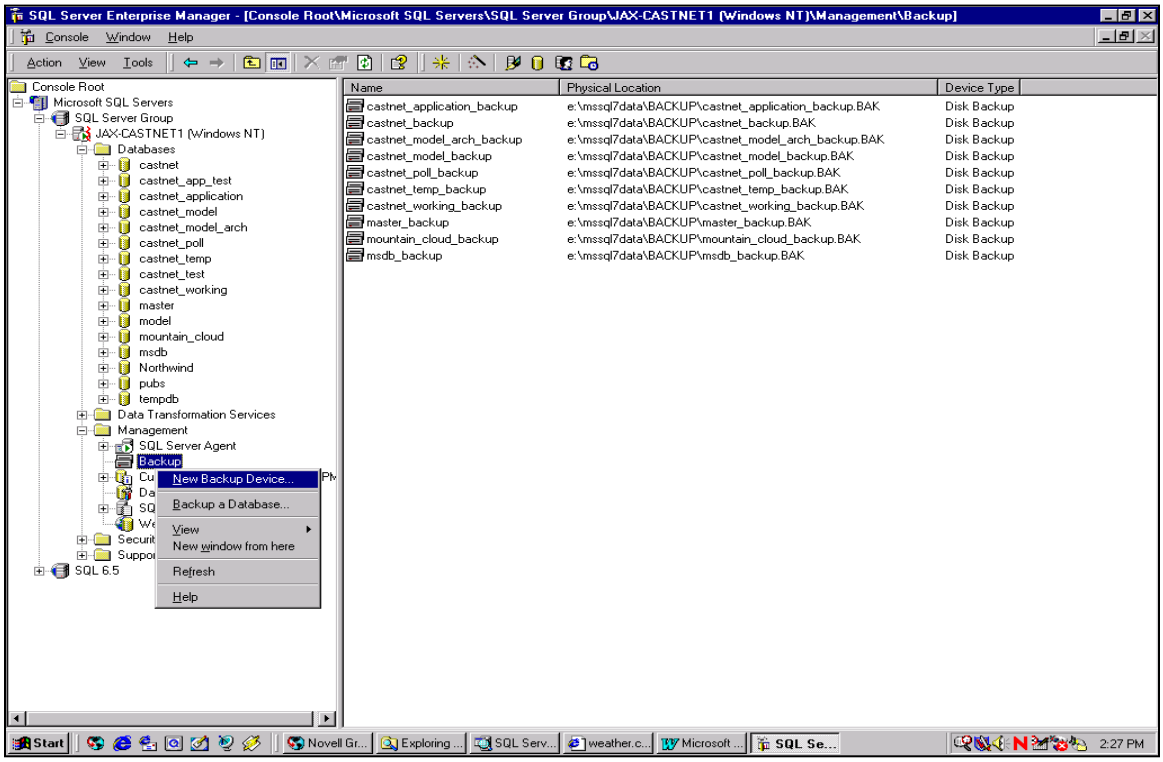
## 6.0 PROCEDURE

### 6.1 Creating Backup Devices in Sql Server™ 7.0

The CASTNET data set, which consists of seven permanent databases managed using Microsoft® SQL Server™ 7.0, must be backed up weekly to ensure protection against catastrophic server failure, theft, and other forms of data loss. The process for routine backups of SQL Server™ 7.0 managed databases begins with the creation of a backup device specific to each database. Figure 1 displays the process of creating a new backup device for an existing

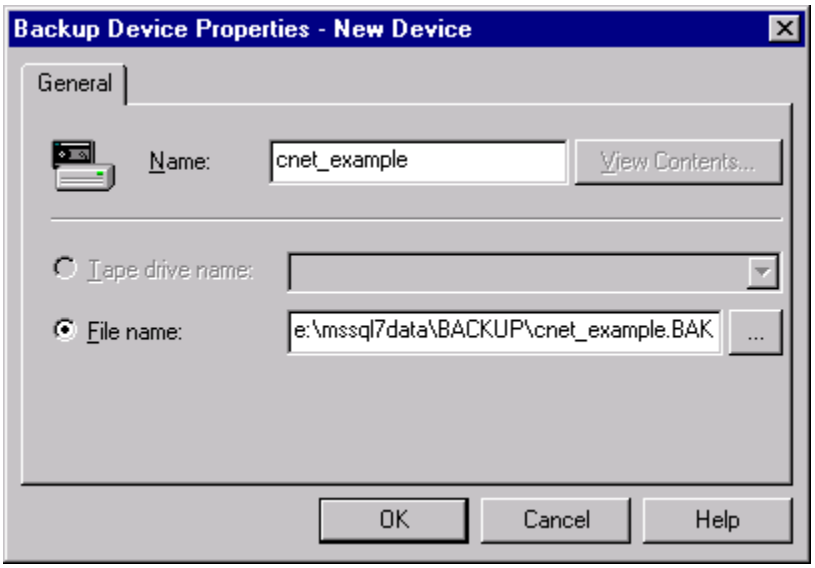
database. In the directory tree under “Databases,” open the “Management” folder and right click on “Backup.” The first option is “New Backup Device”:

**Figure 1**




Select “New Backup Device” and the following form (Figure 2) is displayed. Enter the name of the new backup device (the file name is automatically created), and click “OK” to establish the device:

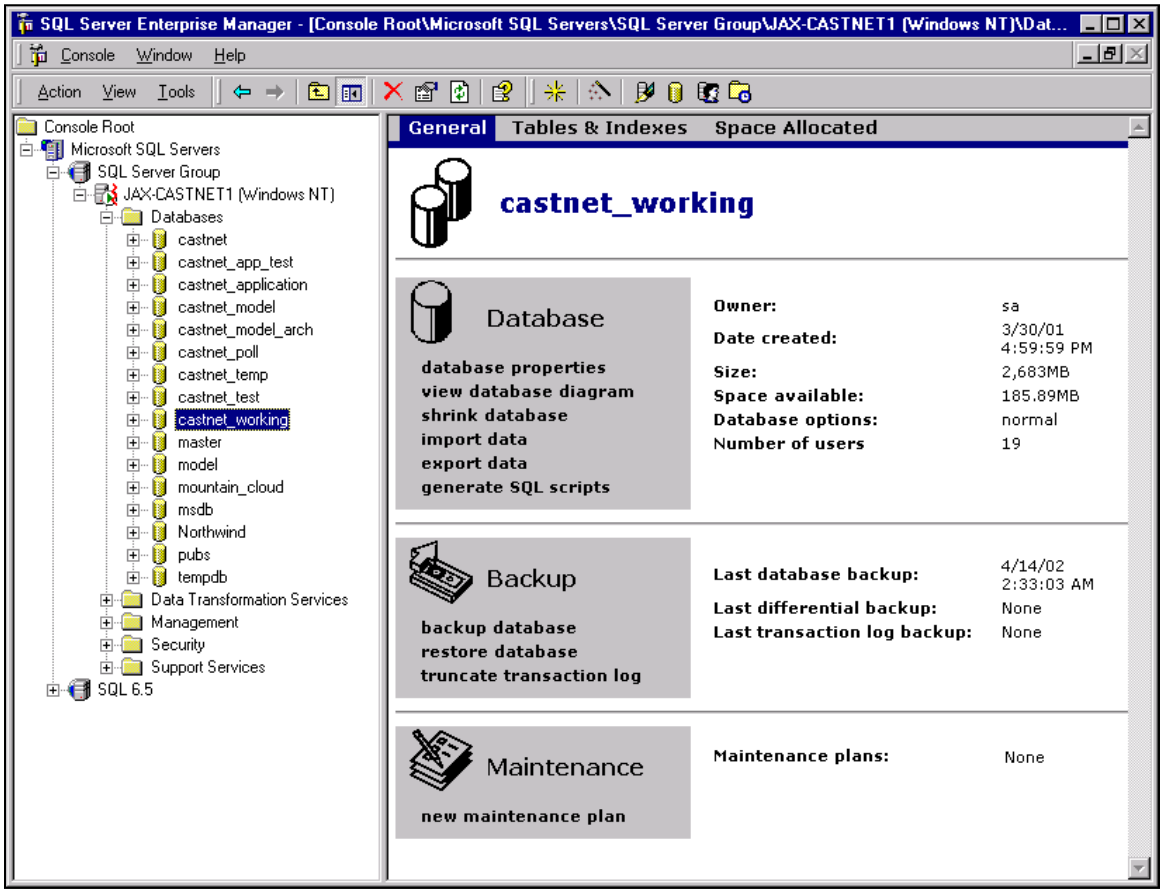
**Figure 2**



## 6.2 Manual Database Backups Using Sql Server™ 7.0

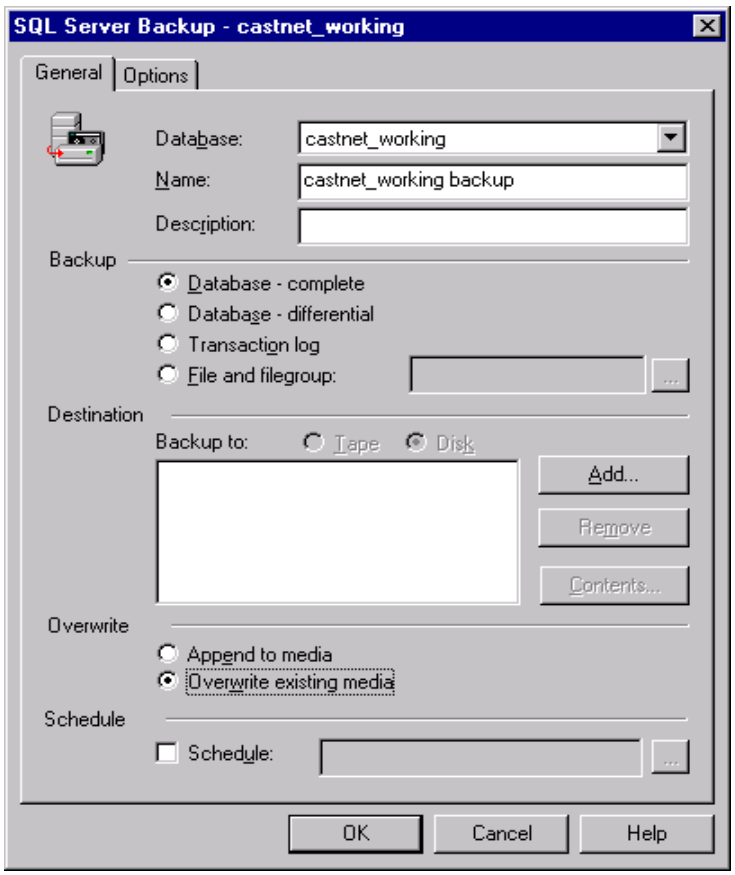
Databases can be backed up without a backup device. However, for a database that is routinely backed up, it is simpler to first create a backup device that can then be used repeatedly. Once the database backup device is established, a database can be manually backed up. To begin, under the "Databases" folder, highlight the database to be backed up (Figure 3):

**Figure 3**



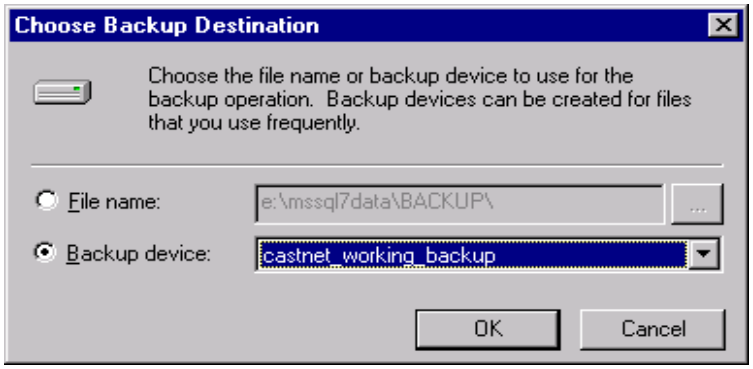

Multiple options are shown in the right window. Under the "Backup" options, select "backup database." The following form (Figure 4) is displayed:

**Figure 4**



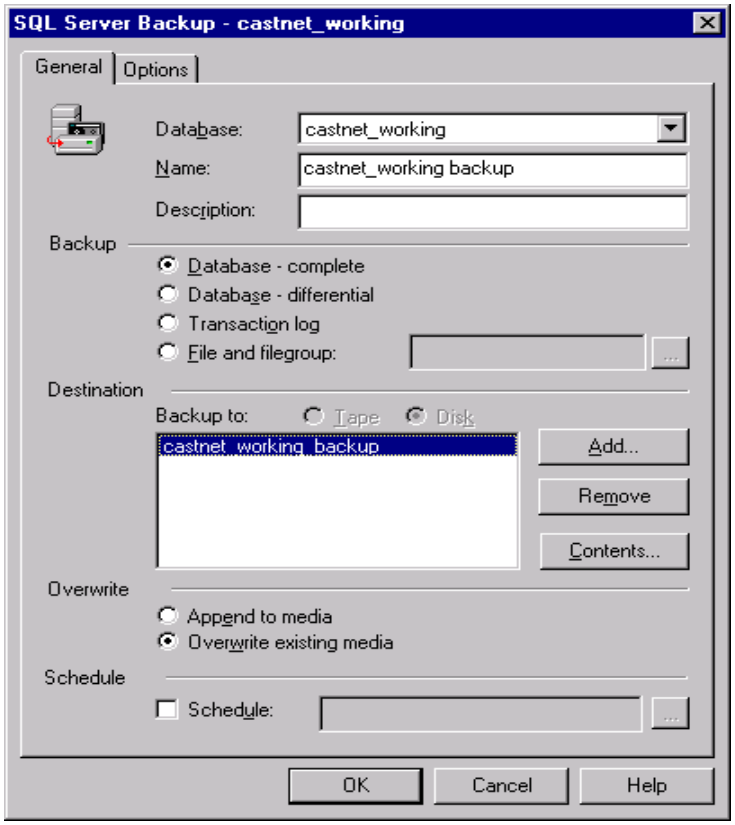

Only complete backups of the CASTNET databases are performed. This is the default setting and is indicated by the selected radio button next to "Database – complete." As an additional step, when a new backup is created, existing backups are overwritten. This option is not a default and must be selected by clicking the radio button next to "Overwrite existing media." In Figure 4, the "Destination" box is empty. To select a destination, click the "Add" button and the following form (Figure 5) will display:

**Figure 5**



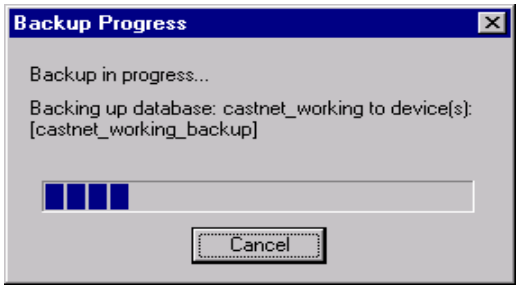

Backups can either be sent to a file or to a backup device which points to the file to be used. Open the combo box next to "Backup device" and select the backup device to be used. In this example, the castnet_working database is being backed up and therefore the "castnet_working_backup" backup device is selected. After clicking "OK," the "Destination" box now indicates "castnet_working_backup" (Figure 6):

**Figure 6**



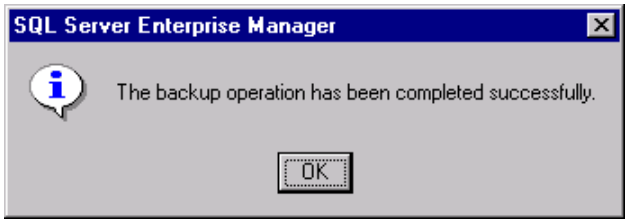
To start the manual backup, click “OK.” The progress bar (Figure 7) indicates the percent of completion for the backup process:

**Figure 7**




When the backup is done, the following will appear (Figure 8):

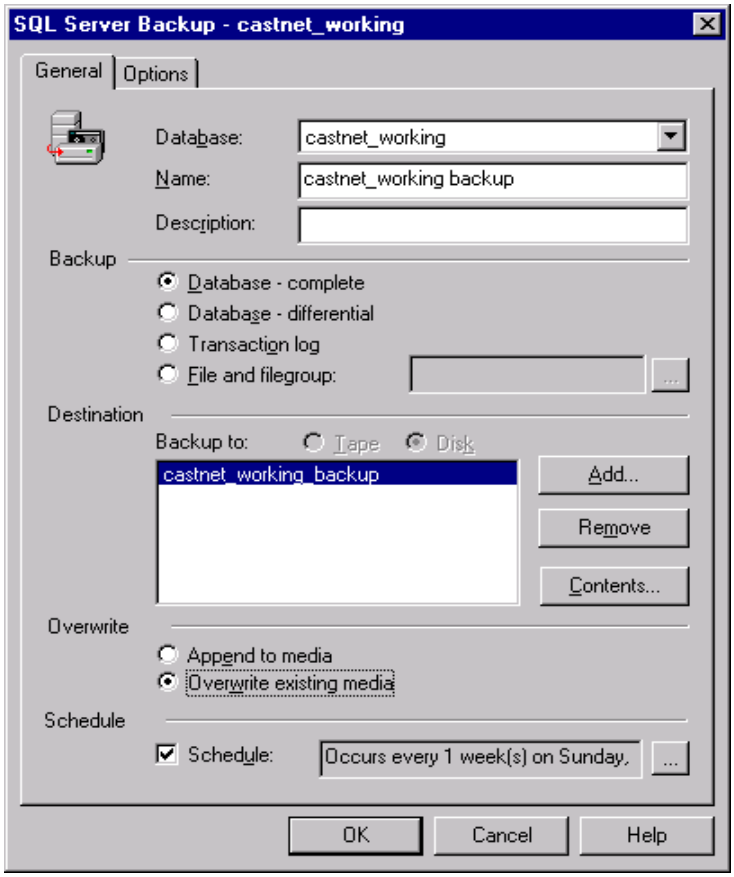
**Figure 8**




### 6.3 Scheduling the Backup Job

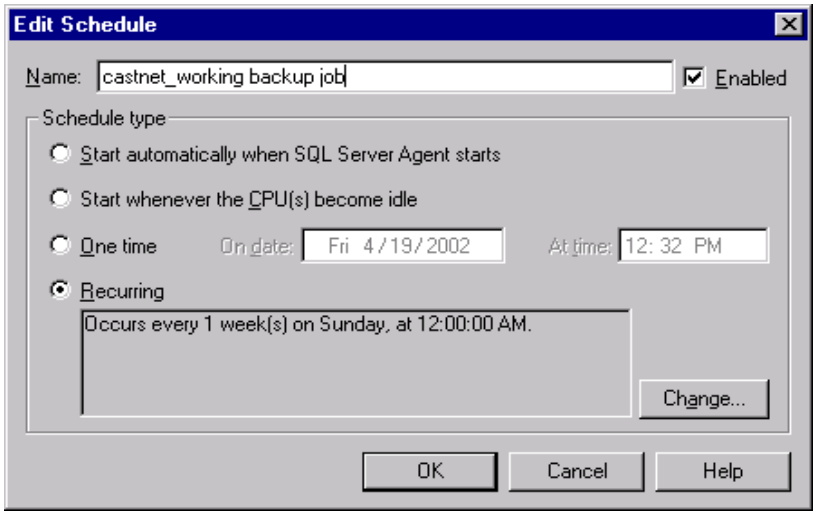
To schedule the backup to run at a specific frequency and time, follow the instructions in Section 4.0 for selecting the backup device, but put a check mark in the “Schedule” box instead of clicking “OK” to start the manual backup (Figure 9):

**Figure 9**



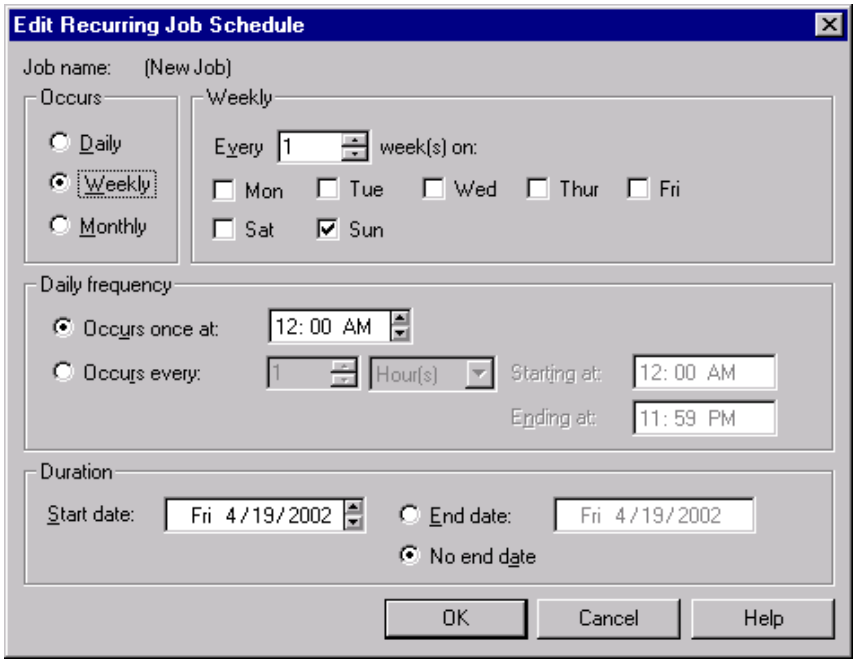

To select the date, time, and frequency of the backup job, select the button with three ellipsis dots next to the schedule list box. The following form (Figure 10) is displayed:

**Figure 10**



Provide a name for the job in the "Name" box. Since this is a backup of the castnet_working database, the name of the job is "castnet_working backup job." Verify that the "Enabled" box has a check mark in it and that the "Recurring" radio button is selected. Click the "Change" button to provide specifics for the job, which are displayed on a new form (Figure 11):

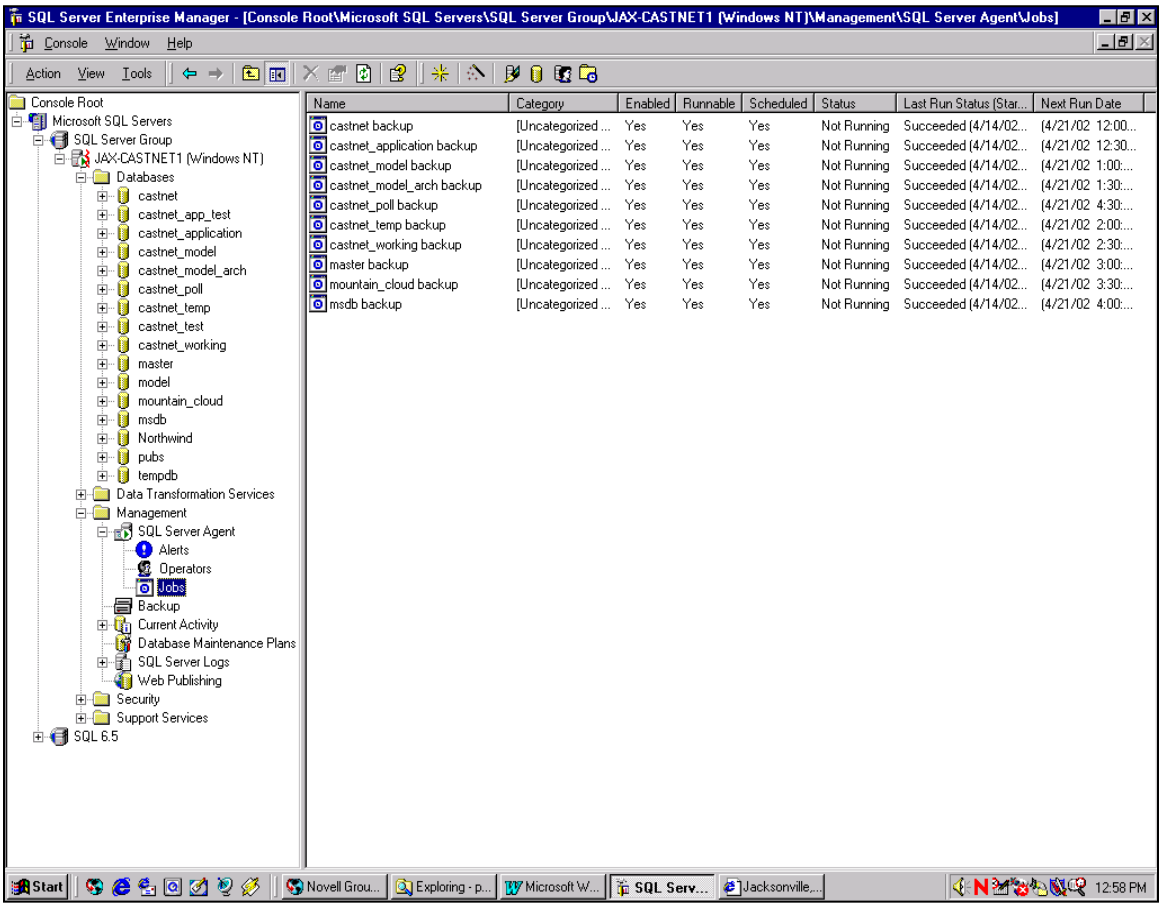
**Figure 11**




Each CASTNET database must be backed up at least once a week. The scheduled backups are staggered, beginning on Friday at midnight. To set up a weekly backup, select "Weekly" in the "Occurs" list, select "Every 1 week(s) on Thu" from the "Weekly" list, and then select a time for the job to run in the "Daily frequency" list. For "Duration," verify the "Start date," which defaults to the current date, and that the radio button for "No end date" is selected. Click "OK" when finished. In addition to the weekly backups, there is a differential backup of the labelement database each day.

Click "OK" on the "Edit Schedule" form (Figure 10) and again on the "SQL Server Backup" form (Figure 9) to save the job. Backup jobs can be viewed in the "Management" folder by clicking on "Jobs." Figure 12 shows the list of all backup jobs scheduled to run each week. Note that each backup job has a "Yes" in the enabled, runnable, and scheduled categories. Information is also given concerning the status of the last run of the backup job and the next time the job is scheduled.

**Figure 12**




## 6.4 Weekly Archiving of the Backup Files

Each Friday, all database backup files are copied to an eternal hard drive by an automated script.. In addition, the GNVCASTNET server is backed up daily to tape by AMEC IT. Backup tapes are stored in a fire-proof safe.

## 6.5 CREATING BACKUPS IN ORACLE 11G

The Oracle 11g CASTNET database is also backed up weekly. To backup the Oracle 11g database, open the Oracle Enterprise Manager Console. Select the desired database from the directory tree. Select the “Tools” menu item, and then from the expanded menu select “Database Tools”, “Backup Management”, and “Backup” (see Figure 13). This item launches the Backup Wizard tool. As shown by Figure 14, select the “Predefined Backup Strategy” radio button and click “Next”. For the CASTNET Oracle 11g database, weekly backups are adequate. Therefore, select the radio button for “My database is not frequently updated (DSS)” as shown by Figure 15, which provides for one full backup each week, and click “Next”. Figure 16 shows the form for selecting the start time for the backup. The default is 12:00 AM. The specific configuration for the backup job is shown by Figure 17. Accept the default configuration and click “Next”.

Figure 18 shows which database is selected. Click “Finish” to close the wizard and save the job. The status of the backup job can be viewed by clicking on “Jobs” in the directory tree (Figure 19).

**Figure 13**

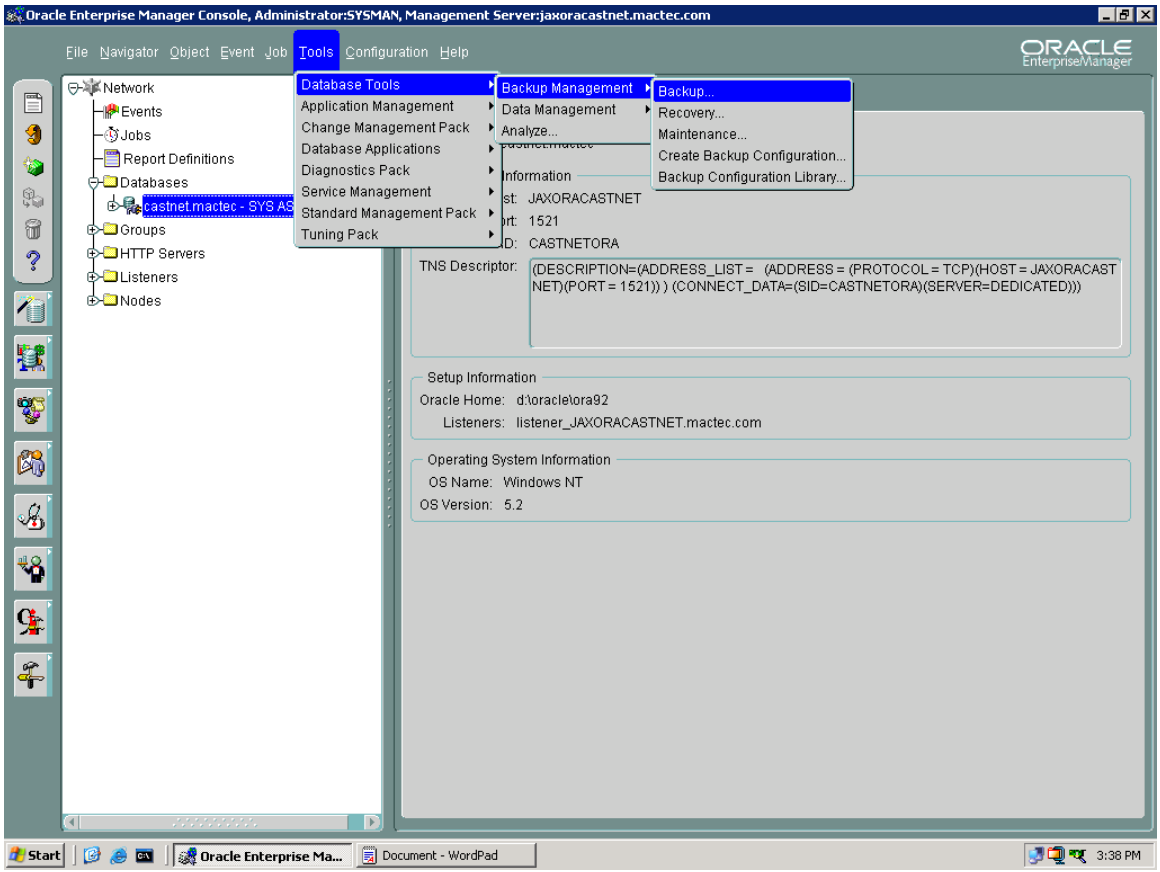
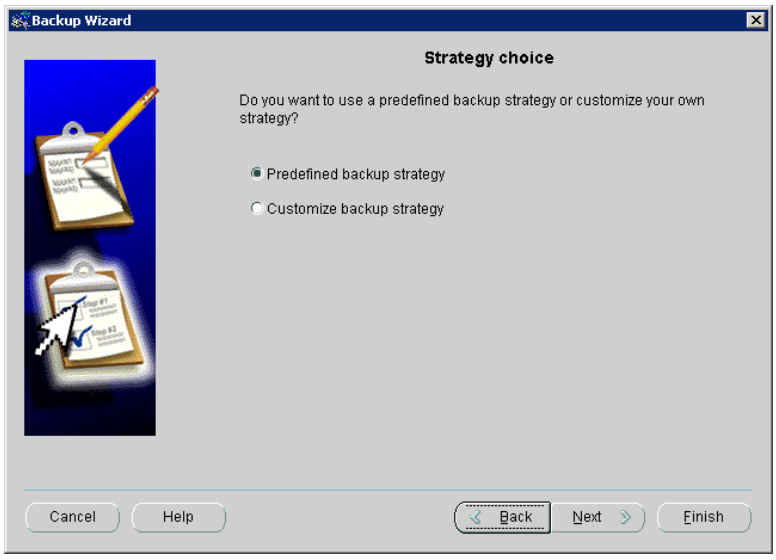
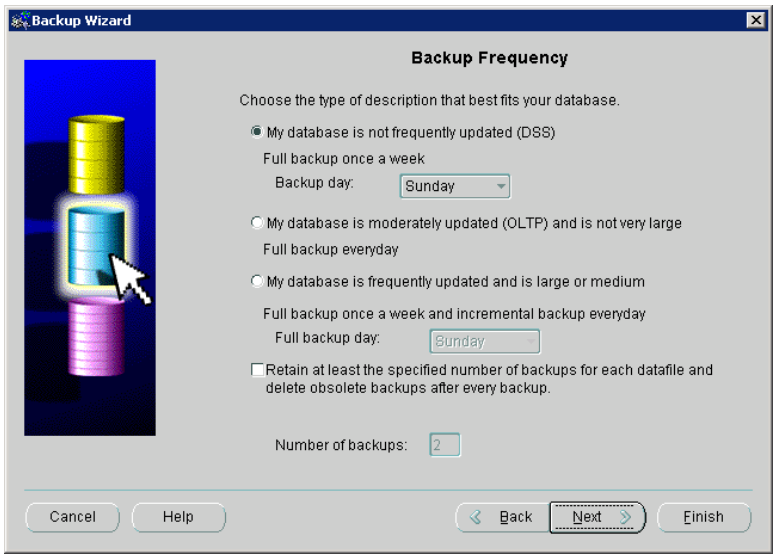


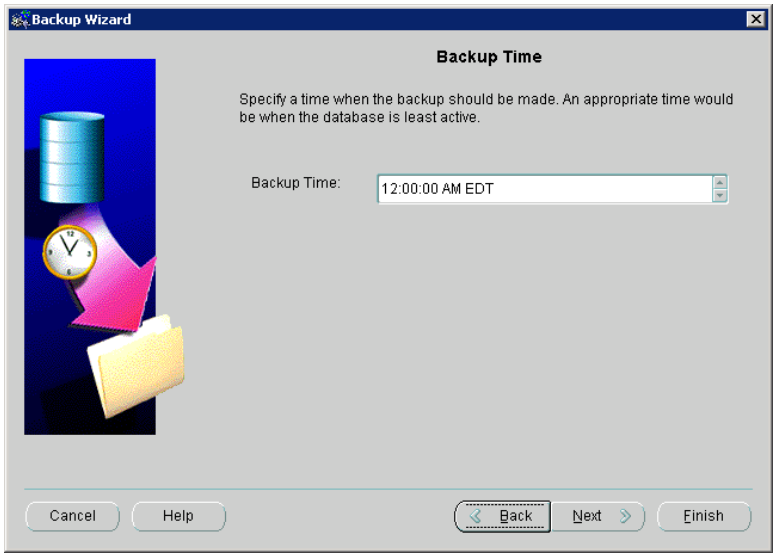

**Figure 14**



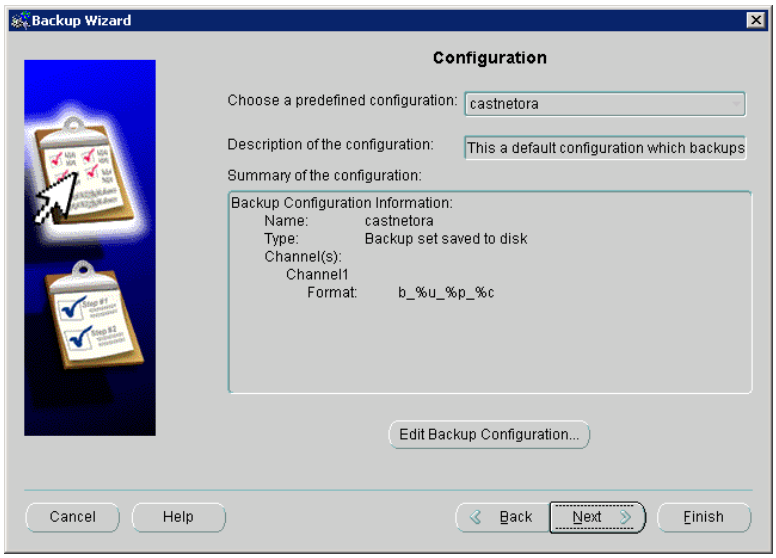
## Figure 15



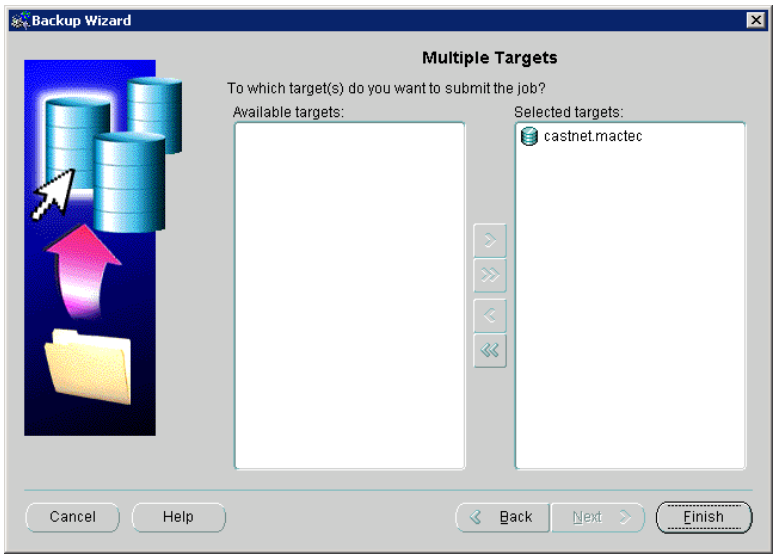

## Figure 16



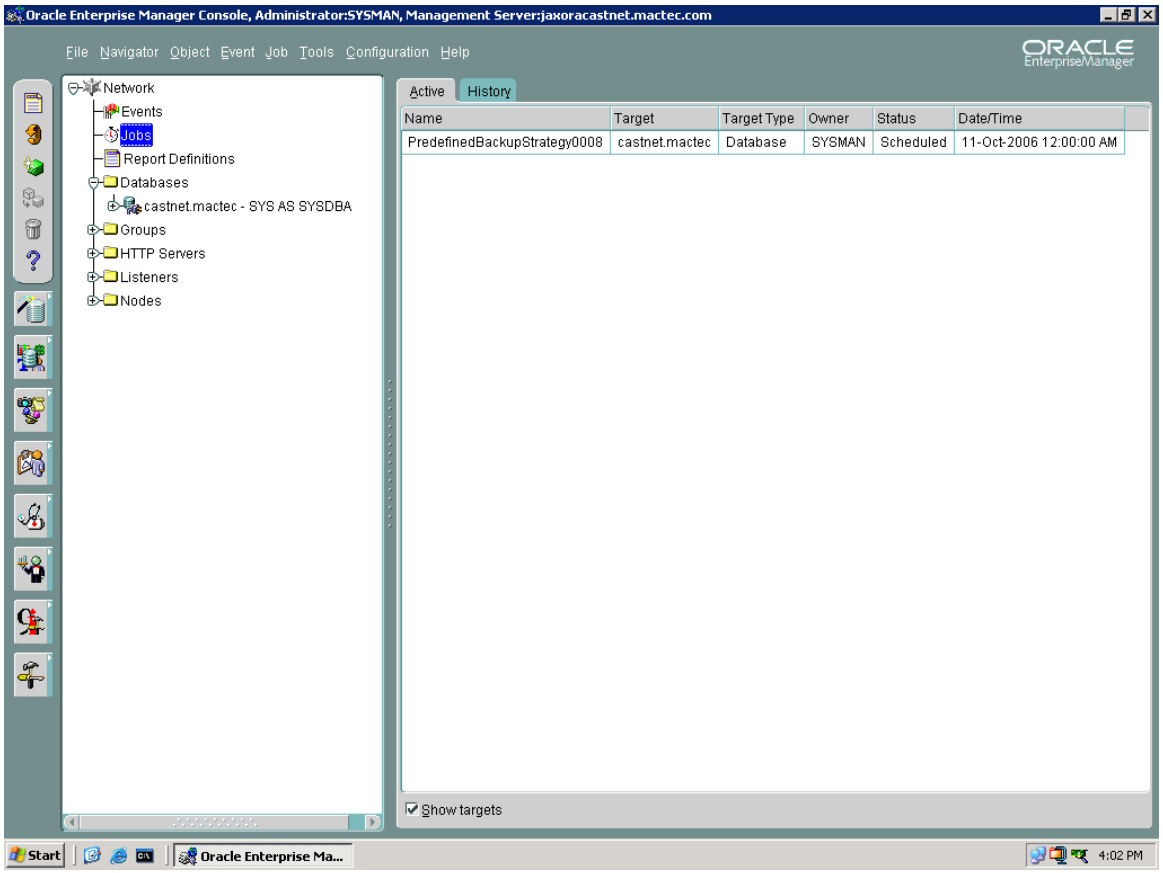
## Figure 17




## Figure 18



## Figure 19


Oracle Enterprise Manager Console, Administrator:SYSMAN, Management Server:jaxoracastnet.mactec.com
File Navigator Object Event Job Tools Configuration Help
ORACLE EnterpriseManager
Network
Events
Jobs
Report Definitions
Databases
castnet.mactec - SYS AS SYSDBA
Groups
HTTP Servers
Listeners
Nodes
Active
History
Name
Target
Target Type
Owner
Status
Date/Time
PredefinedBackupStrategy0008
castnet.mactec
Database
SYSMAN
Scheduled
11-Oct-2006 12:00:00 AM
Show targets
Start
Oracle Enterprise Ma...
4:02 PM

## 7.0 REFERENCES

AMEC E&I, Inc. (AMEC). 2011. *Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan, Revision* 8.0. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

## 8.0 ATTACHMENTS

This SOP does not contain attachments.

# TITLE: CASTNET DATA MANAGEMENT SYSTEM APPLICATION USER MANUAL

Effective Date: 11-9-11

Prepared by: Christopher M. Rogers
Data Management, Analysis, Interpretation, and Reporting Manager

Reviewed by: Marcus O. Stewart
Project QA Manager

Approved by: Holton K. Howell
Project Manager

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|---|---|---|---|
| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Mgr | 10/26/12 | |
| MS | QA Mgr | 10/30/13 | |
| MS | QA Mgr | 10/29/14 | |
| | | | |
| | | | |

# CASTNET DATA MANAGEMENT SYSTEM APPLICATION USER MANUAL

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide guidance to AMEC E&I, Inc. (AMEC) data operations personnel for the operation of the Clean Air Status and Trends Network (CASTNET) Data Management System Application.

## 2.0 SCOPE

These processes apply to the use of the CASTNET Data Management System Application.

## 3.0 SUMMARY

The CASTNET Data Management System Application (application) is a custom designed and built software program written in Microsoft® Visual Basic™ 6.0. Development of this application began in 1999 and continues with contributions from both AMEC and subcontracted programmers. The CASTNET Data Operations Manager (DOM) directs and supervises development of the application with input from the Data Management Center (DMC) staff. This document describes the use of the application. For additional information concerning the design, programming, and testing efforts that are a part of the development process, see the CASTNET Quality Assurance Project Plan (QAPP) (AMEC, 2011), the CASTNET Quality Management Plan (QMP) (AMEC, 2011), and the CASTNET Software Management Plan (SMP) (AMEC, 2011).

The application is directly linked to the CASTNET database. As a security measure, users are asked for their CASTNET database user identification (ID) and password when the application is first opened to ensure that only those users with proper authorization can access and alter certain data.

## 4.0 MATERIALS

## 5.0 SAFETY

The same level of care and caution should be exercised while using the laptop/computer as would be taken when using any electrically powered device. Keep all cords out of walkways. If needed, use appropriately rated extension cords and surge protectors, and do not overload the electrical circuit. Keep liquids and food away from the computer and keyboard.

Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using the computer. Take breaks regularly to allow muscles to relax and to promote blood flow,

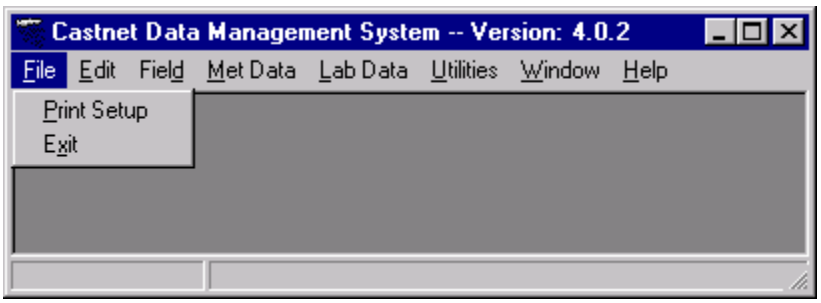
including standing up, briefly walking around the room, and stretching to counteract the repetitive motion activities and extended periods of sitting.

## 6.0 PROCEDURE

### 6.1 File Menu

Figure 1 shows the top-level menu structure listed under the "File" menu option.

**Figure 1**




#### 6.1.1 Print Setup

The "Print Setup" option is used to select which printer to use when printing from the application. The form displayed is standard for most Microsoft® Windows® type applications.

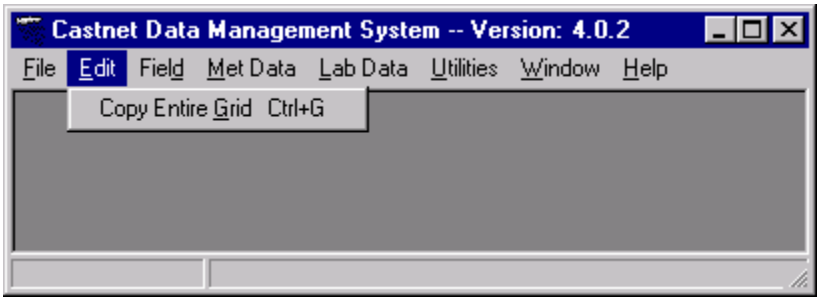
#### 6.1.2 Exit

Select "Exit" to end the current session in the application. Users also can close the application by clicking on the "X" in the upper right-hand corner of the application window. The user will be prompted to confirm the exit. Select "OK" to close the application.

### 6.2 Edit Menu

Figure 2 shows the menu structure listed under the "Edit" menu option.

**Figure 2**



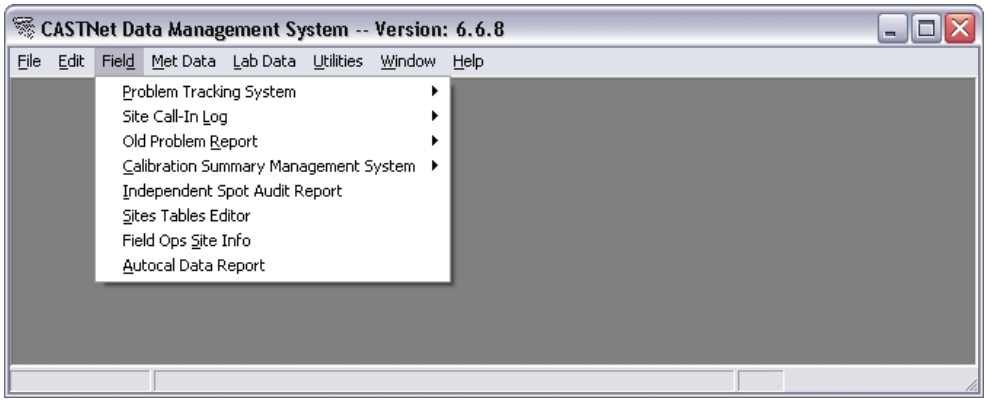

The "Copy Entire Grid" option works with many of the grids found throughout the application. As the application has evolved over several years, two different types of grids (Microsoft® and

Janus® GridEX™ 2000) are used. For each grid discussed, the correct copy procedure is identified.

## 6.3 Field Menu

Figure 3 shows the top-level menu structure listed under the "Field" menu option.

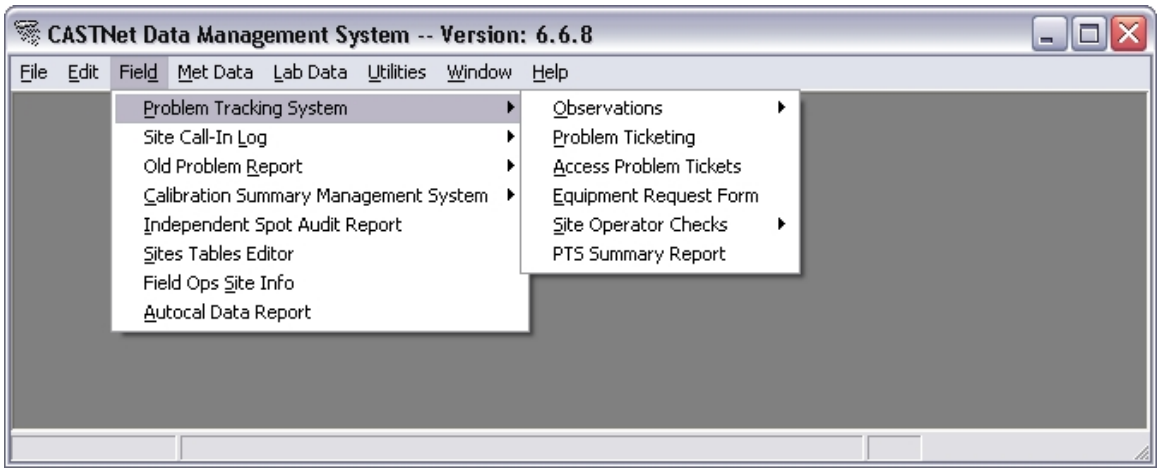
**Figure 3**




### 6.3.1 Problem Tracking System

Figure 4 shows the menu structure listed under the "Field / Problem Tracking System" top-level menu option. Field operations personnel use the Problem Tracking System to enter and report Observations, ticket selected Observations as Problems, enter and report Actions, enter Equipment Request Forms, enter and report Site Operator Checks, and produce Problem Tracking System Summary Reports.

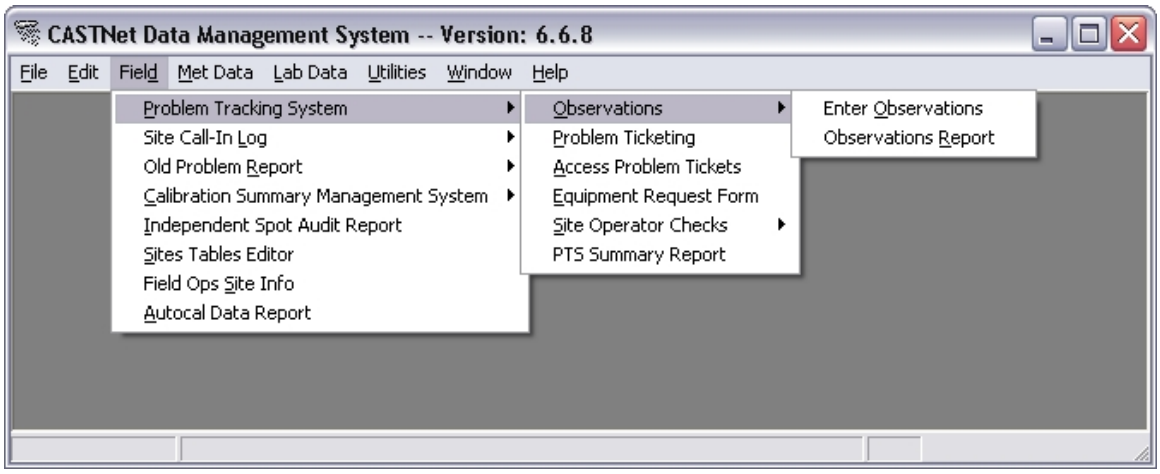
**Figure 4**



### 6.3.2 Observations

Figure 5 shows the menu structure listed under the "Observations" submenu option.

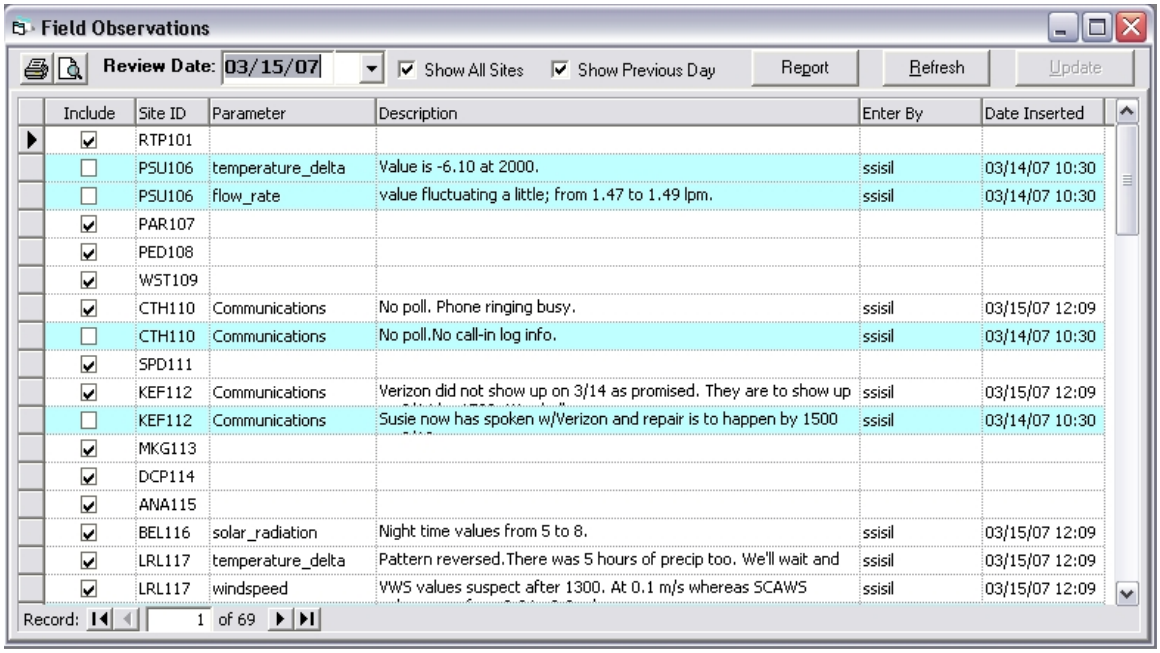
**Figure 5**




### 6.3.3 Enter Observations

Selecting "Enter Observations" from the Observations submenu displays the Field Observations form, as shown below in Figure 6.

**Figure 6**

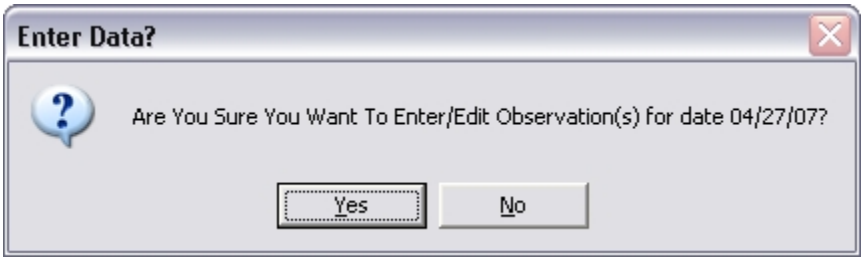



| Include | Site ID | Parameter | Description | Enter By | Date Inserted |
|---|---|---|---|---|---|
| ☑ | RTP101 | | | | |
| ☐ | PSU106 | temperature_delta | Value is -6.10 at 2000. | ssisil | 03/14/07 10:30 |
| ☐ | PSU106 | flow_rate | value fluctuating a little; from 1.47 to 1.49 lpm. | ssisil | 03/14/07 10:30 |
| ☑ | PAR107 | | | | |
| ☑ | PED108 | | | | |
| ☑ | WST109 | | | | |
| ☑ | CTH110 | Communications | No poll. Phone ringing busy. | ssisil | 03/15/07 12:09 |
| ☐ | CTH110 | Communications | No poll.No call-in log info. | ssisil | 03/14/07 10:30 |
| ☑ | SPD111 | | | | |
| ☑ | KEF112 | Communications | Verizon did not show up on 3/14 as promised. They are to show up | ssisil | 03/15/07 12:09 |
| ☐ | KEF112 | Communications | Susie now has spoken w/Verizon and repair is to happen by 1500 | ssisil | 03/14/07 10:30 |
| ☑ | MKG113 | | | | |
| ☑ | DCP114 | | | | |
| ☑ | ANA115 | | | | |
| ☑ | BEL116 | solar_radiation | Night time values from 5 to 8. | ssisil | 03/15/07 12:09 |
| ☑ | LRL117 | temperature_delta | Pattern reversed.There was 5 hours of precip too. We'll wait and | ssisil | 03/15/07 12:09 |
| ☑ | LRL117 | windspeed | VWS values suspect after 1300. At 0.1 m/s whereas SCAWS | ssisil | 03/15/07 12:09 |

### 6.3.4 Adding a New Observation

Upon attempting to enter data for a new Observation, or edit an existing one, the prompt in Figure 7 will be generated. This is to ensure that the Observation data is entered for the correct Review Date. Be sure firstly to select the correct Review Date before attempting to enter or edit Observation data.

**Figure 7**



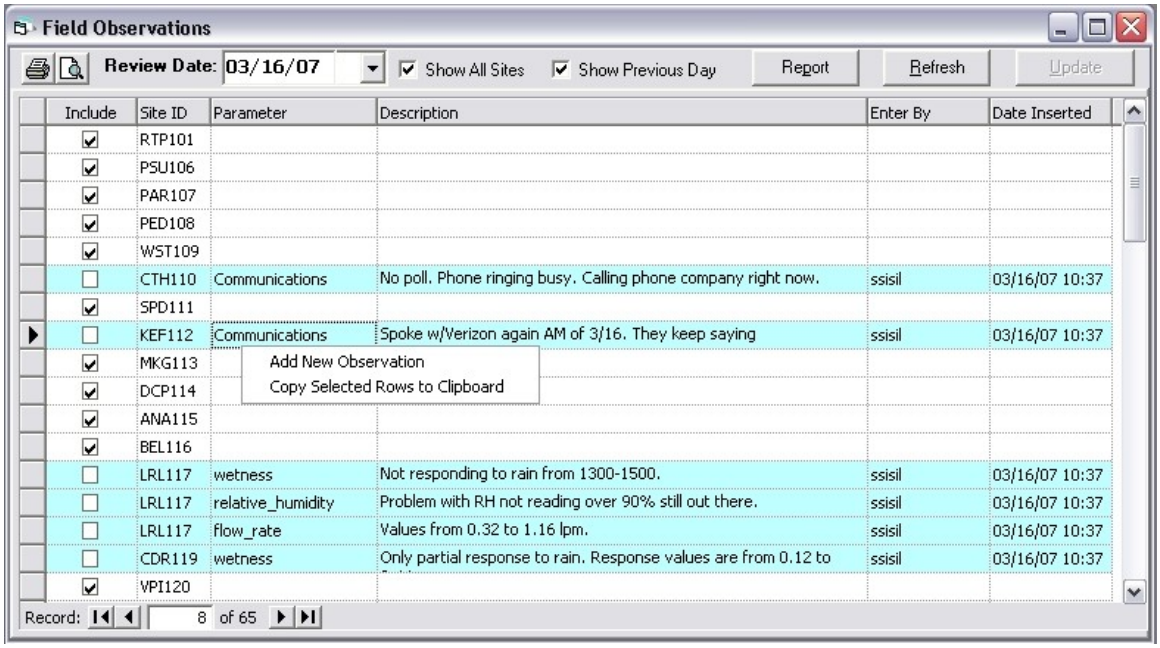

To add a new Observation to a site that currently does not have an observation listed for the Review Date:

1. Select the Review Date, or confirm it is correct, and acknowledge the message box above if prompted
2. Select the site by clicking the grey row button on the left end of the row
3. Select a Parameter by clicking in the Parameter field and selecting one from the list box
4. Enter a Description
5. Click Update

To add another Observation to a site which already has an observation listed for the Review Date:

1. Select the Review Date, or confirm it is correct, and acknowledge the message box above if prompted
2. Select the site by clicking the grey row button on the left end of the row
3. As shown in Figure 8 below for site KEF112, right-click the row to access the context menu, and then click “Add New Observation” from the pop-up menu
4. A new blank row will appear for that site; follow the steps above for entering a new observation.

**Figure 8**



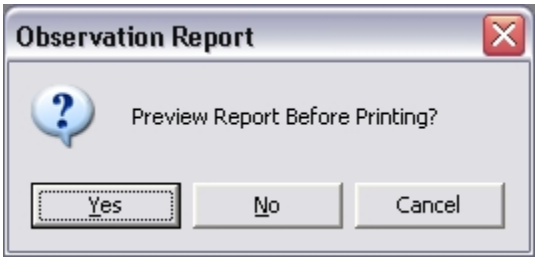

### 6.3.5 Observations Report

Selecting "Observations Report" from the Observations submenu displays the Site Observations Report form, as shown in Figure 9.

**Figure 9**

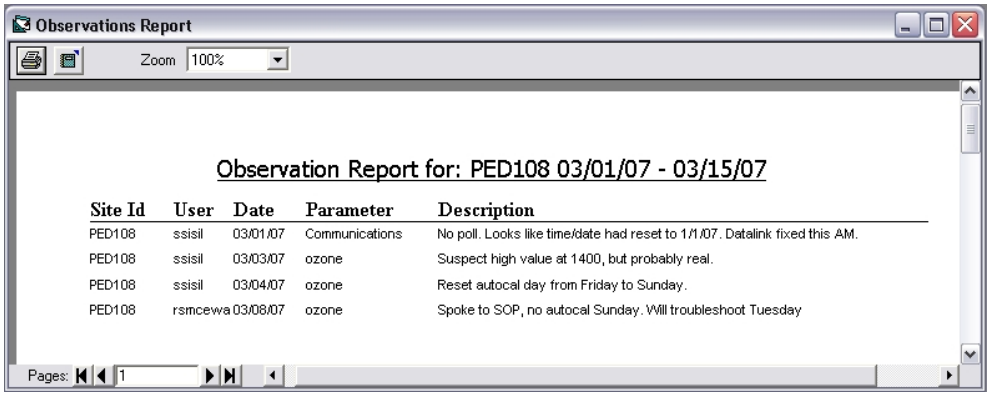
To produce an Observations Report, select a Site ID, or "ALL" from the list box, select a date range for the report, and click "OK". This will produce the "Preview Report" prompt as shown in Figure 10.

**Figure 10**




Click "Yes" will generate the Preview Report as shown below in Figure 11. The Preview Report has two buttons in the top left corner, the Print button and the Export button. These are used respectively for printing the report, and for exporting to either of two types of text files: html and txt.

**Figure 11**




### 6.3.6 Problem Ticketing

The second option listed under the "Field / Problem Tracking System" top-level menu option is "Problem Ticketing". Selecting this option produces the Problem Ticketing form shown in Figure 13 on the next page.

**Figure 12**

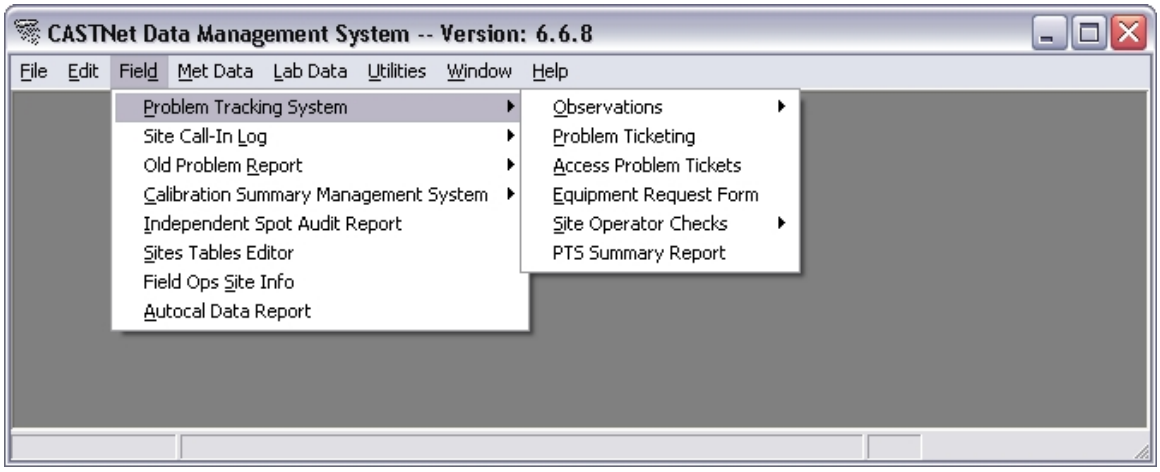
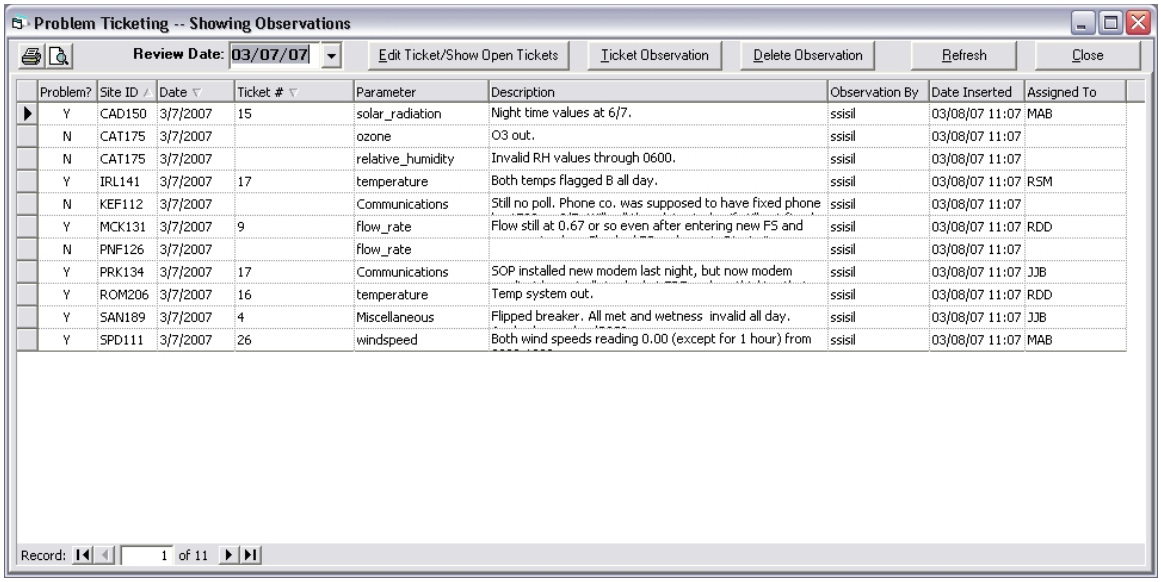



**Figure 13**




### 6.3.7 Create a Problem Ticket

The first column in the Problem Ticketing form in Figure 13, labeled “Problem?”, displays a “Y” or “N” to indicate if the Observation has been ticketed or not. To ticket an observation, select a row in which the “Problem?” column indicates “N”, and then click the button “Ticket Observation”. Performing this operation on the second observation for site CAT175 produces the Create /Edit Tickets form shown in Figure 14.

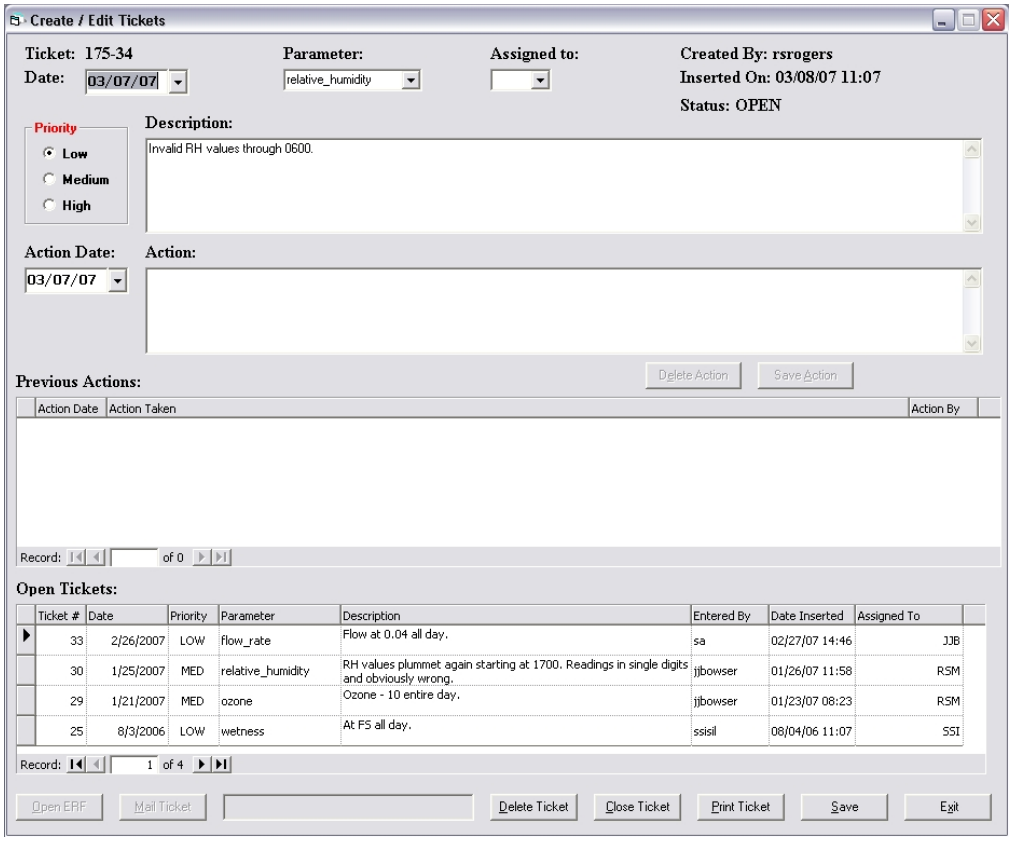
New tickets must be assigned to a staff member before they can be saved. Select the person’s initials from the list box labeled “Assigned To” to select the Assignee. The ticket may be saved

by clicking the "Save" button. To e-mail the ticket to the Assignee, after saving the ticket click the "Mail Ticket" button. The buttons labeled "Delete Ticket", "Close Ticket", and "Print Ticket" perform the indicated functions.

An Action may be added to any saved ticket by selecting the Action Date, entering the description of the action taken in the "Action" text box, and clicking the "Save Action" button. Previously entered actions may be edited by double-clicking them in the "Previous Actions" grid, which will load the selected action into the Action section of the form. Similarly, an Action may be deleted by double-clicking it to load it, and then clicking the "Delete Action" button.

The "Open ERF" button will be active for any saved ticket. Clicking it will open the ERF form with a request associated with the ticket. Equipment Request Forms are covered in section 6.3.13.

**Figure 14**

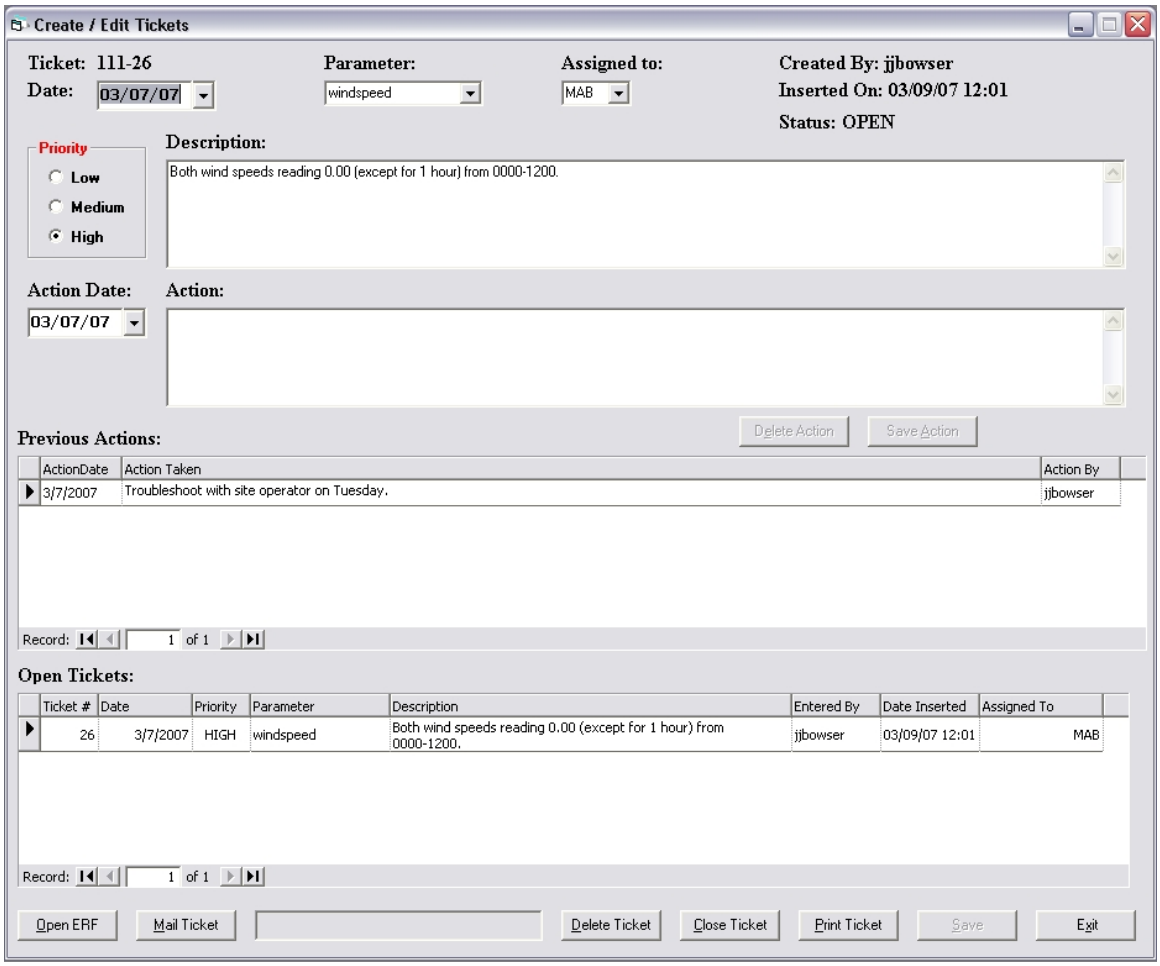



### 6.3.8 Edit an Existing Problem Ticket

To edit an existing ticket, select a row in which the "Problem?" column indicates "Y", and then click the button "Edit Ticket/Show Open Tickets". Performing this operation on ticket SPD111-26 at the bottom of Figure 13 produces the Create /Edit Ticket form shown in Figure 15. A

different Open Ticket may be edited from this form by double-clicking it in the grid labeled "Open Tickets". If the current ticket has been modified, you will be prompted to save it first before a different ticket can be opened.

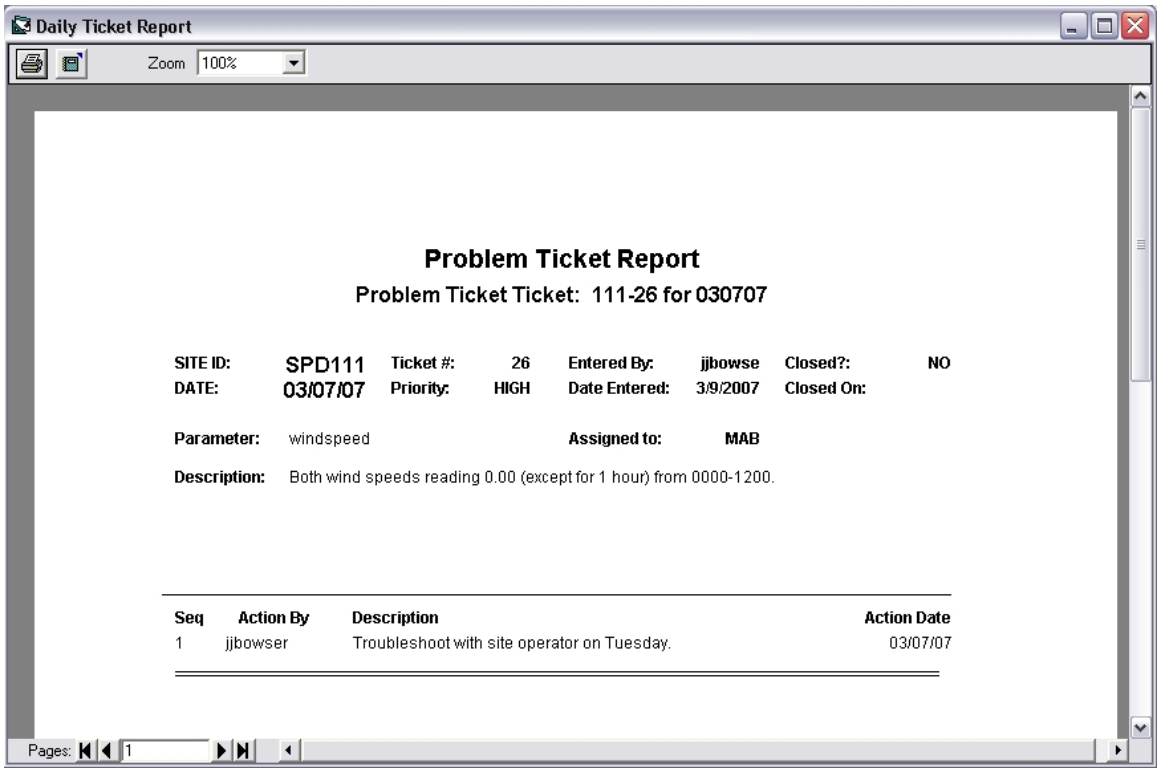
**Figure 15**




### 6.3.9 Problem Ticket Report

To print a Problem Ticket, click the "Print Ticket" button on the Edit/Create Ticket form. Performing this operation on ticket SPD111-26 produces the Problem Ticket Report shown in Figure 16.

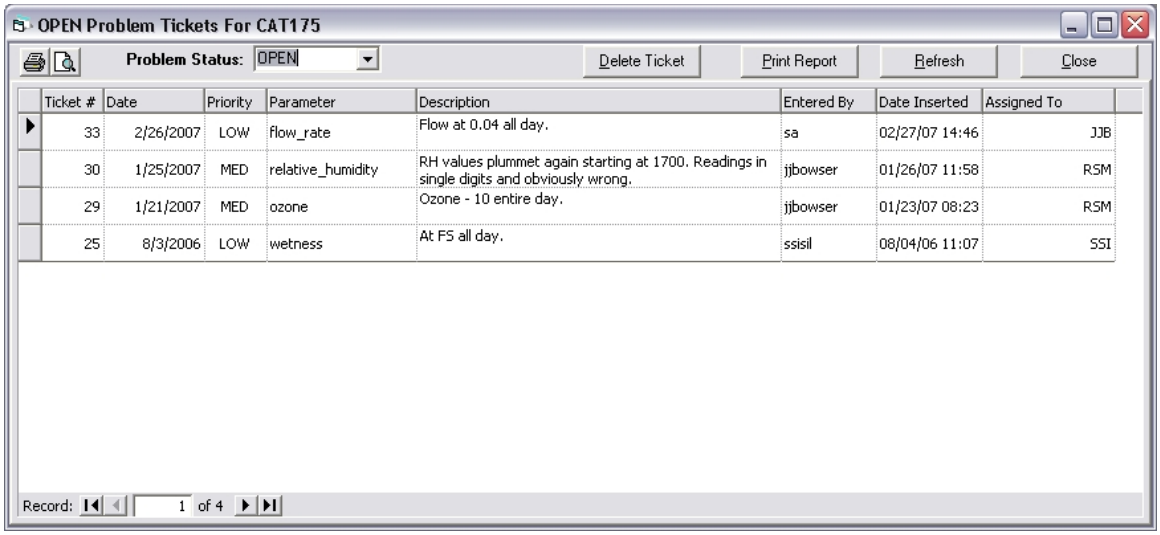
**Figure 16**




### 6.3.10 Show Open Problem Tickets

To show the Open Tickets for a site, select a row in which the "Problem?" column indicates "N", and then click the button "Edit Ticket/Show Open Tickets". Performing this operation on one of the observations for CAT175 in Figure 13 produces the Open Problem Tickets form shown in Figure 17. The "Problem Status" defaults to Open, but tickets with a status of Closed, or Both may be viewed by changing the selection in the "Problem Status" list box. Existing tickets may be edited by double-clicking them.

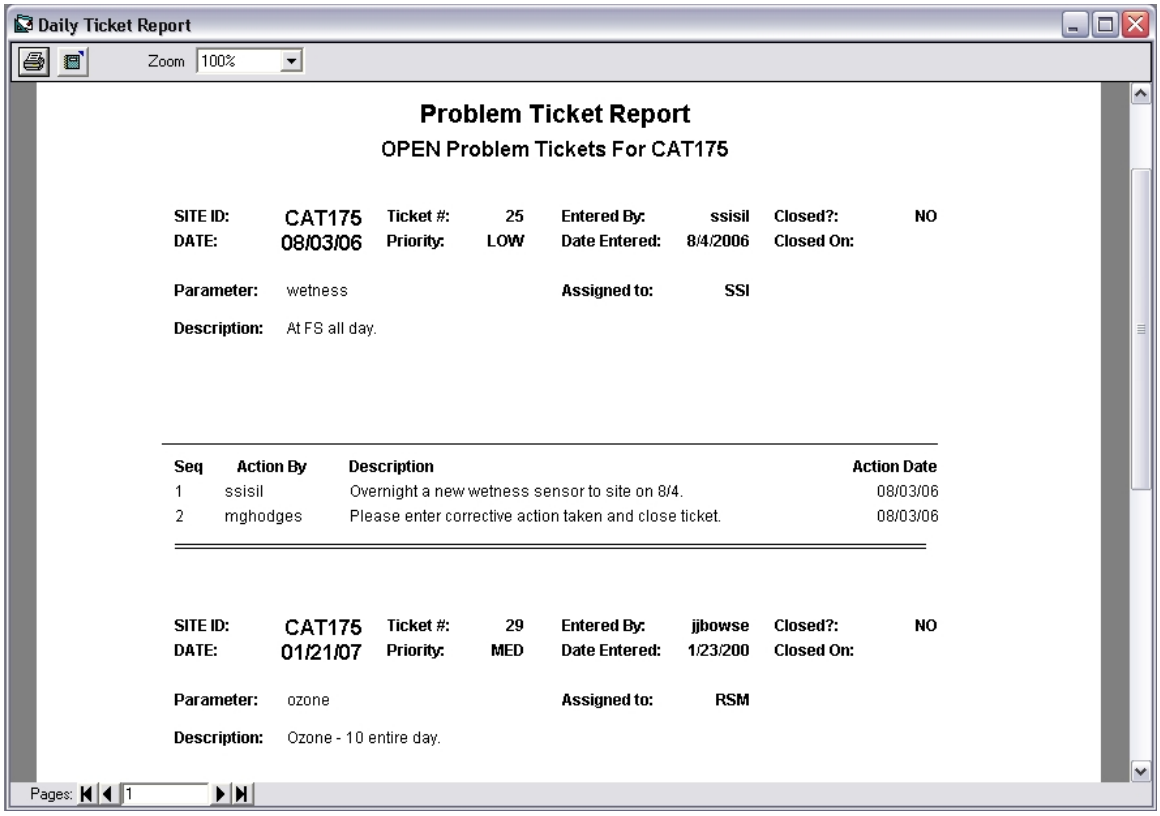
**Figure 17**




### 6.3.11 Print Report - Open Problem Tickets

To print the Open Tickets Report for a site, clicking the "Print Report" button on the Open Problem Tickets form produces the Open Problem Ticket Report shown in Figure 18.

**Figure 18**



### 6.3.12 Access Problem Tickets

The third option listed under the "Field / Problem Tracking System" top-level menu option is "Access Problem Tickets". Selecting this option produces the Access Problem Tickets form shown in Figure 20.

**Figure 19**

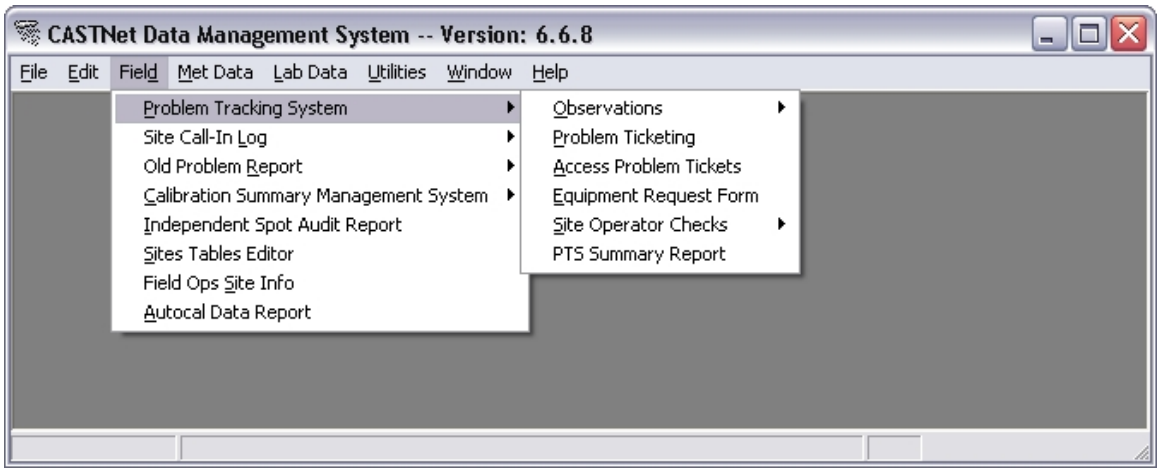
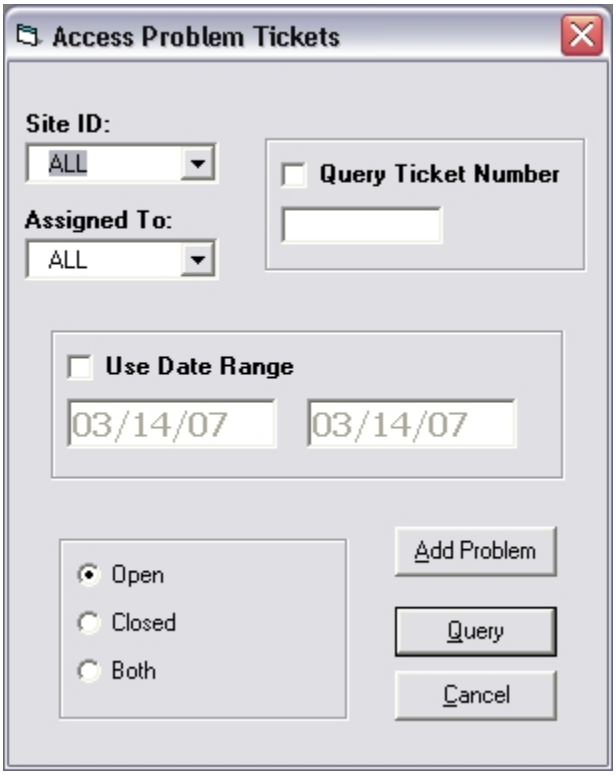



**Figure 20**



The Access Problem Tickets form allows for selecting tickets based on Site ID, Assignee, Ticket Number, Date Range, and Open, Closed, or Both Status. In Figure 21, the ticket PSU106-10 is queried for by making these selections, and clicking the "Query" button. The resulting Problem Ticket form is displayed as in Figure 22, if the ticket exists. Otherwise a prompt indicates that no such ticket exists for the specified input parameters. The "Add Problem" button may be used to add a problem ticket to a specified site.

**Figure 21**

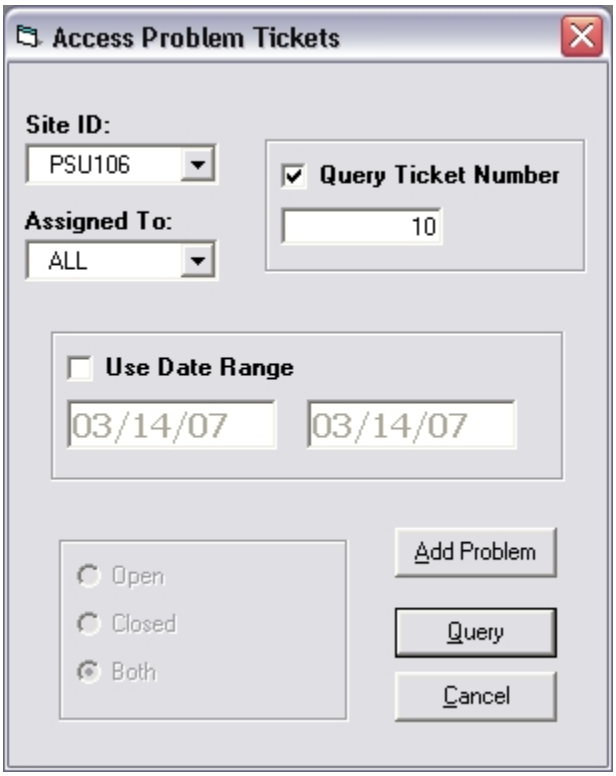
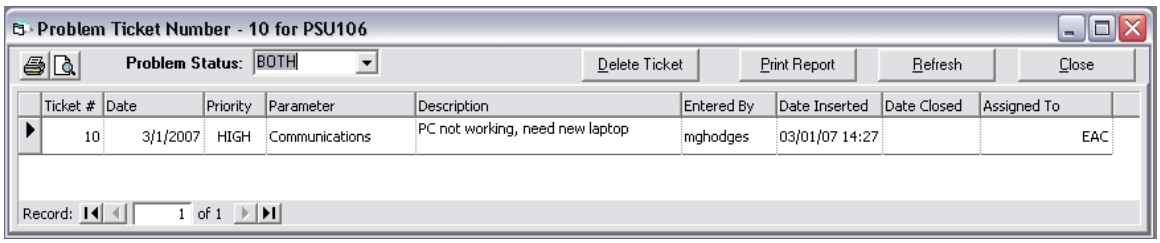



**Figure 22**




### 6.3.13 Equipment Request Form

The fourth option listed under the "Field / Problem Tracking System" top-level menu option is "Equipment Request Form". Selecting this option produces the Open Tickets (ERF) form shown

in Figure 24. Selecting Site ID WST109 and clicking the ”OK” button produces the “Existing ERFs” form shown in Figure 25. Selecting the row for ticket WST109-16 and clicking the “New ERF” button produces the “Add ERF” prompt form in Figure 26. Clicking the “Yes” button on this form then produces the ERF entry form shown in Figure 27. In order to log an ERF, complete the form as appropriate, and then click the “Save” button. The “Print” button may then be used to print the ERF if desired.

**Figure 23**

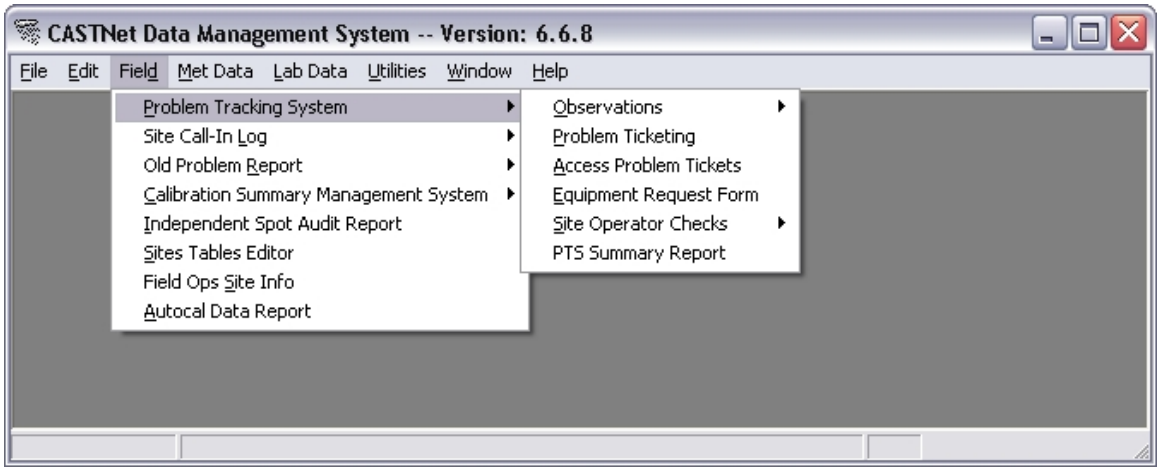
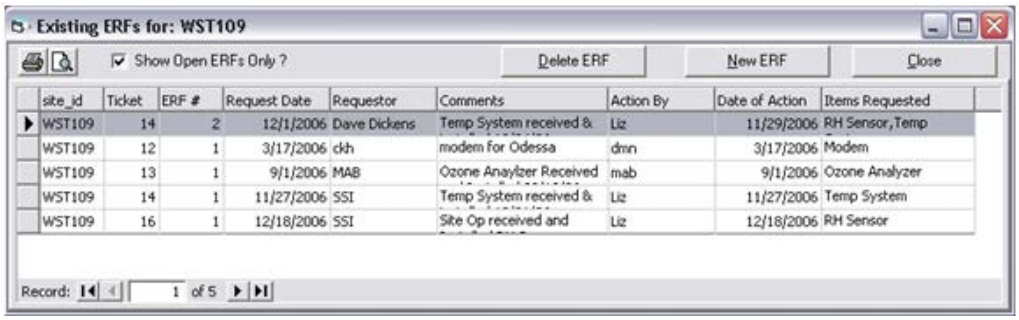
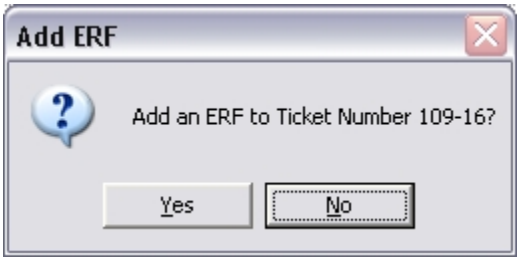



**Figure 24**

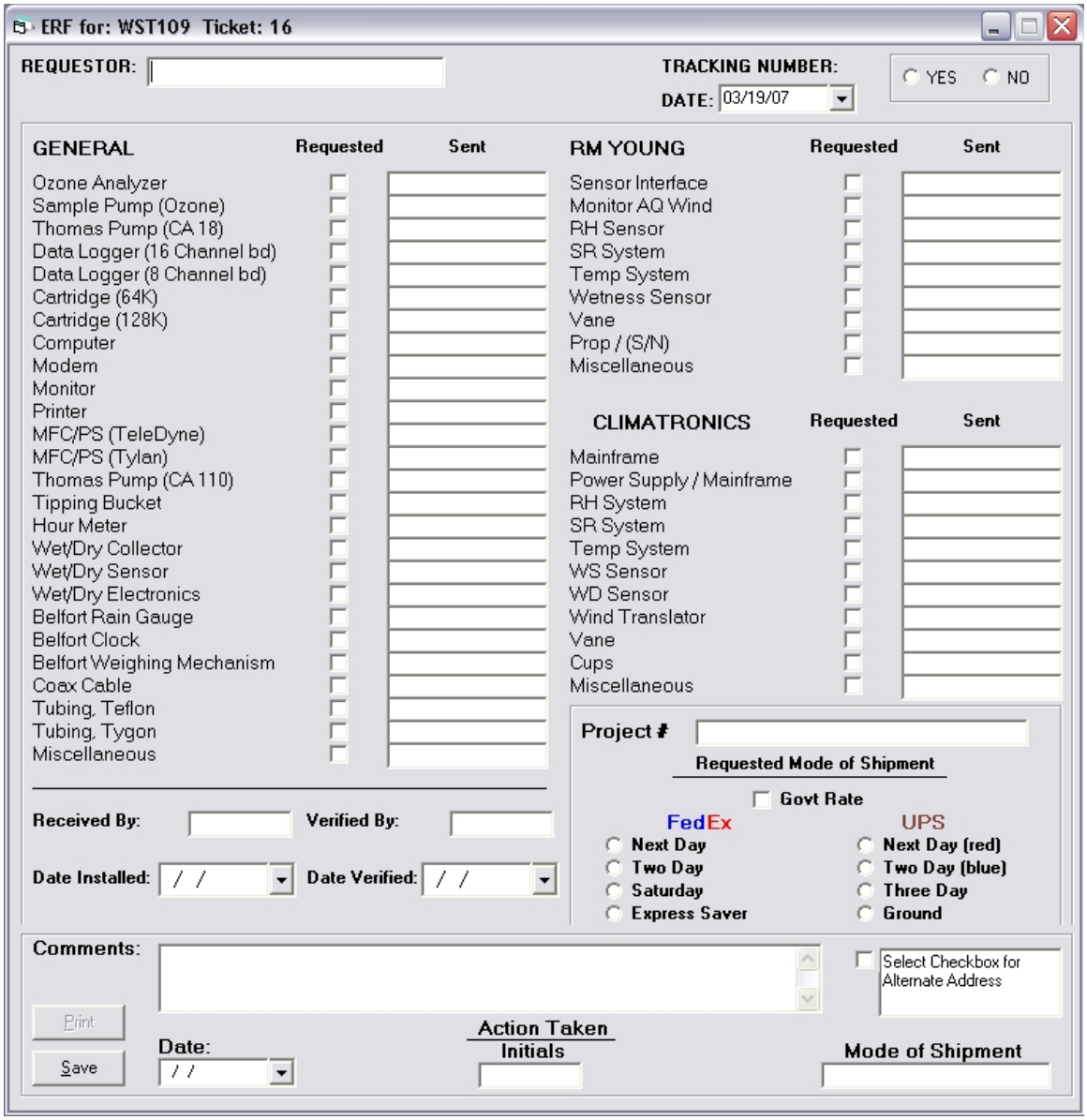
**Figure 25**



## Figure 26



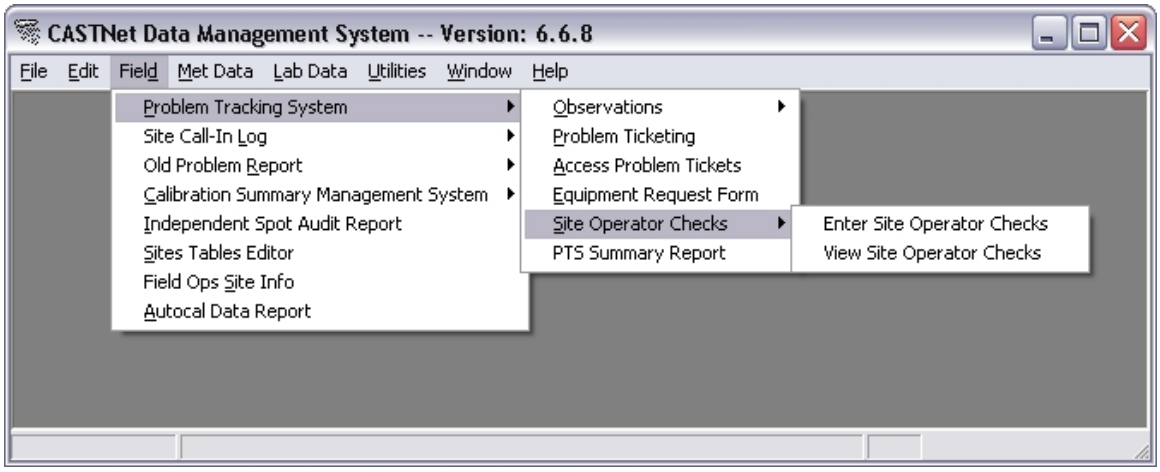

## Figure 27



### 6.3.14 Site Operator Checks

The fifth option listed under the "Field / Problem Tracking System" top-level menu option is "Site Operator Checks". The submenu structure for this option is shown in Figure 28.

**Figure 28**




### 6.3.15 Enter Site Operator Checks

Selecting the "Enter Site Operator Checks" menu option produces the entry form with the same title shown in Figure 29. Select the desired Site ID, Date Range, and Parameters, and then click the "Enter" button to enter the Site Operator Checks.

### 6.3.16 View Site Operator Checks

Selecting the "View Site Operator Checks" menu option produces the "Site Operator Checks" report form shown in Figure 30. The default Site ID is "ALL". Selecting a site from the list box, such as ABT147 in Figure 30 will show the Site Operator Checks for only the specified site, as shown in Figure 31. Clicking the "Print Grid" button on this form will generate the report shown in Figure 32.

**Figure 29**

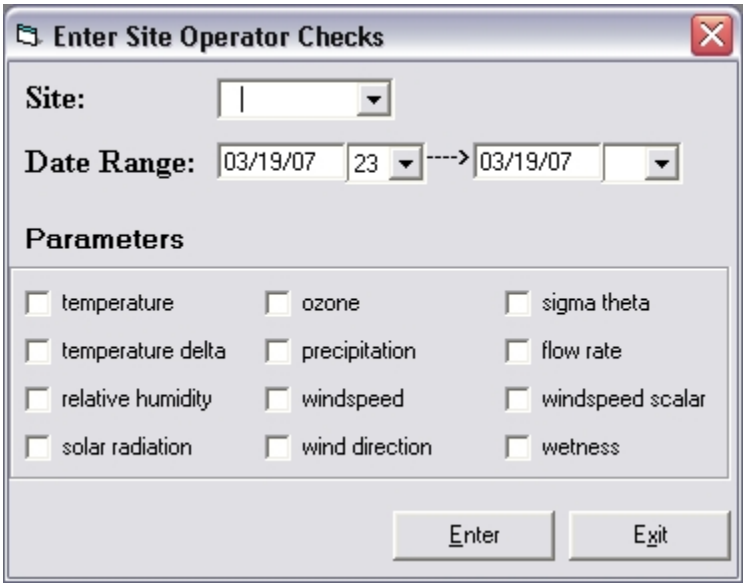



**Figure 30**

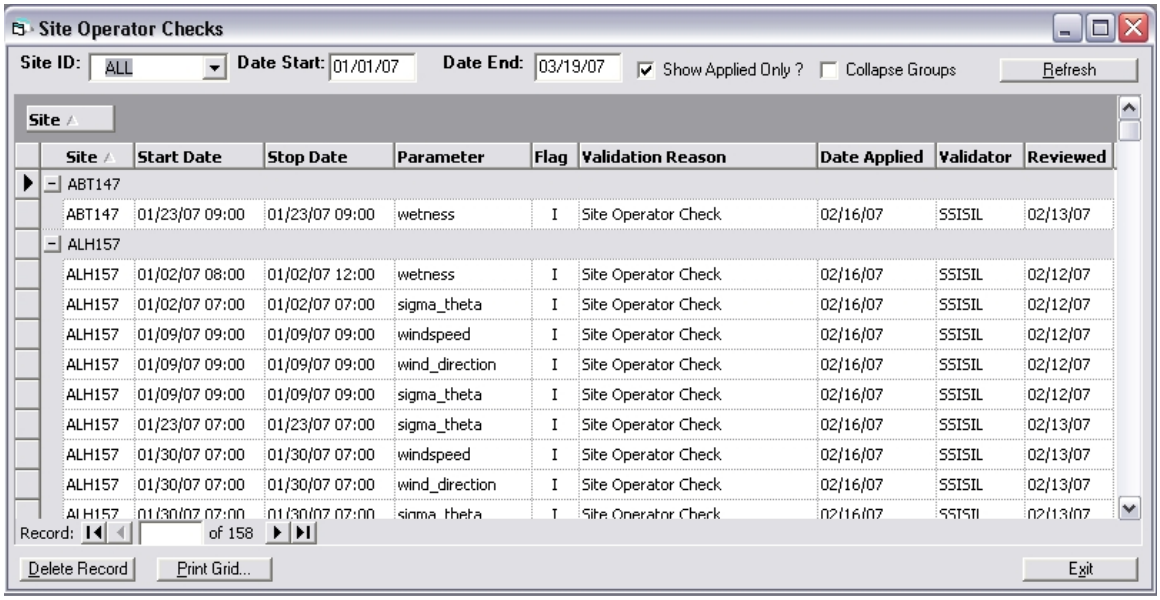


**Figure 31**

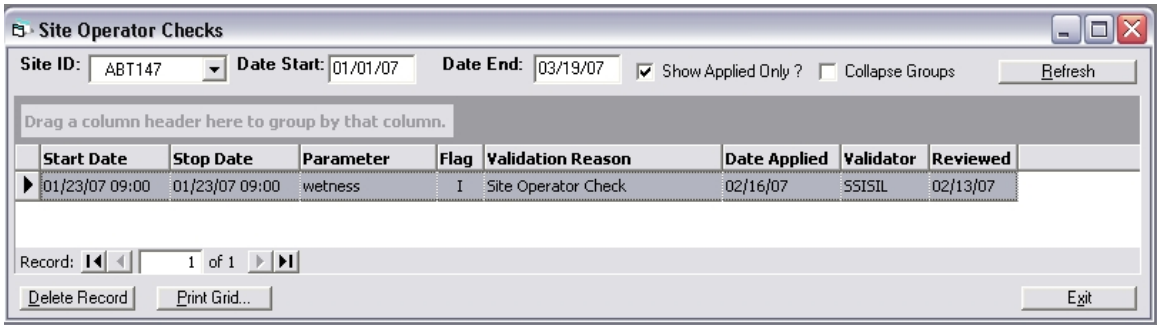
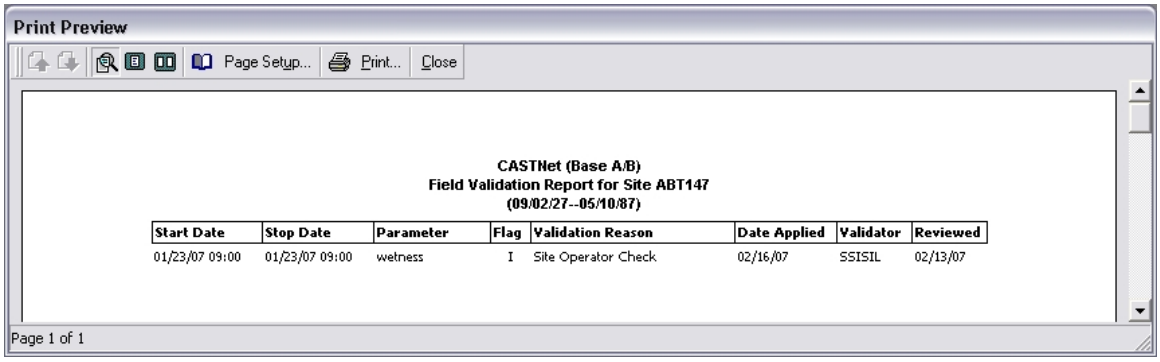



**Figure 32**




### 6.3.17 PTS Summary Report

The sixth and last option listed under the "Field / Problem Tracking System" top-level menu option is "PTS Summary Report". Selecting this menu option produces the selection form with the same title shown in Figure 34. No Site IDs are selected by default. Various predetermined site groups are available via command buttons. Selecting site ALC188 for example and clicking "OK" produces the report shown in Figure 35.

**Figure 33**

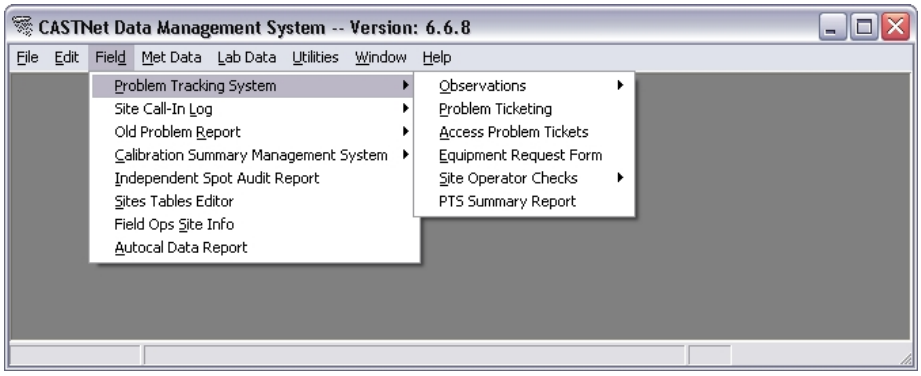


**Figure 34**

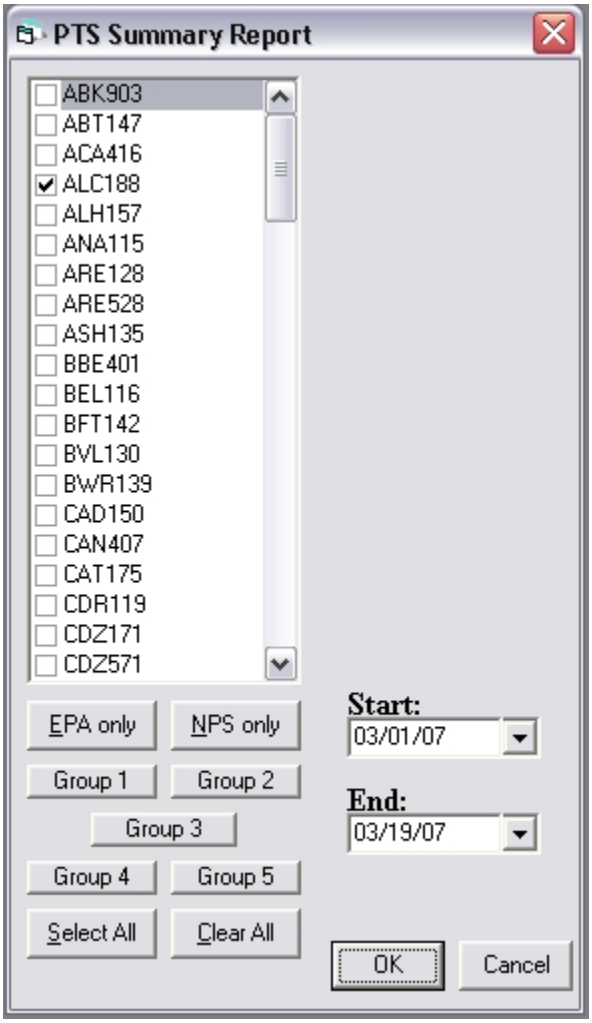
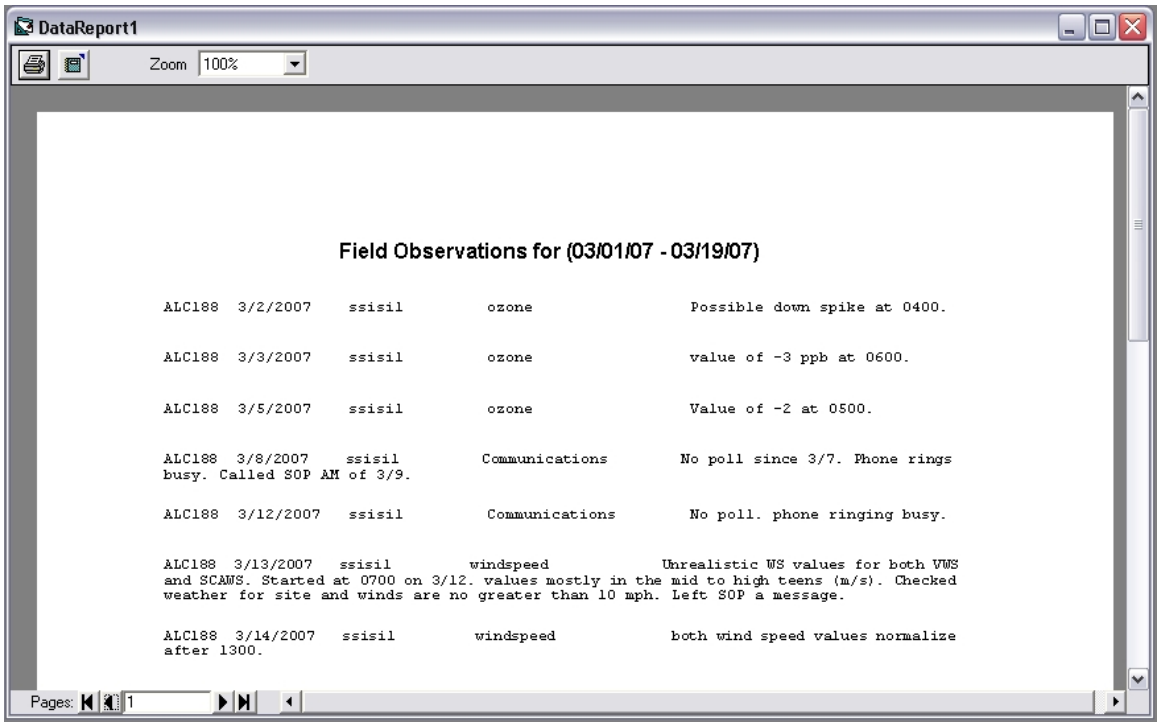

PTS Summary Report
ABK903
ABT147
ACA416
ALC188
ALH157
ANA115
ARE128
ARE528
ASH135
BBE401
BEL116
BFT142
BVL130
BWR139
CAD150
CAN407
CAT175
CDR119
CDZ171
CDZ571
EPA only
NPS only
Group 1
Group 2
Group 3
Group 4
Group 5
Select All
Clear All
Start:
03/01/07
End:
03/19/07
OK
Cancel

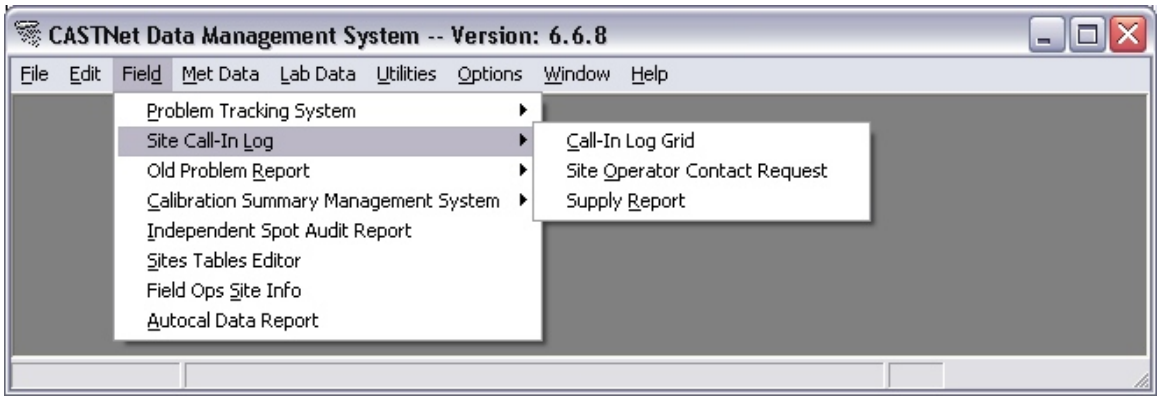
**Figure 35**




### 6.3.18 Site Call-In Log

Figure 36 shows the menu structure listed under the "Field / Site Call-In Log" top-level menu option. Field operations personnel use the Site Call-In Log to enter and report Call-Ins, Site Operator Requests, and produce Call-In Log Supply Reports for the sites.

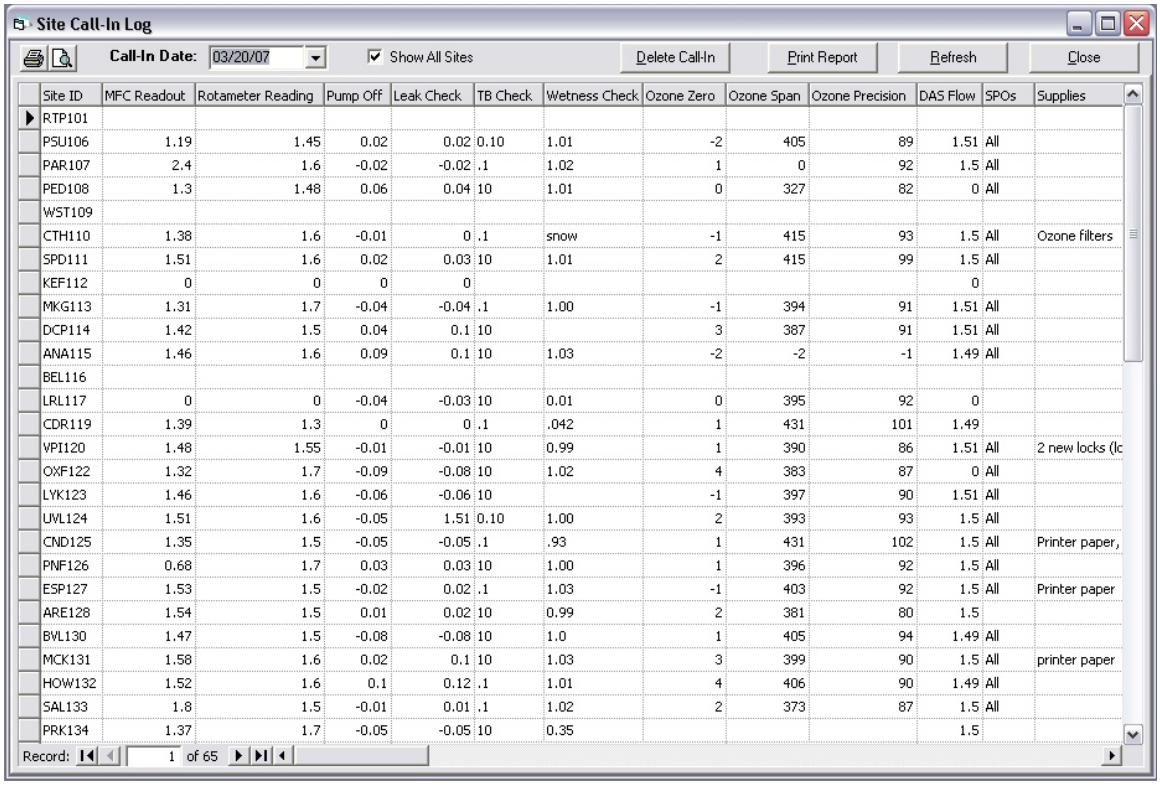
**Figure 36**



### 6.3.19 Call-In Log Grid

Selecting "Call-In Log Grid" from the Site Call-In Log submenu displays the Call-In Log List form, as shown below in Figure 37. De-selecting the "Show All Sites" checkbox will display only those sites for which there is a Call-In logged for the default Call-In Date, which is the most recent past Tuesday.

**Figure 37**




| Site ID | MFC Readout | Rotameter Reading | Pump Off | Leak Check | TB Check | Wetness Check | Ozone Zero | Ozone Span | Ozone Precision | DAS Flow | SPOs | Supplies |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RTP101 | | | | | | | | | | | | |
| PSU106 | 1.19 | 1.45 | 0.02 | 0.02 | 0.10 | 1.01 | -2 | 405 | 89 | 1.51 | All | |
| PAR107 | 2.4 | 1.6 | -0.02 | -0.02 | .1 | 1.02 | 1 | 0 | 92 | 1.5 | All | |
| PED108 | 1.3 | 1.48 | 0.06 | 0.04 | 10 | 1.01 | 0 | 327 | 82 | 0 | All | |
| WST109 | | | | | | | | | | | | |
| CTH110 | 1.38 | 1.6 | -0.01 | 0 | .1 | snow | -1 | 415 | 93 | 1.5 | All | Ozone filters |
| SPD111 | 1.51 | 1.6 | 0.02 | 0.03 | 10 | 1.01 | 2 | 415 | 99 | 1.5 | All | |
| KEF112 | 0 | 0 | 0 | 0 | | | | | | 0 | | |
| MKG113 | 1.31 | 1.7 | -0.04 | -0.04 | .1 | 1.00 | -1 | 394 | 91 | 1.51 | All | |
| DCP114 | 1.42 | 1.5 | 0.04 | 0.1 | 10 | | 3 | 387 | 91 | 1.51 | All | |
| ANA115 | 1.46 | 1.6 | 0.09 | 0.1 | 10 | 1.03 | -2 | -2 | -1 | 1.49 | All | |
| BEL116 | | | | | | | | | | | | |
| LRL117 | 0 | 0 | -0.04 | -0.03 | 10 | 0.01 | 0 | 395 | 92 | 0 | | |
| CDR119 | 1.39 | 1.3 | 0 | 0 | .1 | .042 | 1 | 431 | 101 | 1.49 | | |
| VPI120 | 1.48 | 1.55 | -0.01 | -0.01 | 10 | 0.99 | 1 | 390 | 86 | 1.51 | All | 2 new locks (lc |
| OXF122 | 1.32 | 1.7 | -0.09 | -0.08 | 10 | 1.02 | 4 | 383 | 87 | 0 | All | |
| LYK123 | 1.46 | 1.6 | -0.06 | -0.06 | 10 | | -1 | 397 | 90 | 1.51 | All | |
| UVL124 | 1.51 | 1.6 | -0.05 | 1.51 | 0.10 | 1.00 | 2 | 393 | 93 | 1.5 | All | |
| CND125 | 1.35 | 1.5 | -0.05 | -0.05 | .1 | .93 | 1 | 431 | 102 | 1.5 | All | Printer paper, |
| PNF126 | 0.68 | 1.7 | 0.03 | 0.03 | 10 | 1.00 | 1 | 396 | 92 | 1.5 | All | |
| ESP127 | 1.53 | 1.5 | -0.02 | 0.02 | .1 | 1.03 | -1 | 403 | 92 | 1.5 | All | Printer paper |
| ARE128 | 1.54 | 1.5 | 0.01 | 0.02 | 10 | 0.99 | 2 | 381 | 80 | 1.5 | | |
| BVL130 | 1.47 | 1.5 | -0.08 | -0.08 | 10 | 1.0 | 1 | 405 | 94 | 1.49 | All | |
| MCK131 | 1.58 | 1.6 | 0.02 | 0.1 | 10 | 1.03 | 3 | 399 | 90 | 1.5 | All | printer paper |
| HOW132 | 1.52 | 1.6 | 0.1 | 0.12 | .1 | 1.01 | 4 | 406 | 90 | 1.49 | All | |
| SAL133 | 1.8 | 1.5 | -0.01 | 0.01 | .1 | 1.02 | 2 | 373 | 87 | 1.5 | All | |
| PRK134 | 1.37 | 1.7 | -0.05 | -0.05 | 10 | 0.35 | | | | 1.5 | | |

### 6.3.20 Print Call-In Log Report

To print a report of the Call-In Log, click the "Print Report" button. Performing this produces the Preview Report prompt shown in Figure 38. Click "Yes" to preview the report. An example Preview Report is shown is Figure 39.

**Figure 38**

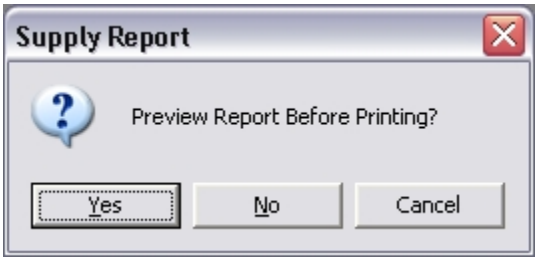
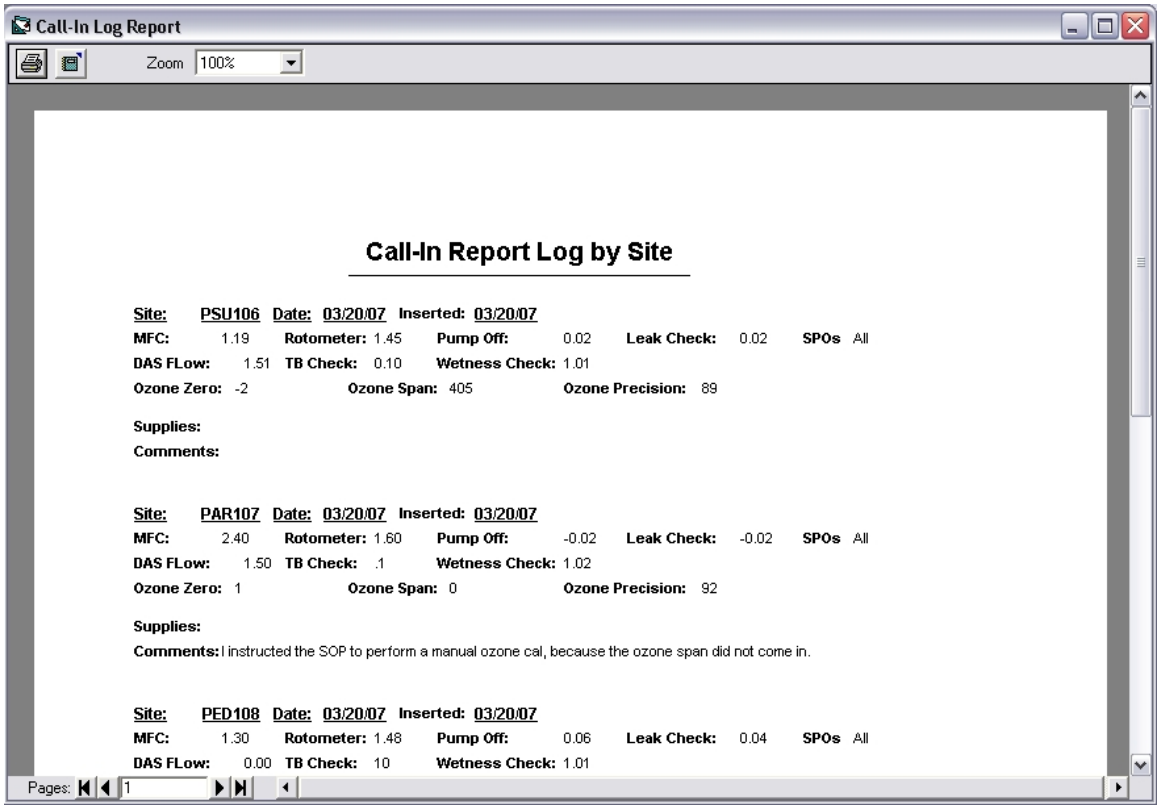



**Figure 39**




### 6.3.21 Delete a Call-In

To delete a Call-In, select the Call-In by clicking the gray row button on the left end of the row. Then click the "Delete Call-In" button. Performing this on a Call-In on the form in Figure 37 produces the confirmation prompt shown in Figure 40. Click "Yes" to delete the Call-In.

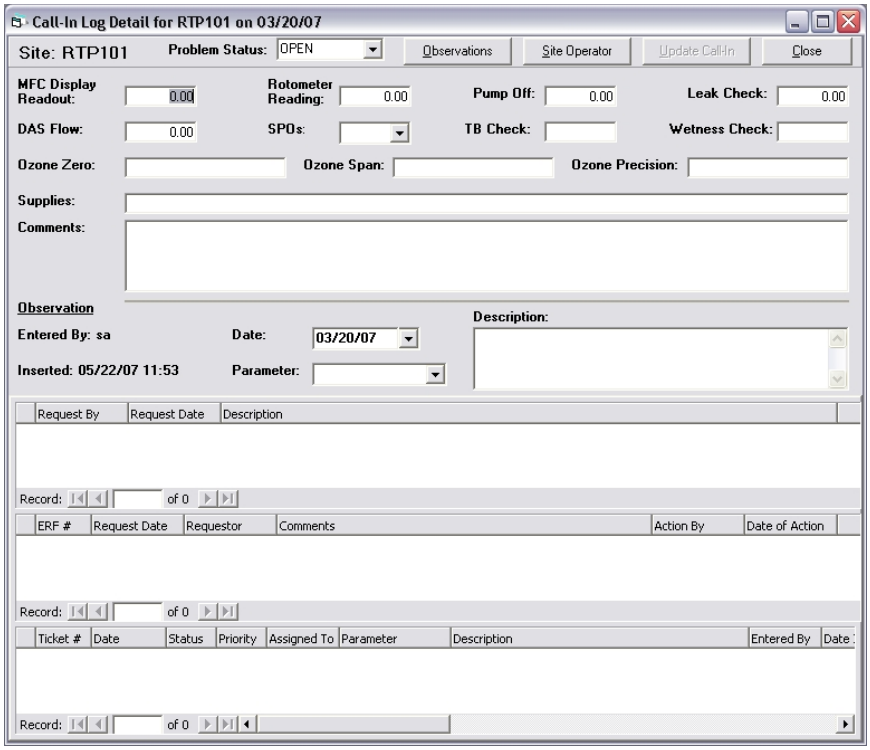
**Figure 40**

### 6.3.22 Add a Call-In

To add a new Call-In, double-click a row without an existing Call-In. Performing this for example, on the row for site RTP101, produces the Call-In Log Detail form shown in Figure 41. Enter the desired data, and click "Update Call-In" to save the record. An Observation may be added also.

On this form, Site Operator Requests are shown in red, ERF's in orange, and Problem Tickets in yellow, as seen in Figure 42 for the Call-In Log Detail for LRL117 for 03/20/07. Existing ERF's and Problem Tickets may be edited by double-clicking their respective rows. Tickets may be viewed based on status by clicking the list box at the top to select Open, Closed, or Both. The default ticket status is Open.

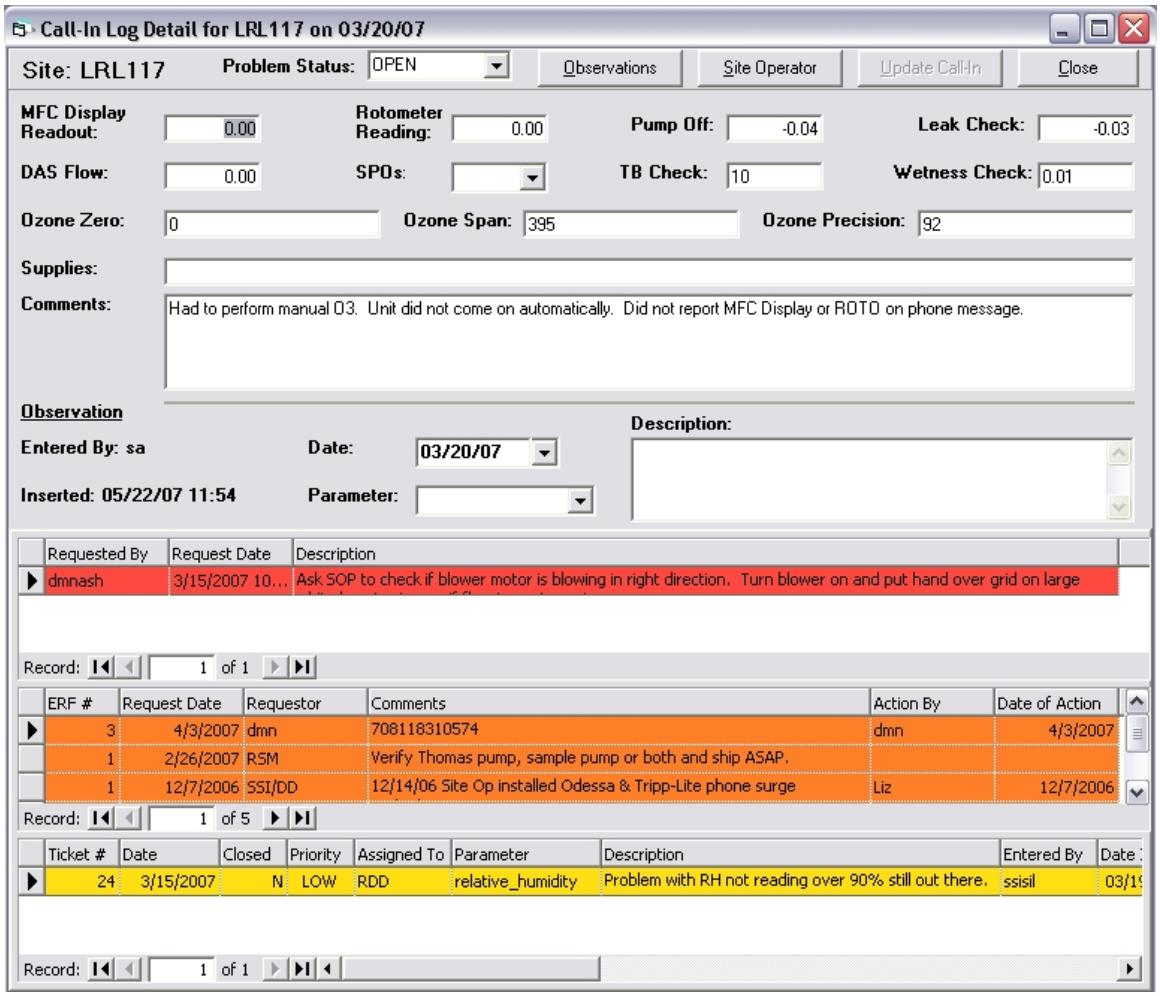
**Figure 41**



### 6.3.23 Edit a Call-In

To edit a Call-In, double-click the row for that Call-In, in the Call-In Log List form, as shown above in Figure 37. Performing this on the row for site LRL117, produces the Call-In Log Detail form shown in Figure 42. Edit the data as desired and then click the "Update Call-In" button. An Observation may be added or edited also.

**Figure 42**




### 6.3.24 Observations

To display all observations associated with the site, click the "Observations" button on the Call-In Log Detail form. Performing this on the Call-In Log Detail form shown in Figure 42 produces the Obervations form shown in Figure 43. In order to print the obervations data, click the "Report" button. Doing so in this case produces the print preview prompt shown in Figure 44. Click the "Yes" button to preview the report. An example report is shown in Figure 45. The Preview Report has two buttons in the top left corner, the Print button and the Export button.

These are used respectively for printing the report, and for exporting to either of two types of text files: html and txt.

**Figure 43**

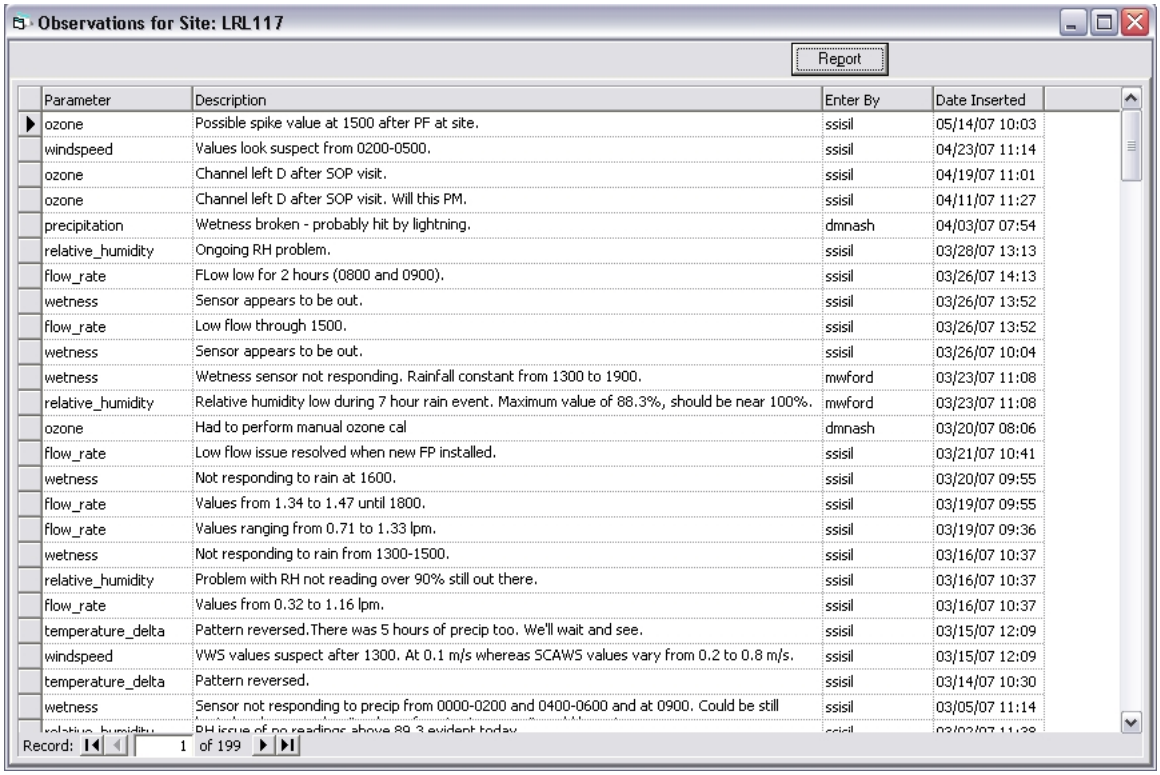



**Figure 44**

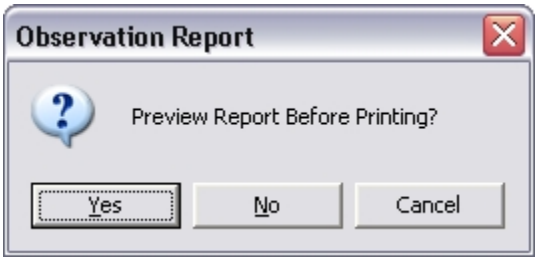
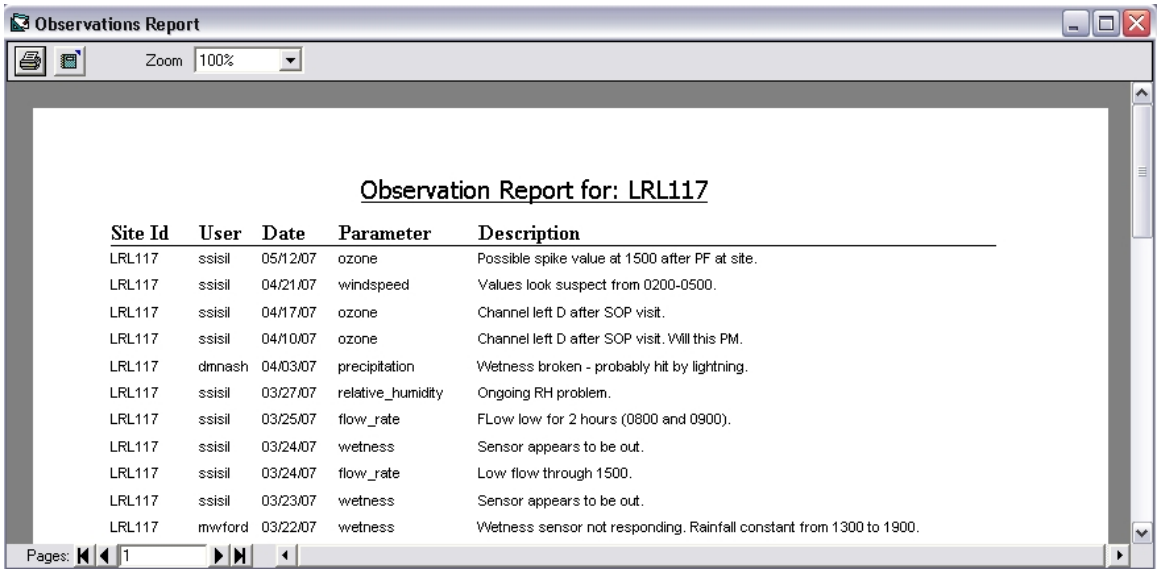


**Figure 45**




### 6.3.25 Site Operator Detail

To display the Site Operator's Detail form, click the "Site Operator" button on the Call-In Log Detail form. Performing this on the Call-In Log Detail form shown in Figure 42, produces the Site Operator Detail form shown in Figure 46. The site selected may be changed by making a selecting in the Site ID list box in the upper left area of the form. In order to print the Site Operator's Detail form data, click the "Print Report" button. Doing so on the form shown in Figure 46 produces the Site Operators Print Options form shown in Figure 47. Select the desired options and click the "OK" button to print the report. An example report is shown in Figure 48.

**Figure 46**

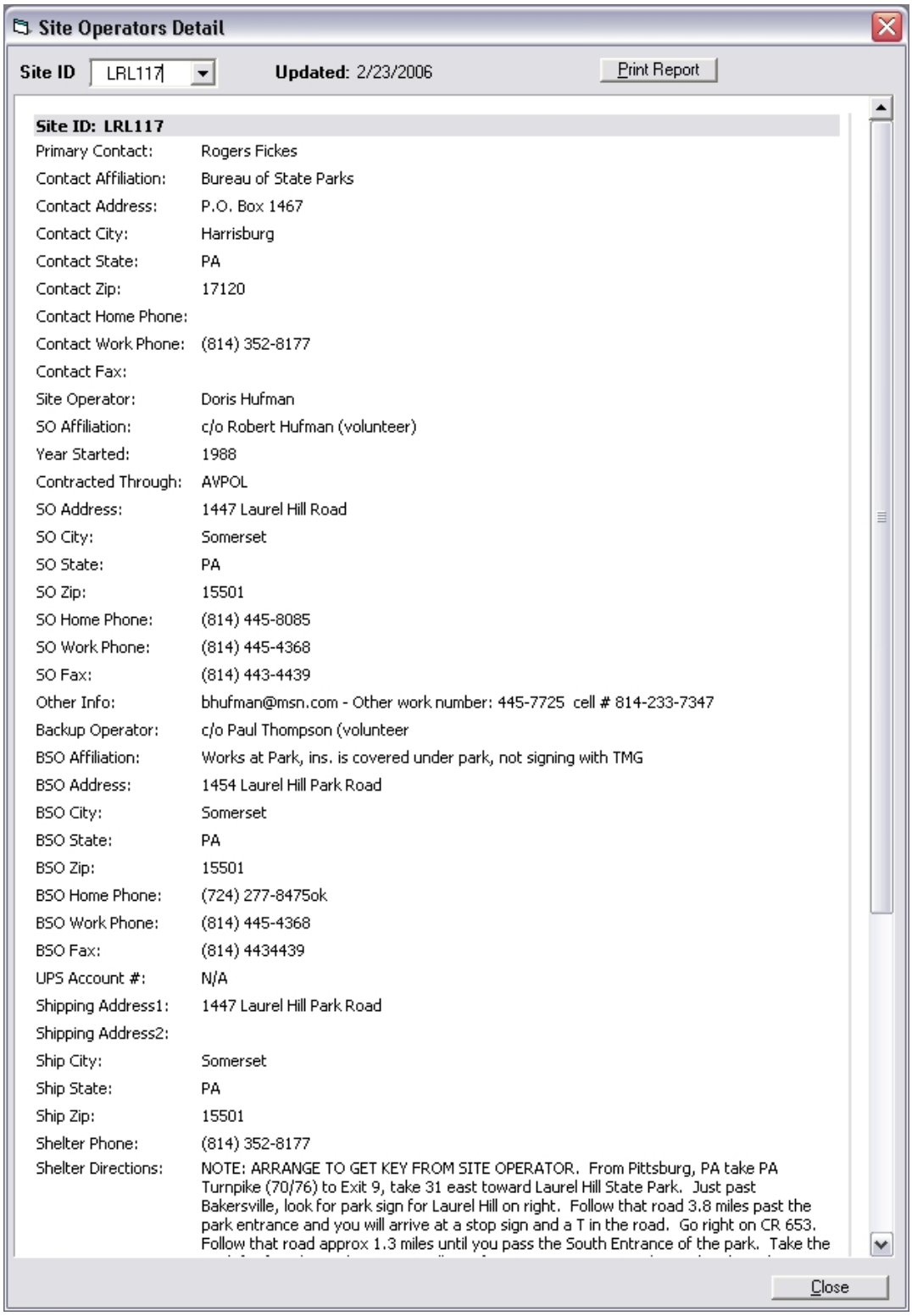

Site Operators Detail
Site ID
LRL117
Updated: 2/23/2006
Print Report
Site ID: LRL117
Primary Contact: Rogers Fickes
Contact Affiliation: Bureau of State Parks
Contact Address: P.O. Box 1467
Contact City: Harrisburg
Contact State: PA
Contact Zip: 17120
Contact Home Phone:
Contact Work Phone: (814) 352-8177
Contact Fax:
Site Operator: Doris Hufman
SO Affiliation: c/o Robert Hufman (volunteer)
Year Started: 1988
Contracted Through: AVPOL
SO Address: 1447 Laurel Hill Road
SO City: Somerset
SO State: PA
SO Zip: 15501
SO Home Phone: (814) 445-8085
SO Work Phone: (814) 445-4368
SO Fax: (814) 443-4439
Other Info: bhufman@msn.com - Other work number: 445-7725 cell # 814-233-7347
Backup Operator: c/o Paul Thompson (volunteer
BSO Affiliation: Works at Park, ins. is covered under park, not signing with TMG
BSO Address: 1454 Laurel Hill Park Road
BSO City: Somerset
BSO State: PA
BSO Zip: 15501
BSO Home Phone: (724) 277-8475ok
BSO Work Phone: (814) 445-4368
BSO Fax: (814) 4434439
UPS Account #: N/A
Shipping Address1: 1447 Laurel Hill Park Road
Shipping Address2:
Ship City: Somerset
Ship State: PA
Ship Zip: 15501
Shelter Phone: (814) 352-8177
Shelter Directions: NOTE: ARRANGE TO GET KEY FROM SITE OPERATOR. From Pittsburg, PA take PA Turnpike (70/76) to Exit 9, take 31 east toward Laurel Hill State Park. Just past Bakersville, look for park sign for Laurel Hill on right. Follow that road 3.8 miles past the park entrance and you will arrive at a stop sign and a T in the road. Go right on CR 653. Follow that road approx 1.3 miles until you pass the South Entrance of the park. Take the
Close

**Figure 47**

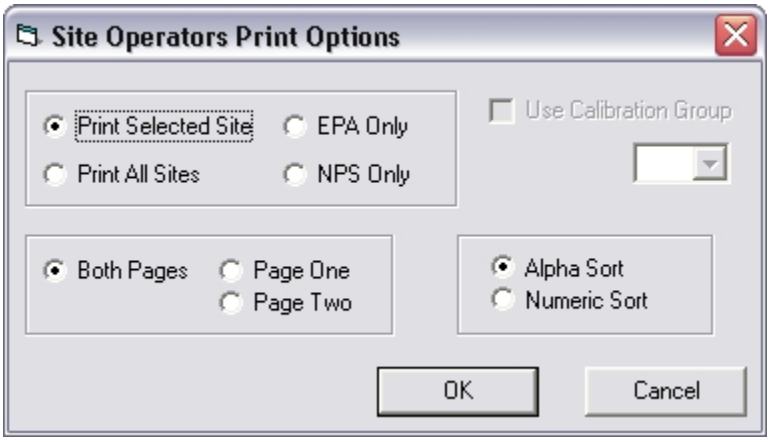
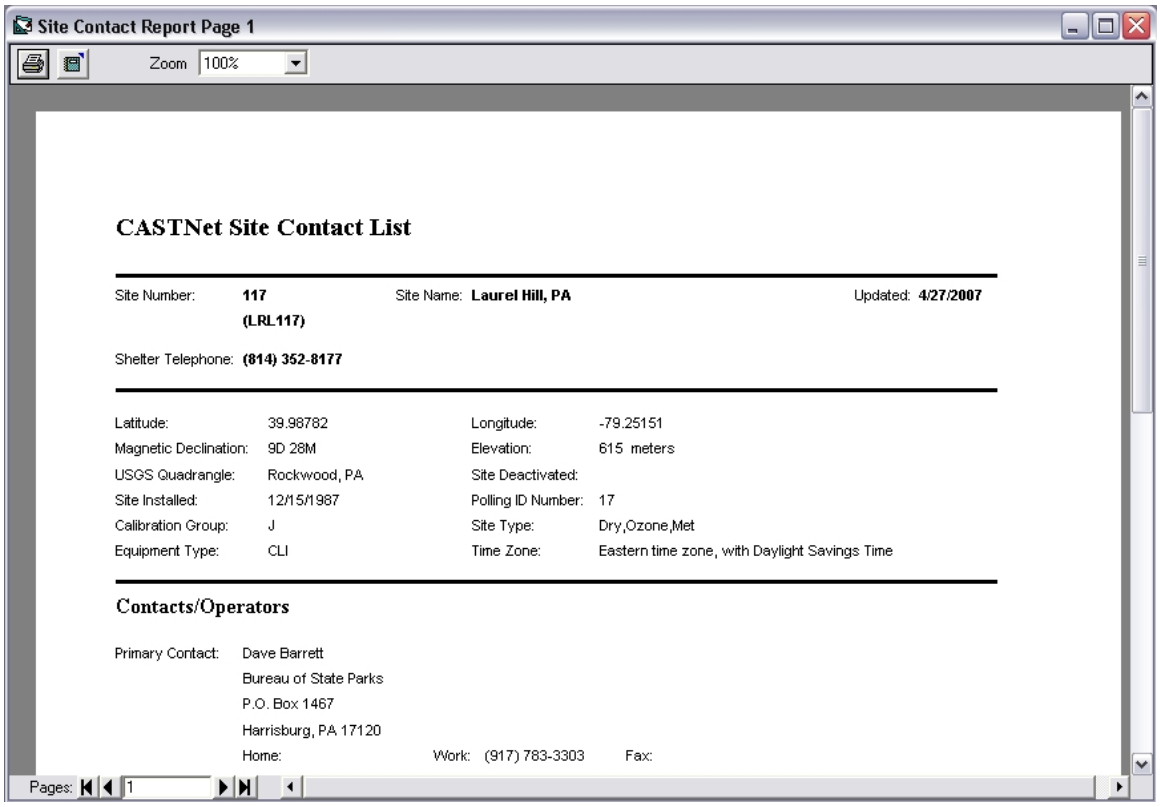



**Figure 48**




## 6.3.26 Site Operator Contact Request

The second option in the menu structure under the "Field / Site Call-In Log" menu is "Site Operator Contact Request" (Figure 49). Selecting this option produces the form shown in Figure 50. To enter a Site Operator Contact Request, select the Site ID, Date (if different than the

nearest Tuesday), and enter a Description. The “Save” and “Clear Fields” buttons perform the indicated actions.

**Figure 49**

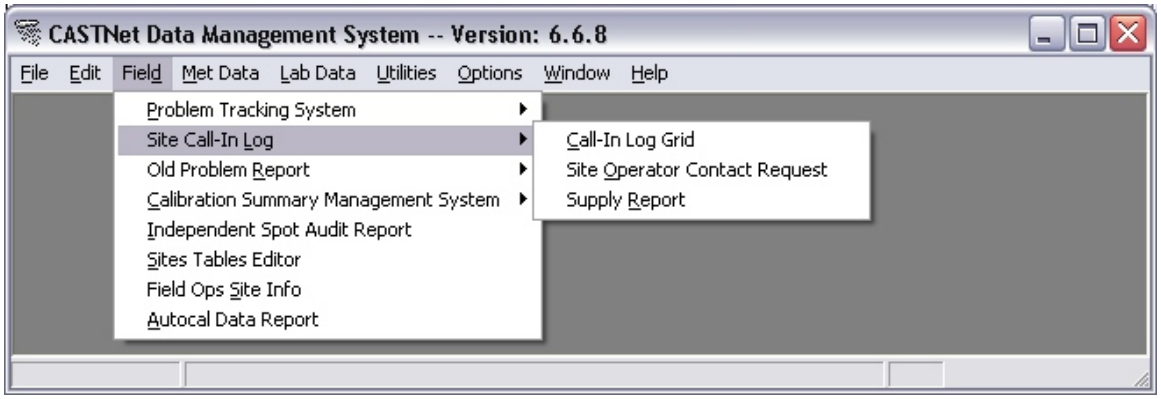



**Figure 50**

### 6.3.27 Supply Report

The third and last option in the menu structure under the “Field / Site Call-In Log” menu is “Supply Report” (Figure 51). Selecting this option produces the Preview Report form shown in Figure 52. Clicking the “Yes” button produces the report shown in Figure 53. The Preview Report has two buttons in the top left corner, the Print button and the Export button. These are used respectively for printing the report, and for exporting to either of two types of text files: html and txt.

**Figure 51**

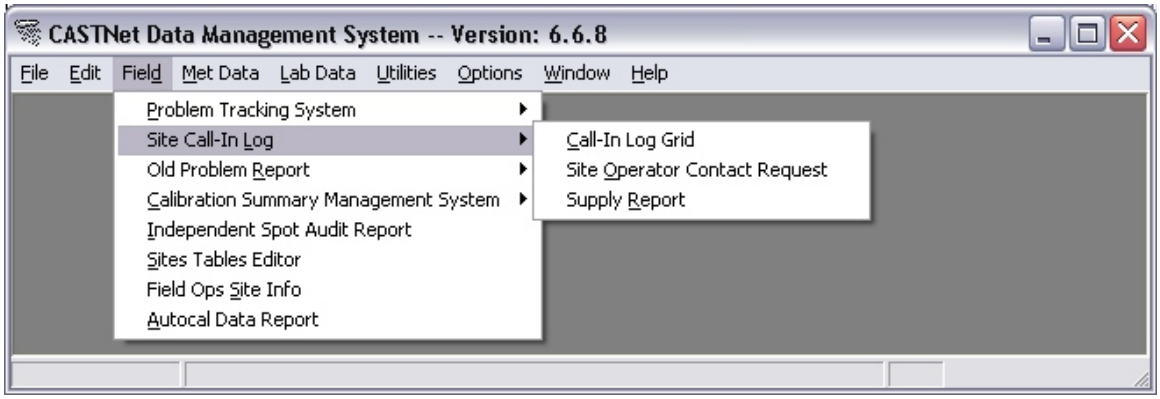



**Figure 52**

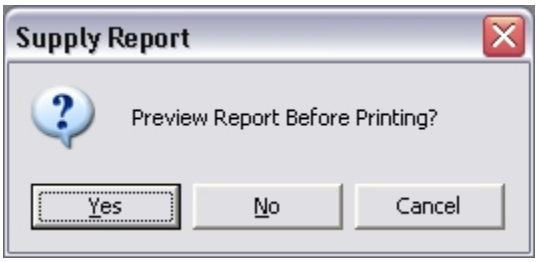
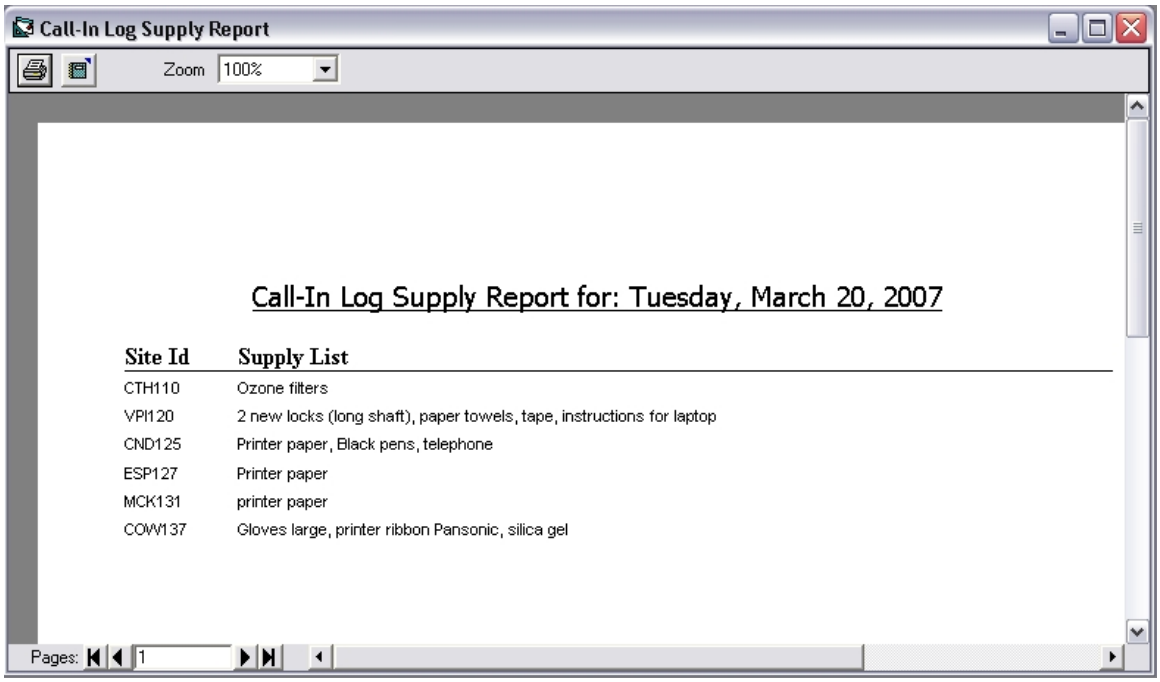


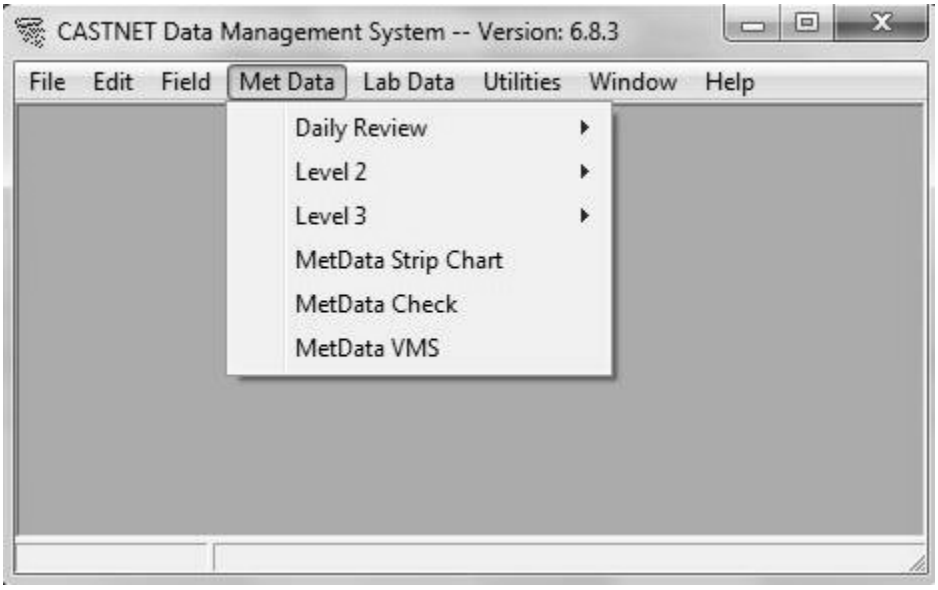

**Figure 53**



## 6.4 Metdata Menu

Figure 54 shows the menu structure listed under the “Met Data” top level menu option.

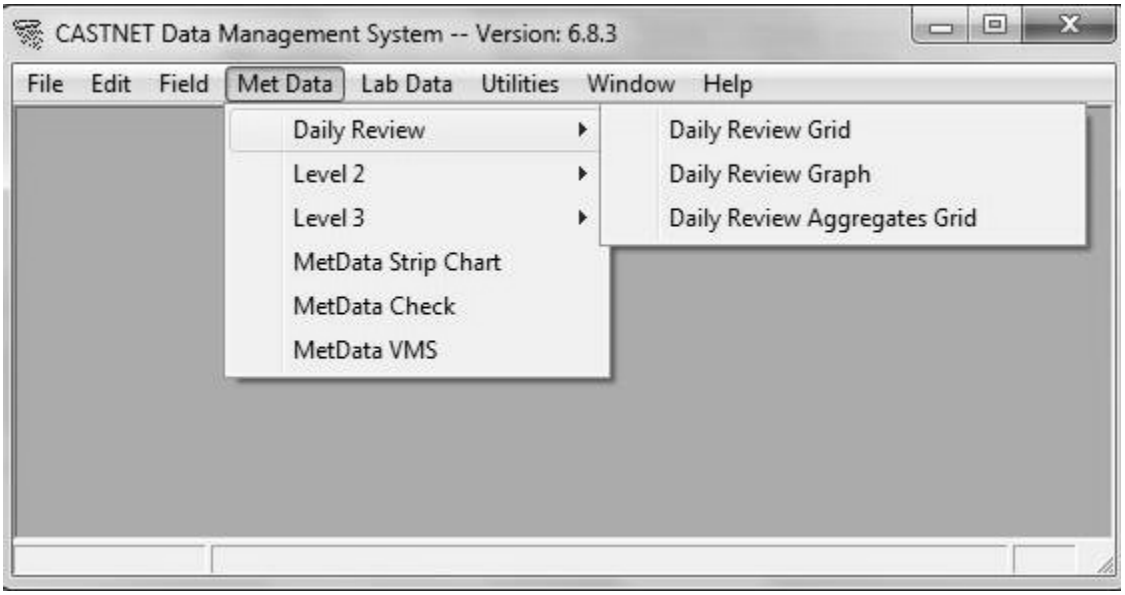
**Figure 54**




### 6.4.1 Daily Review

Figure 55 shows the menu structure listed under the “Met Data / Daily Review” top level menu option.

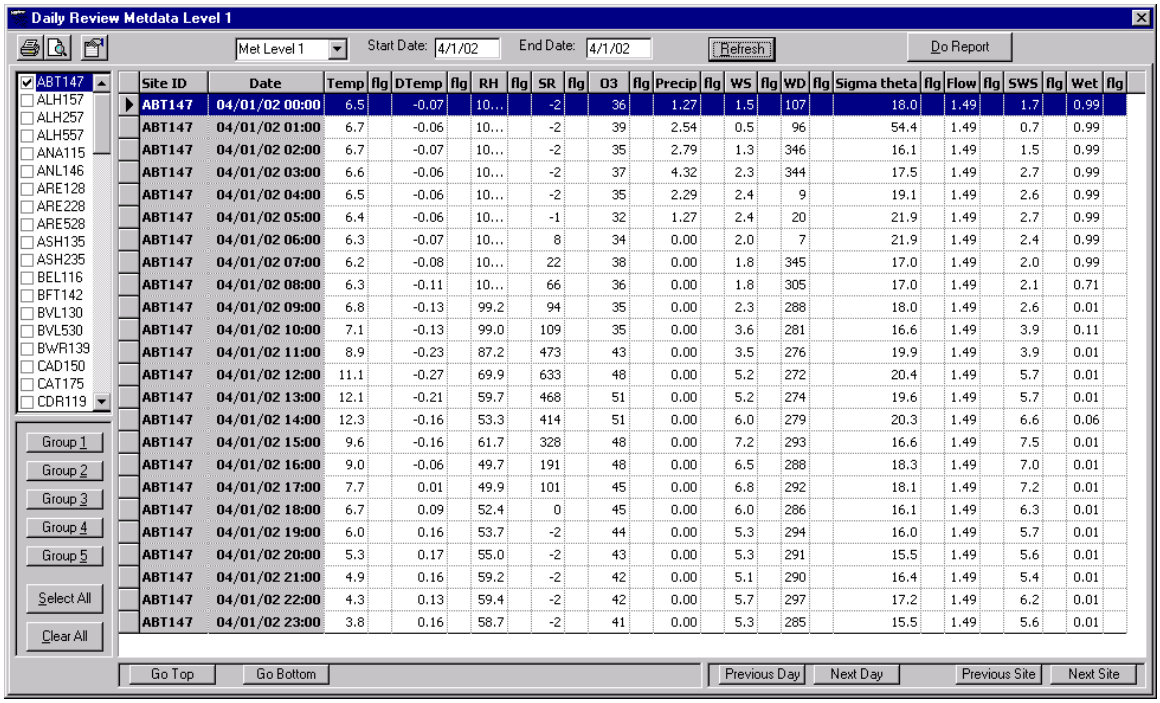
**Figure 55**



### 6.4.2 Daily Review Grid

The "Met Data / Daily Review Grid" menu option displays a grid containing all continuous data for a site (or group of sites) for a specific number of days. The grid is configured to automatically display 24 records (hours). Figure 56 shows the grid after it has been loaded with data.

**Figure 56**




To load the grid, select the site(s) to include individually from the list box or use the calibration group or "Select All" buttons. Choose a start and end date. The hour of 00:00 is assumed for the start date and the hour of 23:00 is assumed for the end date. Use the combo box at the top of the form to select the data source. Table 2 details the possible choices. Click the "Refresh" button to load the grid.

**Table 2**

| Data Source | Database | Table |
|---|---|---|
| Met Level I | castnet_working | METDATA_L1 |
| Met Level 2 | castnet_working | METDATA_L2 |
| Historical | castnet | METDATA |
| NPS New | castnet_temp | NPS_NEW |
| Met Level 0 | castnet_temp | METDATA_L0 |
| ESC Sites Raw | castnet_working | vwCrossMetPolled (database view) |

Once the grid is loaded, the buttons along the bottom of the form can be used to change the data displayed in the grid between days and/or sites.

To create a report from the data displayed in the grid, click the "Do Report" button in the upper right-hand corner of the form. Figure 57 shows an example of a partial Daily Report. The actual report shows all hours for one day on a page.

**Figure 57**

***Metdata Level1 Daily Review Report***

Thursday, May 23, 2002

STATION ID: ***ABT147***

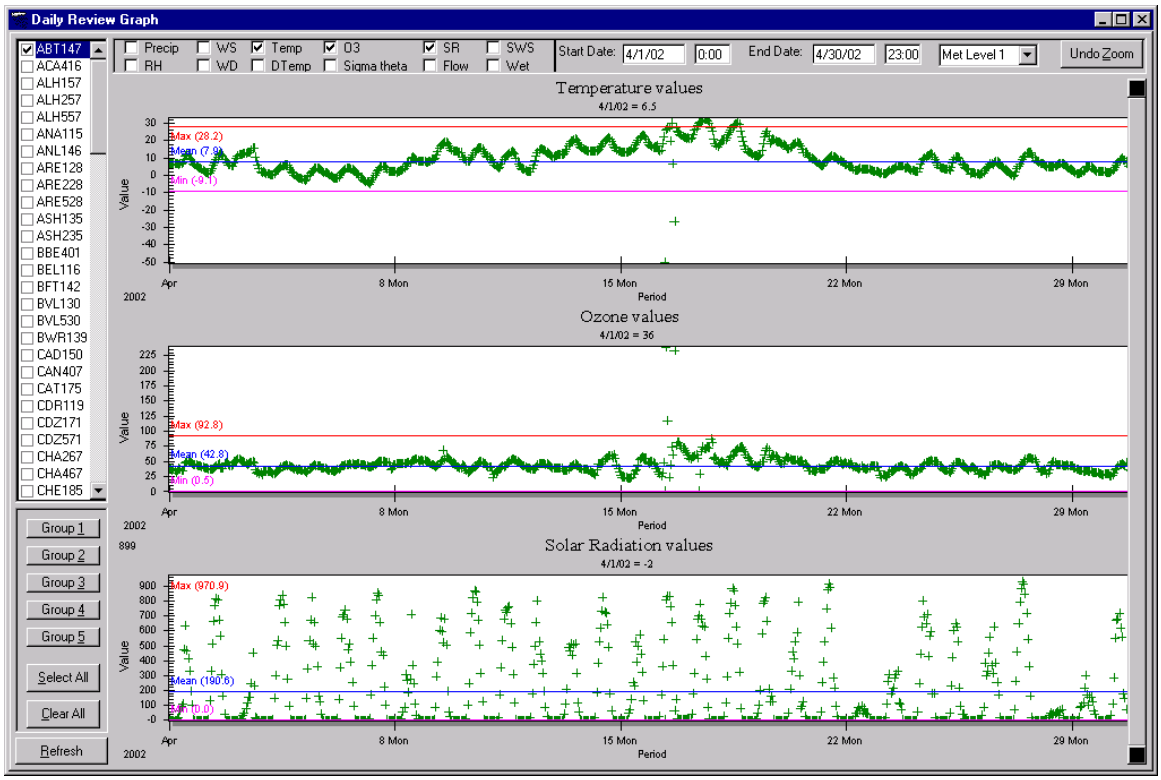
| Date Time | TEMP (CENT) | DELTA or TEMP2 (CENT) | REL HUMID | SOLAR RADIATION (WATTS/M2) | OZONE (PPB) | PRECIP (MM/HR) | VEC WIND SPEED (METERS/SEC) | VEC WIND DIRECTION | STD DEV DIRECTION (DEGREES) | FLOW (LPM) | SCALAR WIND SPEED (METERS/SEC) | WETNESS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/1/02 0:00 | 6.5 | -0.07 | 101.6 | -2 | 36 | 1.27 | 1.5 | 107 | 18.0 | 1.49 | 1.7 | 0.99 |
| 4/1/02 1:00 | 6.7 | -0.06 | 101.7 | -2 | 39 | 2.54 | 0.5 | 96 | 54.4 | 1.49 | 0.7 | 0.99 |
| 4/1/02 2:00 | 6.7 | -0.07 | 101.7 | -2 | 35 | 2.79 | 1.3 | 346 | 16.1 | 1.49 | 1.5 | 0.99 |
| 4/1/02 3:00 | 6.6 | -0.06 | 101.7 | -2 | 37 | 4.32 | 2.3 | 344 | 17.5 | 1.49 | 2.7 | 0.99 |
| 4/1/02 4:00 | 6.5 | -0.06 | 101.7 | -2 | 35 | 2.29 | 2.4 | 9 | 19.1 | 1.49 | 2.6 | 0.99 |
| 4/1/02 5:00 | 6.4 | -0.06 | 101.7 | -1 | 32 | 1.27 | 2.4 | 20 | 21.9 | 1.49 | 2.7 | 0.99 |
| 4/1/02 6:00 | 6.3 | -0.07 | 101.7 | 8 | 34 | 0.00 | 2.0 | 7 | 21.9 | 1.49 | 2.4 | 0.99 |
| 4/1/02 7:00 | 6.2 | -0.08 | 101.6 | 22 | 38 | 0.00 | 1.8 | 345 | 17.0 | 1.49 | 2.0 | 0.99 |
| 4/1/02 8:00 | 6.3 | -0.11 | 101.3 | 66 | 36 | 0.00 | 1.8 | 305 | 17.0 | 1.49 | 2.1 | 0.71 |
| 4/1/02 9:00 | 6.8 | -0.13 | 99.2 | 94 | 35 | 0.00 | 2.3 | 288 | 18.0 | 1.49 | 2.6 | 0.01 |
| 4/1/02 10:00 | 7.1 | -0.13 | 99.0 | 109 | 35 | 0.00 | 3.6 | 281 | 16.6 | 1.49 | 3.9 | 0.11 |
| 4/1/02 11:00 | 8.9 | -0.23 | 87.2 | 473 | 43 | 0.00 | 3.5 | 276 | 19.9 | 1.49 | 3.9 | 0.01 |
| 4/1/02 12:00 | 11.1 | -0.27 | 69.9 | 633 | 48 | 0.00 | 5.2 | 272 | 20.4 | 1.49 | 5.7 | 0.01 |

### 6.4.3 Daily Review Graph

Selecting the "Met Data / Daily Review Graph" menu option displays the "Daily Review Graph" form. This graph can be used to view up to a month's worth of continuous data for one or more parameters for a site. First, select the site(s) using the checkboxes on the left side of the form or use the buttons below the list to select either a specific group of sites or all sites. At the top of the

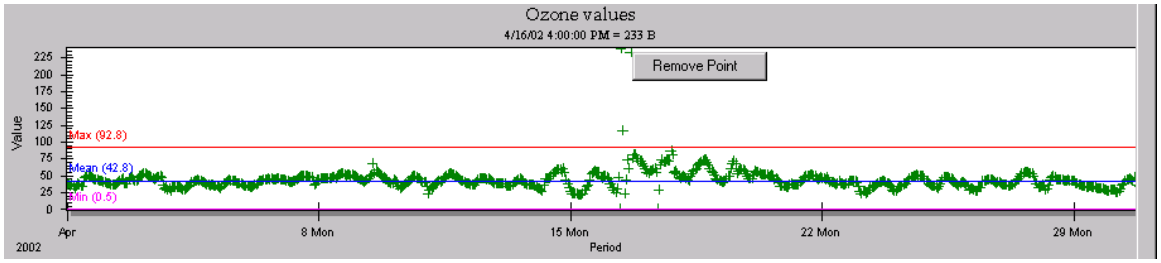
form, select the parameters to display. Up to three parameters can be displayed at one time. Finally, enter the start date, end date, and data source. The data sources available are the same as described in Table 2. Click the "Refresh" button to display the graphs as shown in Figure 58.

**Figure 58**




Values of points on a graph can be identified by clicking on the point or by using the arrow keys to move between points. Values are displayed beneath the heading of the graph with the associated status flag and the date_time. Points can be removed from the graph causing the y-axis to rescale by left clicking to select the point and then right clicking on the point and selecting "Remove Point" (Figure 59). In this example, the datum is flagged "B" indicating that it is invalid and can be removed. (Note: This process only removes the point from the graphical display. The data within the database are maintained.) Historical minimum, mean, and maximum values are displayed as purple, blue, and red lines, respectively.

**Figure 59**




The graph offers a zoom feature to allow the user to focus on a smaller time period than was initially selected. To zoom, click within the graph and drag to indicate the timeframe to zoom into (Figure 60).

**Figure 60**

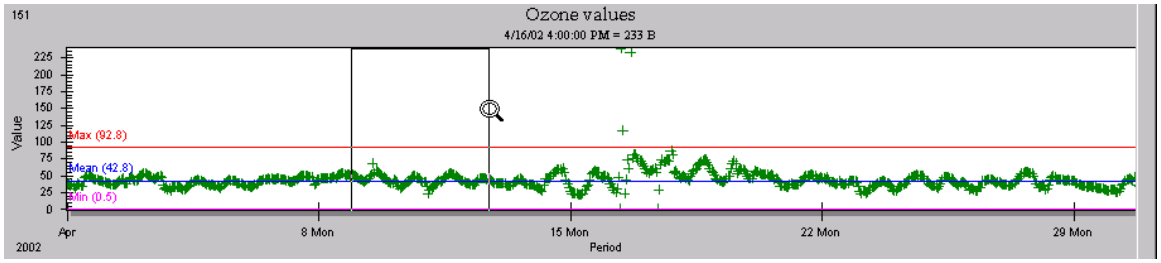
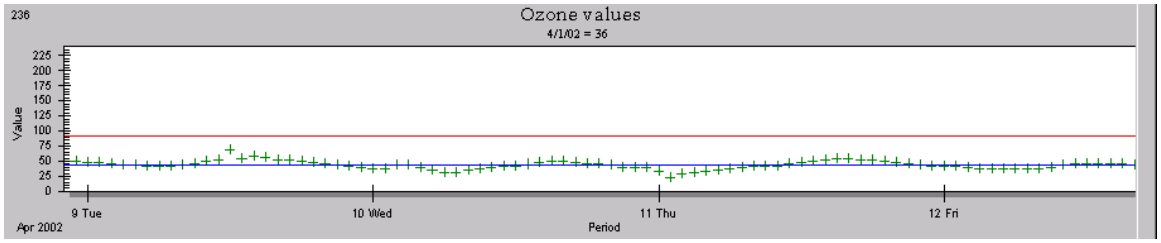



Figure 61 shows the graph following the zoom action.

**Figure 61**



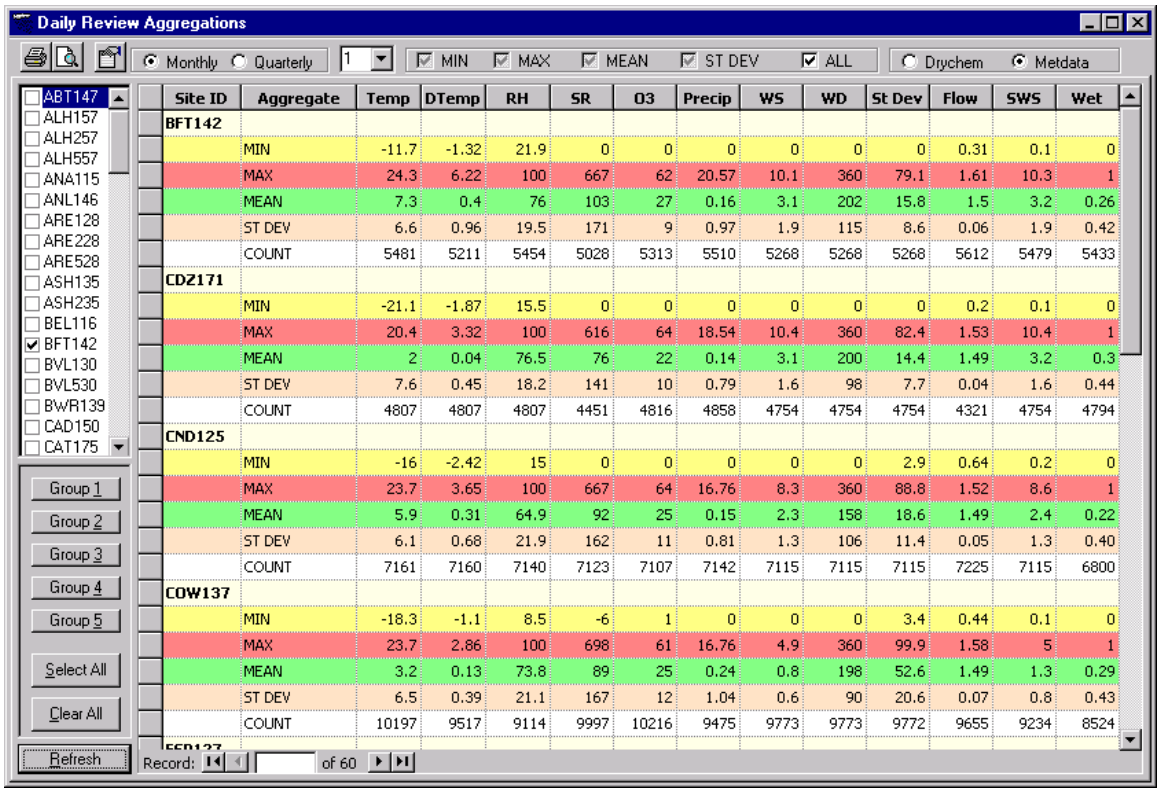

To undo the zoom, click the "Undo Zoom" button in the upper right corner of the form (Figure 52). If more than one site is selected, use the navigation bar on the right side of the form to maneuver between sites.

### 6.4.4 Daily Review Aggregates Grid

Selecting the "Met Data / Daily Review / Daily Review Aggregates Grid" menu option (Figure 55) displays a grid that is used to view historical aggregates from the METDATA and DRYCHEM tables (Figure 62). To load the grid, select the site(s) to include individually by selecting the box next to the Site ID or use a group or "Select All" button. Select either monthly or quarterly aggregations and then select either the month (1–12) or quarter (1–4) of interest.

Select the types of aggregations to display. Aggregations are calculated from all available data for that month or quarter regardless of the year. Finally, select either “Drychem” or “Metdata” aggregations. Click the “Refresh” button to load the grid (Figure 62).

**Figure 62**



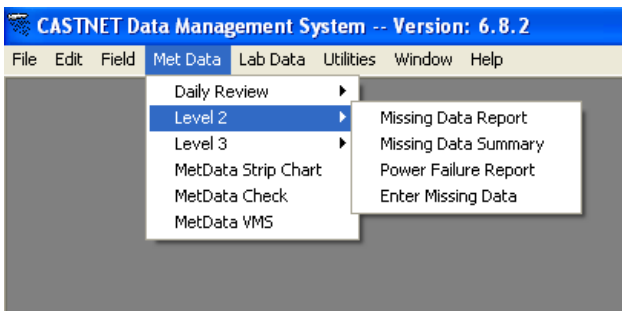

| Site ID | Aggregate | Temp | DTemp | RH | SR | O3 | Precip | WS | WD | St Dev | Flow | SWS | Wet |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BFT142 | | | | | | | | | | | | | |
| | MIN | -11.7 | -1.32 | 21.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0.31 | 0.1 | 0 |
| | MAX | 24.3 | 6.22 | 100 | 667 | 62 | 20.57 | 10.1 | 360 | 79.1 | 1.61 | 10.3 | 1 |
| | MEAN | 7.3 | 0.4 | 76 | 103 | 27 | 0.16 | 3.1 | 202 | 15.8 | 1.5 | 3.2 | 0.26 |
| | ST DEV | 6.6 | 0.96 | 19.5 | 171 | 9 | 0.97 | 1.9 | 115 | 8.6 | 0.06 | 1.9 | 0.42 |
| | COUNT | 5481 | 5211 | 5454 | 5028 | 5313 | 5510 | 5268 | 5268 | 5268 | 5612 | 5479 | 5433 |
| CDZ171 | | | | | | | | | | | | | |
| | MIN | -21.1 | -1.87 | 15.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0.1 | 0 |
| | MAX | 20.4 | 3.32 | 100 | 616 | 64 | 18.54 | 10.4 | 360 | 82.4 | 1.53 | 10.4 | 1 |
| | MEAN | 2 | 0.04 | 76.5 | 76 | 22 | 0.14 | 3.1 | 200 | 14.4 | 1.49 | 3.2 | 0.3 |
| | ST DEV | 7.6 | 0.45 | 18.2 | 141 | 10 | 0.79 | 1.6 | 98 | 7.7 | 0.04 | 1.6 | 0.44 |
| | COUNT | 4807 | 4807 | 4807 | 4451 | 4816 | 4858 | 4754 | 4754 | 4754 | 4321 | 4754 | 4794 |
| CND125 | | | | | | | | | | | | | |
| | MIN | -16 | -2.42 | 15 | 0 | 0 | 0 | 0 | 0 | 2.9 | 0.64 | 0.2 | 0 |
| | MAX | 23.7 | 3.65 | 100 | 667 | 64 | 16.76 | 8.3 | 360 | 88.8 | 1.52 | 8.6 | 1 |
| | MEAN | 5.9 | 0.31 | 64.9 | 92 | 25 | 0.15 | 2.3 | 158 | 18.6 | 1.49 | 2.4 | 0.22 |
| | ST DEV | 6.1 | 0.68 | 21.9 | 162 | 11 | 0.81 | 1.3 | 106 | 11.4 | 0.05 | 1.3 | 0.40 |
| | COUNT | 7161 | 7160 | 7140 | 7123 | 7107 | 7142 | 7115 | 7115 | 7115 | 7225 | 7115 | 6800 |
| COW137 | | | | | | | | | | | | | |
| | MIN | -18.3 | -1.1 | 8.5 | -6 | 1 | 0 | 0 | 0 | 3.4 | 0.44 | 0.1 | 0 |
| | MAX | 23.7 | 2.86 | 100 | 698 | 61 | 16.76 | 4.9 | 360 | 99.9 | 1.58 | 5 | 1 |
| | MEAN | 3.2 | 0.13 | 73.8 | 89 | 25 | 0.24 | 0.8 | 198 | 52.6 | 1.49 | 1.3 | 0.29 |
| | ST DEV | 6.5 | 0.39 | 21.1 | 167 | 12 | 1.04 | 0.6 | 90 | 20.6 | 0.07 | 0.8 | 0.43 |
| | COUNT | 10197 | 9517 | 9114 | 9997 | 10216 | 9475 | 9773 | 9773 | 9772 | 9655 | 9234 | 8524 |

To change the aggregations shown, sites, or aggregation period, make the adjustments and click the “Refresh” button. To print the grid, click the printer icon in the upper left corner of the form.

### 6.4.5 Level 2

Figure 63 shows the menu structure listed under the “Met Data / Level 2” top level menu option.

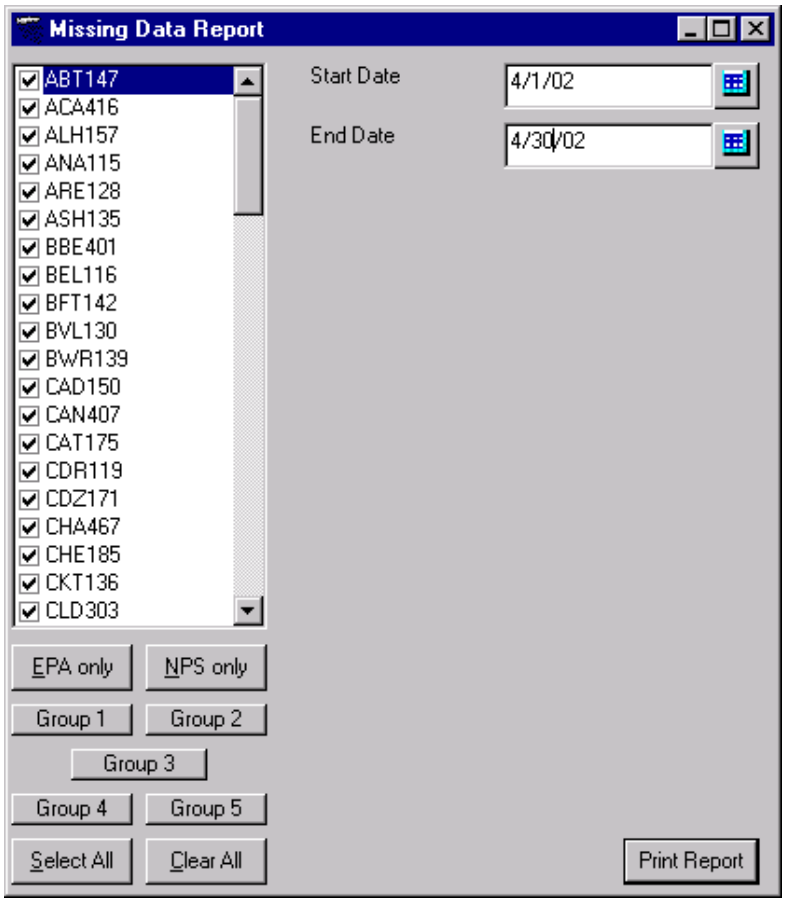
**Figure 63**



### 6.4.6 Missing Data Report

Select the "Met Data / Level 1 /Missing Data Report" menu option to display the "Missing Data Report" form (Figure 64).

**Figure 64**




Select the sites individually or use the buttons below the Site ID list to select specific groups of sites or all sites. Enter start and end dates in the "Start Date" and "End Date" boxes or use the calendar button to the right of the boxes to select a date. Click the "Print Report" button to view a "Print Preview" of the report (not shown). Use the navigation arrows in the bottom left-hand corner of the "Print Preview" screen to navigate the pages of the report. To print the report from the "Print Preview" display, click the printer icon button in the upper left corner. Figure 65 shows an example of the report.

**Figure 65**

*Level 1 Flag Report*
*DRY DEPOSITION NETWORK*

Tuesday, May 14, 2002

STATION ID: *BWR139*

| Date Time | 01 PRECIP (MM/HR) | 02 VEC WIND DIRECTION | 03 VEC WIND SPEED (METERS/SEC) | 04 TEMP (CENT) | 05 DELTA or TEMP2 (CENT) | 06 REL HUMID | 07 OZONE (PPB) | 08 STD DEV DIRECTION (DEGREES) | 09 SOLAR RADIATION (WATTS/M2) | 10 FLOW (LPM) | 11 SCALAR WIND SPEED (METERS/SEC) | 12 WETNESS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/10/02 4:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 5:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 6:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 7:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 8:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 9:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 10:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 11:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 12:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 13:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 14:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 15:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 16:00 | M | M | M | M | M | M | M | M | M | M | M | M |
| 4/10/02 17:00 | 0 | 305.1 | 2.1 | 16.15 | 0.200 | 53.75 | 48.25 | M | 27.22 | 1.493 | 2.1 | 0.025 |
| 4/10/02 18:00 | 0 | 50.94 | 1.325 | 14.25 | 0.875 | 62.1 | 44.5 | M | 0 | 1.493 | 1.35 | 0.025 |
| 4/10/02 19:00 | 0 | 48.78 | 1.3 | 12.5 | 1.215 | 71.9 | 42.25 | M | -0.69 | 1.493 | 1.325 | 0.025 |
| 4/10/02 20:00 | 0 | 137.1 | 2.75 | 12.4 | 0.270 | 82.05 | 31 | M | -0.69 | 1.493 | 2.75 | 0.024 |
| 4/10/02 21:00 | 0 | 132.6 | 3.45 | 11.3 | 0.165 | 85.8 | 32.75 | M | -0.69 | 1.493 | 3.45 | 0.024 |
| 4/10/02 22:00 | 0 | 91.62 | 1.925 | 10.1 | 0.675 | 85.15 | 33.75 | M | -0.69 | 1.493 | 1.95 | 0.024 |
| 4/10/02 23:00 | 0 | 22.5 | 0.875 | 8.300 | 1.385 | 92.15 | 32.25 | M | -0.69 | 1.493 | 0.9 | 1.005 |

### 6.4.7 Missing Data Summary

Select the "Met Data / Level 1 / Missing Data Summary" menu option (Figure 57) to display the "Missing Data Summary Report" form, which is shown in Figure 66.

**Figure 66**

Select the month of interest from the "Select Month" combo box, and enter the year. Click the "Show Report" button. To print the report after it previews on the screen, click the printer icon

button in the upper left-hand corner of the preview screen (not shown). Figure 67 shows an example of the "Missing Data Summary" report.

**Figure 67**

**Missing Data Summary Report**

**April 2002**

| SITE ID | Days with Missing Data for at least one parameter and one hour |
|---|---|
| BEL116 | 30 |
| BWR139 | 10,11,12,13,14,15 |
| CAT175 | 17,18,19,20,23 |
| CDZ171 | 28 |
| CNT169 | 1,5,18,23 |
| CVL151 | 11,12,16,17,21 |
| ESP127 | 19,20,21,22 |
| HOW132 | 27 |
| IRL141 | 2,22 |
| KEF112 | 6,7 |
| MCK131 | 19,20,21,22 |
| MCK231 | 20,21,22,23 |
| PNF126 | 9,17,18,19,20,21,22 |
| PRK134 | 27,28,29 |
| PSU106 | 16 |
| SND152 | 26 |
| UVL124 | 3,4 |
| WST109 | 11,13,17,18,19,21,22 |

### 6.4.8 Power Failure Report

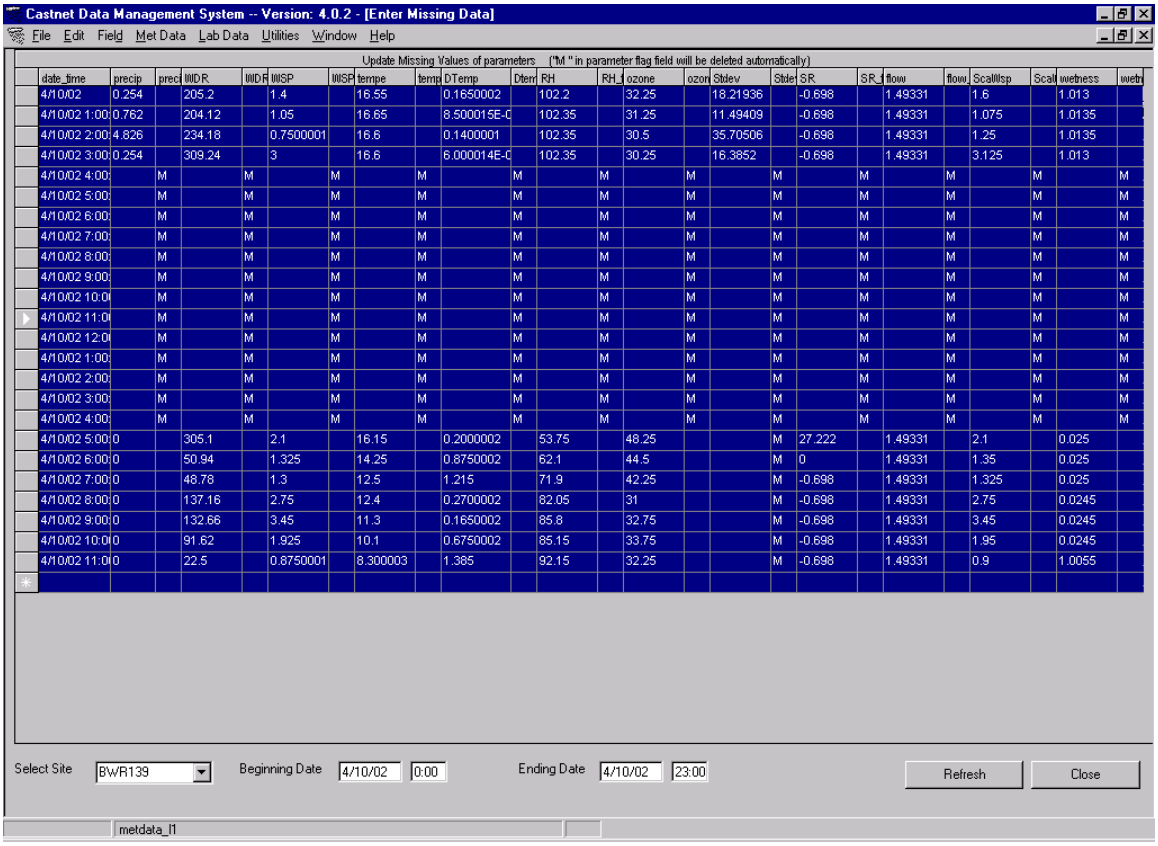
Select the "Met Data / Level 1 / Power Failure Report" menu option (Figure 63) to display the report listing sites with power outages during the time period of interest. The "Power Failure Report" is generated using the same process as the "Missing Data Report." See Section 6.4.6 for a complete description. The report format is identical to the "Missing Data Report" (Figure 67) with the exception that "F" flags are reported rather than "M" flags.

### 6.4.9 Enter Missing Data

Authorized personnel may enter missing continuous data by selecting the "Met Data / Level 1 / Enter Missing Data" menu option (Figure 63) to display the "Enter Missing Data" form (Figure 68). At the bottom of the form, select a site from the "Select Site" combo box and enter a

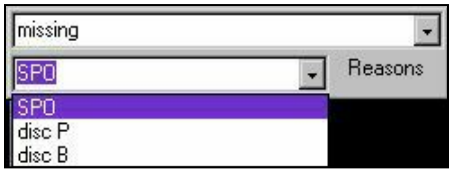
date range. Click the "Refresh" button to load data for the selected site and dates into the grid. Figure 68 displays the grid following the data loading process.

**Figure 68**




Enter missing data, if available, or make corrections and click the "Refresh" button again to update the records. A dialog box will be displayed (Figure 69). Select a source for the entered data from the combo box, and select a reason for replacing or changing the original data. The application will then complete the update process and return to the date range entered at the bottom of the form. Alternatively, the user can enter the next date range to edit before clicking the "Refresh" button so that the application pulls up that period after the update of the previous date range has finished.

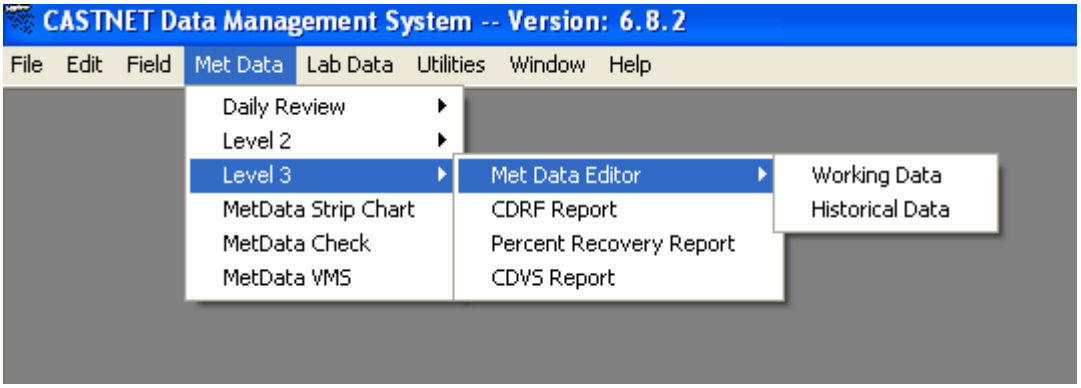
**Figure 69**



### 6.4.10 Level 3

Figure 70 shows the menu structure listed under the "Met Data / Level 3" top level menu option.

**Figure 70**

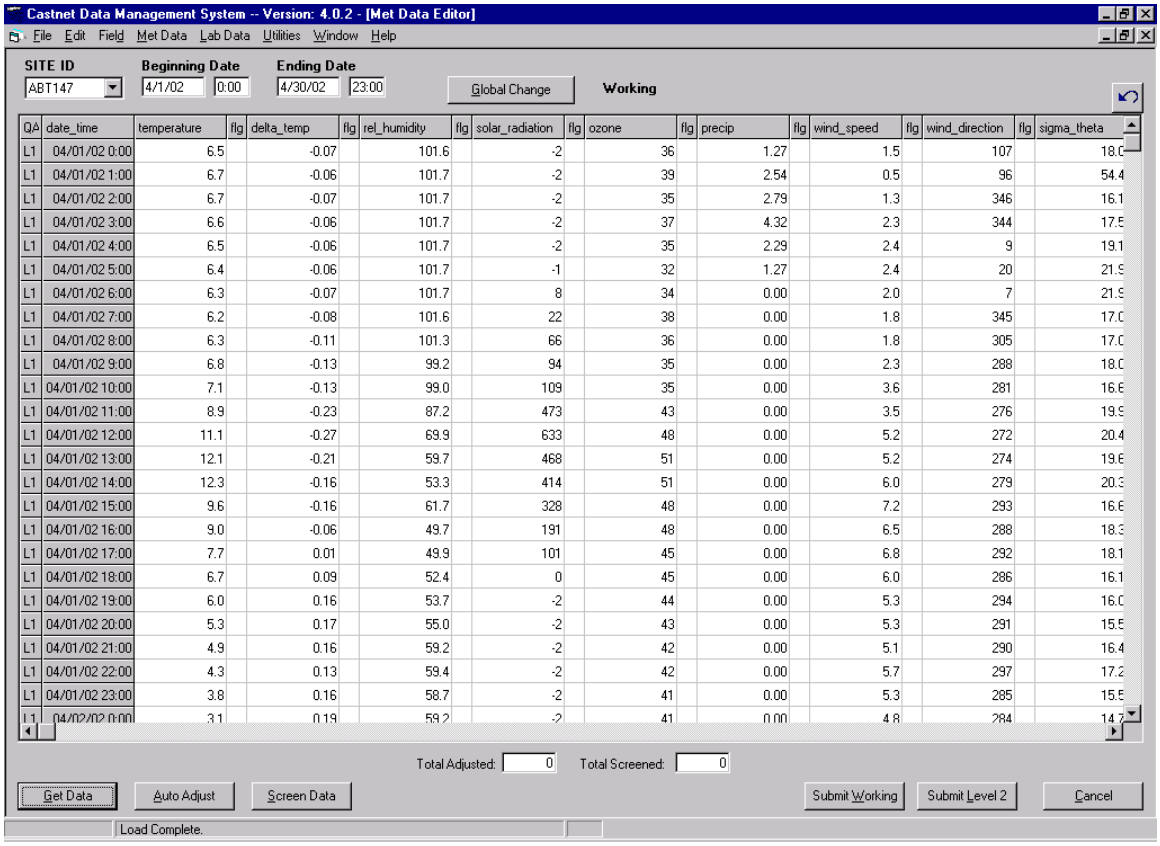



### 6.4.11 Met Data Editor

Authorized DMC staff (data validators) use the "Met Data Editor" to perform Level 3 continuous data validation. The "Met Data Editor" menu option, provides a choice of either current ("working") data or historical data. The "Historical Data" option allows a read-only viewer for the archived Level 3 data found in the METDATA table, which is in the castnet database. Users are limited to read-only access of the "Historical Data" option because Level 3 validation of these data has been completed and the archived data cannot be changed. However, the same processes described for accessing the data using the "Working Data" option are used to access the archived data.

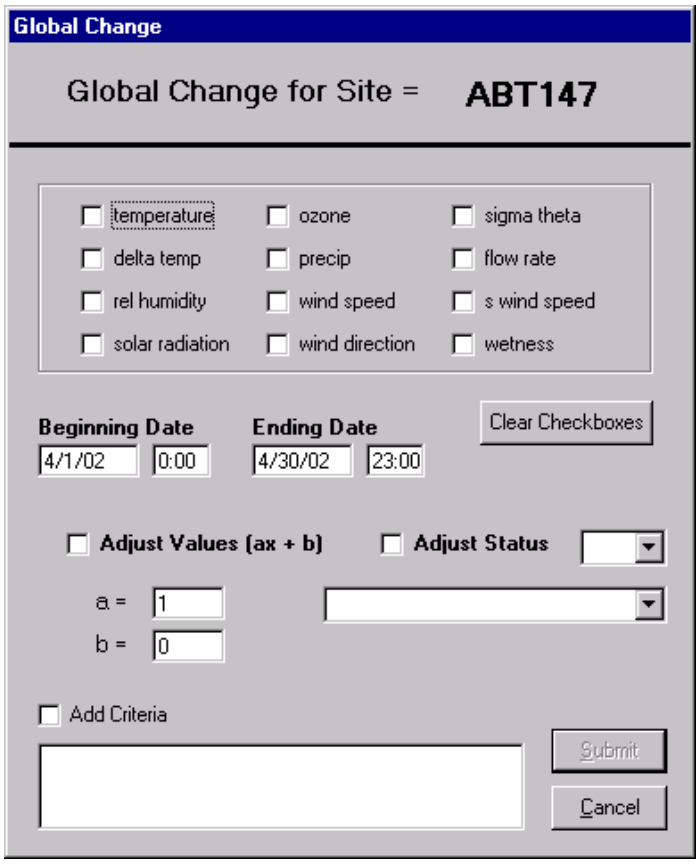
The "Working Data" option accesses data from the METDATA_L1 and METDATA_L2 tables currently undergoing the data validation process. Both tables are in the castnet_working database. Select the "Working Data" menu option to display the Met Data Editor grid and load a data set. The type of data (working or historical) displayed in the grid is labeled at the center of the top of the form. Select a site from the "Site ID" combo box located at the top left of the form and enter the beginning and end dates. Click the "Get Data" button at the bottom left of the screen. Figure 71 shows the Met Data Editor with data loaded into the grid.

**Figure 71**




Global Changes to data within the grid can be accomplished by clicking the “Global Change” button located near the top middle of the screen. The “Global Change” form is displayed as shown in Figure 72.

**Figure 72**

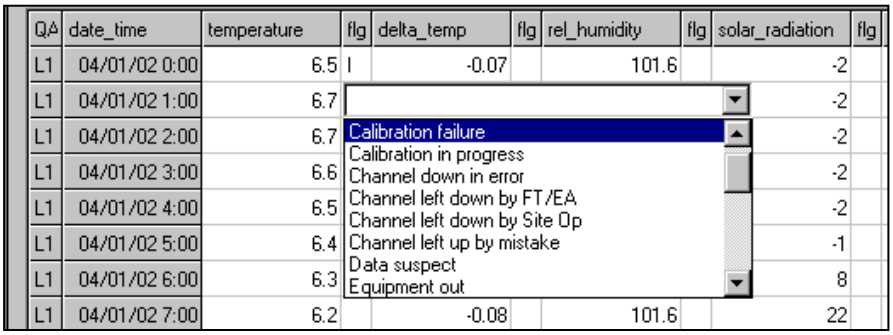



Select the boxes next to the parameters to be changed. Input the beginning and ending dates and times and select either the "Adjust Values" or "Adjust Status" box. "Adjust Values" changes the numerical value of the polled data. "Adjust Status" changes the polled flag status of the chosen data. If the "Adjust Values" option is selected, input the correct value adjustment for "a" and/or "b" based on the formula ax + b where x is the polled value. If the "Adjust Status" option is selected, choose the new flag status from the combo box to the right of the "Adjust Status" label. In either case, a reason for the global change is selected from the combo box immediately below the "Adjust Status" box and label. This combo box contains a list of reasons that are commonly used. However, users may type in a new reason if the action requires a different or more detailed explanation.

If certain criteria need to be met in order to perform any change, click the "Add Criteria" box and input the criteria in the space provided. The criteria should be added in the same format as if the user were completing the "WHERE" clause of a SQL statement. Once all settings are correct, click the "Submit" button. The application will not allow the user to submit a global change until an action and the accompanying reason are supplied.

To perform data changes to individual records, click in the value field or flag field of the record displayed in the "Met Data Editor" grid (Figure 71) and change to the appropriate value or flag status, respectively. In the following detail screen, an "I" flag was added to the temperature value. A combo box displays for explanation of the change (Figure 73). Input the reason for the change into the combo box and press the "Enter" key.

**Figure 73**




The large, curved arrow drawn in a counter-clock wise direction at the top right of the screen is an "UNDO" arrow and will undo the last change.

The following buttons are located on the bottom left side of the screen in the order they appear:

- Get Data – retrieves data for a desired site, date, and time.
- Auto Adjust – changes values of data that poll outside of acceptable/set criteria. When used, the number of records adjusted is shown in the "Total Adjusted" box.
- Screen Data – screens data values that fall outside of set criteria. When used, the number of records screened is shown in the "Total Screened" box.

The following buttons are located on the bottom right side of the screen in the order they appear:

- Submit Working – submits data in the "Met Data Editor" grid to the METDATA_L2 table and maintains the quality assurance (QA) code as 2.
- Submit Level 3 – submits (or updates) data in the "Met Data Editor" grid to the METDATA_L2 table and updates the QA code to 3.
- Cancel – cancels and clears the present grid. Data changes are not saved. The user is prompted to verify whether or not it is "OK" to cancel and reset.

### 6.4.12 CDRF Report

The "Continuous Data Review Form (CDRF) Report" option under the "Met Data / Level 2" menu (Figure 70) displays an electronic log of the changes made to continuous data during Level 2 and Level 3 data validation. Changes are automatically recorded when entered into the database through the "Enter Missing Data" grid (Section 6.4.9), and the "Met Data Editor" (Section 6.4.11). Selecting the "Met Data / Level 2 / CDRF Report" menu option displays the "CDRF Report Dialog" form (Figure 74).

**Figure 74**

To print a CDRF report, select a site from the "Site ID" combo box and then select the starting and ending month and year. To restrict the report to one month, enter the same month and year in each of the respective start and end date combo boxes (Figure 74). Click the "OK" button to produce the report. To print after the report previews on the screen, click the printer icon in the upper left-hand corner (not shown). Figure 75 shows an example of the report format.

**Figure 75**

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A MACTEC COMPANY

**CDN CONTINUOUS DATA REVIEW FORM**

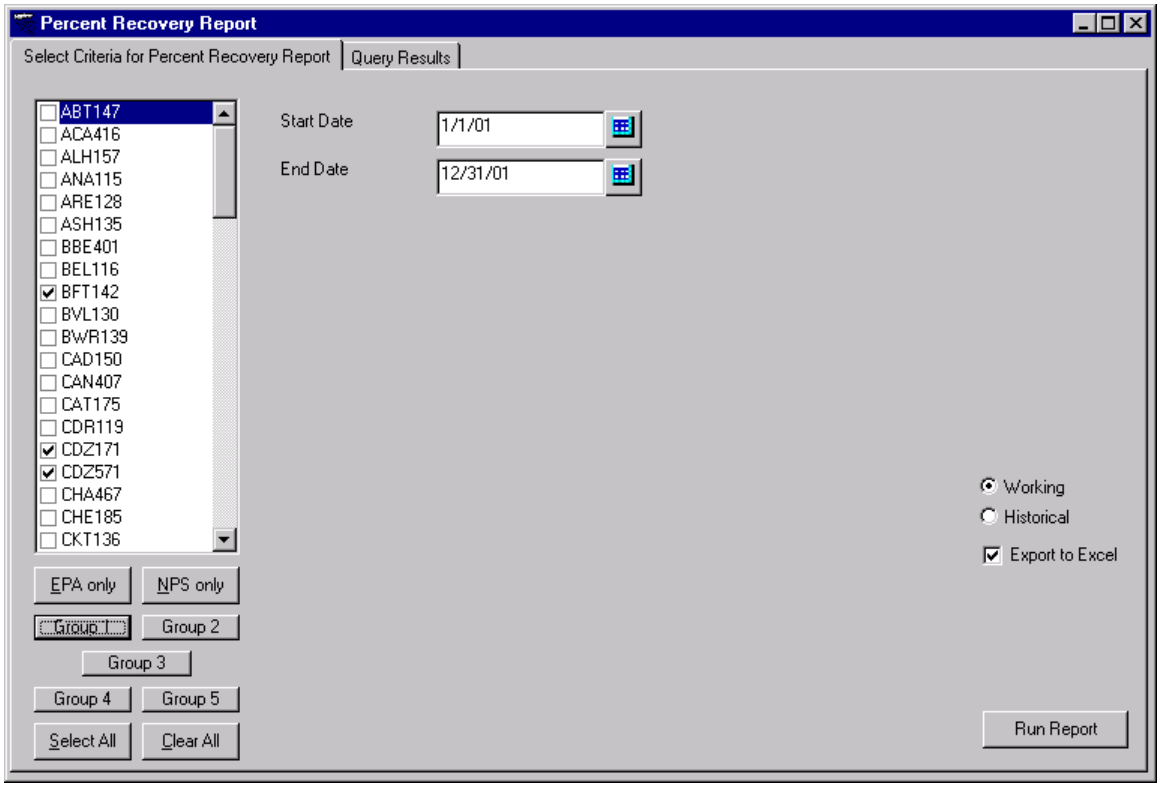
**Site Name:** ***ABT147*** **Period Reviewed:** ***Month of - Jan 2002***

| Parameter | Start Date Time | End Date Time | Editor | Reason |
|---|---|---|---|---|
| rel_humidity | 1/6/02 23:00 | 1/7/02 0:00 | mwford | Adjust RH to 100 |
| rel_humidity | 1/7/02 12:00 | 1/7/02 18:00 | mwford | Adjust RH to 100 |
| rel_humidity | 1/13/02 6:00 | 1/13/02 11:00 | mwford | Adjust RH to 100 |
| rel_humidity | 1/15/02 1:00 | 1/15/02 19:00 | mwford | Adjust RH to 100 |
| rel_humidity | 1/17/02 9:00 | 1/17/02 10:00 | mwford | Adjust RH to 100 |
| rel_humidity | 1/21/02 12:00 | 1/21/02 16:00 | mwford | Adjust RH to 100 |
| rel_humidity | 1/24/02 1:00 | 1/24/02 21:00 | mwford | Adjust RH to 100 |
| rel_humidity | 1/30/02 5:00 | 1/30/02 10:00 | mwford | Adjust RH to 100 |
| rel_humidity | 1/31/02 14:00 | 1/31/02 23:00 | mwford | Adjust RH to 100 |

### 6.4.13 Percent Recovery Report

To produce a continuous data percent recovery report, select the "Percent Recovery Report" menu option from the "Met Data / Level 2" menu listing (Figure 70). The "Select Criteria for Percent Recovery Report" tab of the "Percent Recovery Report" form is shown in Figure 76.

**Figure 76**

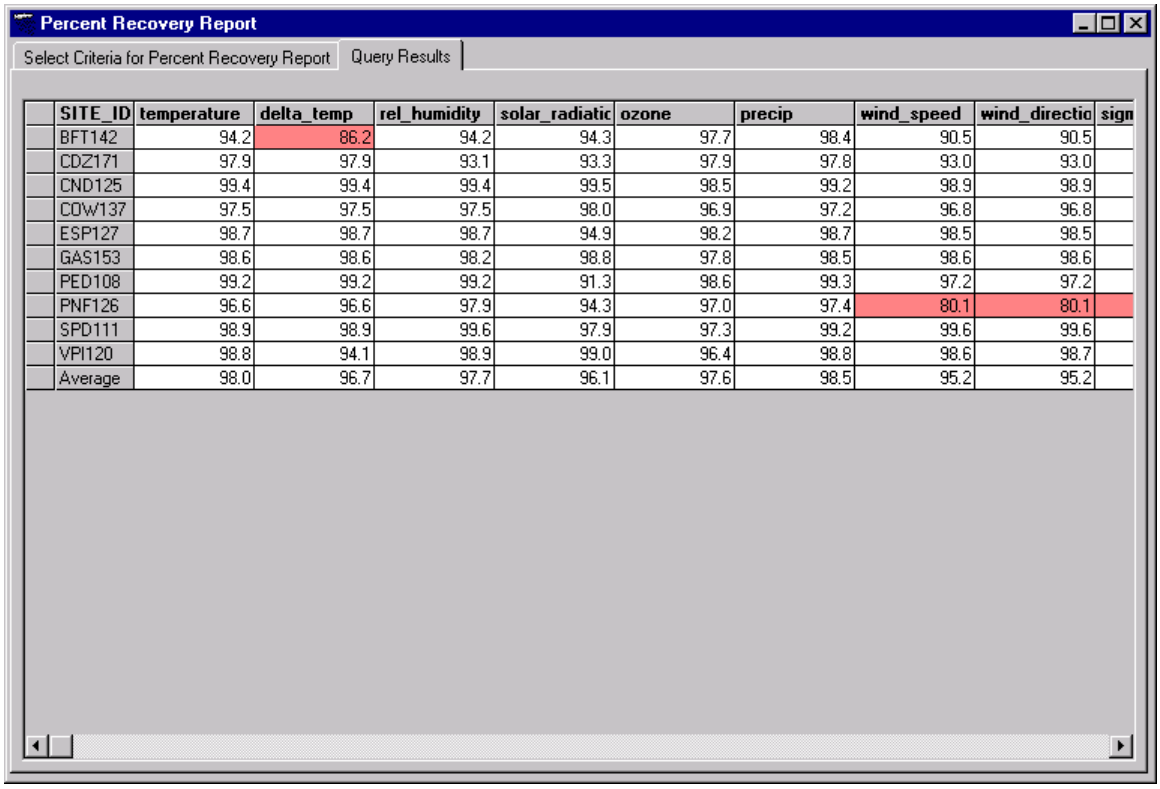



Select the sites individually or use the buttons below the Site ID list to select specific groups of sites or all sites. Manually enter a start and end date into the "Start Date" and "End Date" boxes or use the calendar button to the right of the boxes to select a date. The hour of 00:00 is assumed for the start date and the hour of 23:00 is assumed for the end date. Select either the "Working" (still undergoing the validation process) or "Historical" (Level 3 validation complete) data set. The working option accesses the METDATA_L2 table in the castnet_working database while the historical option accesses the METDATA table in the castnet database. Results can be exported to Microsoft® Excel™ if the "Export to Excel" option is selected. Click the "Run Report" button to produce the report. The user should note that the date range chosen must be wholly contained within the database selected.

The query results may then be reviewed on the "Query Results" grid tab from the "Percent Recovery Report" (Figure 77), which automatically highlights recoveries below the CASTNET 90 percent completion criterion. Results may also be reviewed in Excel™ where they can be

analyzed or corrected using that program's tools. For example, recovery summary results must be corrected for sites that collect ozone on a seasonal basis. During periods in which ozone is not collected, ozone results will be calculated as zero recovery when in fact they should be "NA." Results cannot be printed from the "Query Results" grid but may be printed from Excel™.

**Figure 77**




| SITE_ID | temperature | delta_temp | rel_humidity | solar_radiatic | ozone | precip | wind_speed | wind_directio | sign |
|---|---|---|---|---|---|---|---|---|---|
| BFT142 | 94.2 | 86.2 | 94.2 | 94.3 | 97.7 | 98.4 | 90.5 | 90.5 | |
| CDZ171 | 97.9 | 97.9 | 93.1 | 93.3 | 97.9 | 97.8 | 93.0 | 93.0 | |
| CND125 | 99.4 | 99.4 | 99.4 | 99.5 | 98.5 | 99.2 | 98.9 | 98.9 | |
| COW137 | 97.5 | 97.5 | 97.5 | 98.0 | 96.9 | 97.2 | 96.8 | 96.8 | |
| ESP127 | 98.7 | 98.7 | 98.7 | 94.9 | 98.2 | 98.7 | 98.5 | 98.5 | |
| GAS153 | 98.6 | 98.6 | 98.2 | 98.8 | 97.8 | 98.5 | 98.6 | 98.6 | |
| PED108 | 99.2 | 99.2 | 99.2 | 91.3 | 98.6 | 99.3 | 97.2 | 97.2 | |
| PNF126 | 96.6 | 96.6 | 97.9 | 94.3 | 97.0 | 97.4 | 80.1 | 80.1 | |
| SPD111 | 98.9 | 98.9 | 99.6 | 97.9 | 97.3 | 99.2 | 99.6 | 99.6 | |
| VPI120 | 98.8 | 94.1 | 98.9 | 99.0 | 96.4 | 98.8 | 98.6 | 98.7 | |
| Average | 98.0 | 96.7 | 97.7 | 96.1 | 97.6 | 98.5 | 95.2 | 95.2 | |

### 6.4.14 CDVS Report

This menu selection (see Figure 70) is designated for future development and is not currently functional.

### 6.4.15 MetData Strip Chart

The Met Data Strip Chart function displays individual strip charts for all parameters for a site for a selected date range on one screen. Sites can be selected by using the check boxes on the top right hand corner of the screen and selecting the dates desired in the "Start Date" and "End Date" boxes. Click the "Refresh" button (the circular green arrows box to the left of the printer box) to display the graphs as shown in Figure 78.

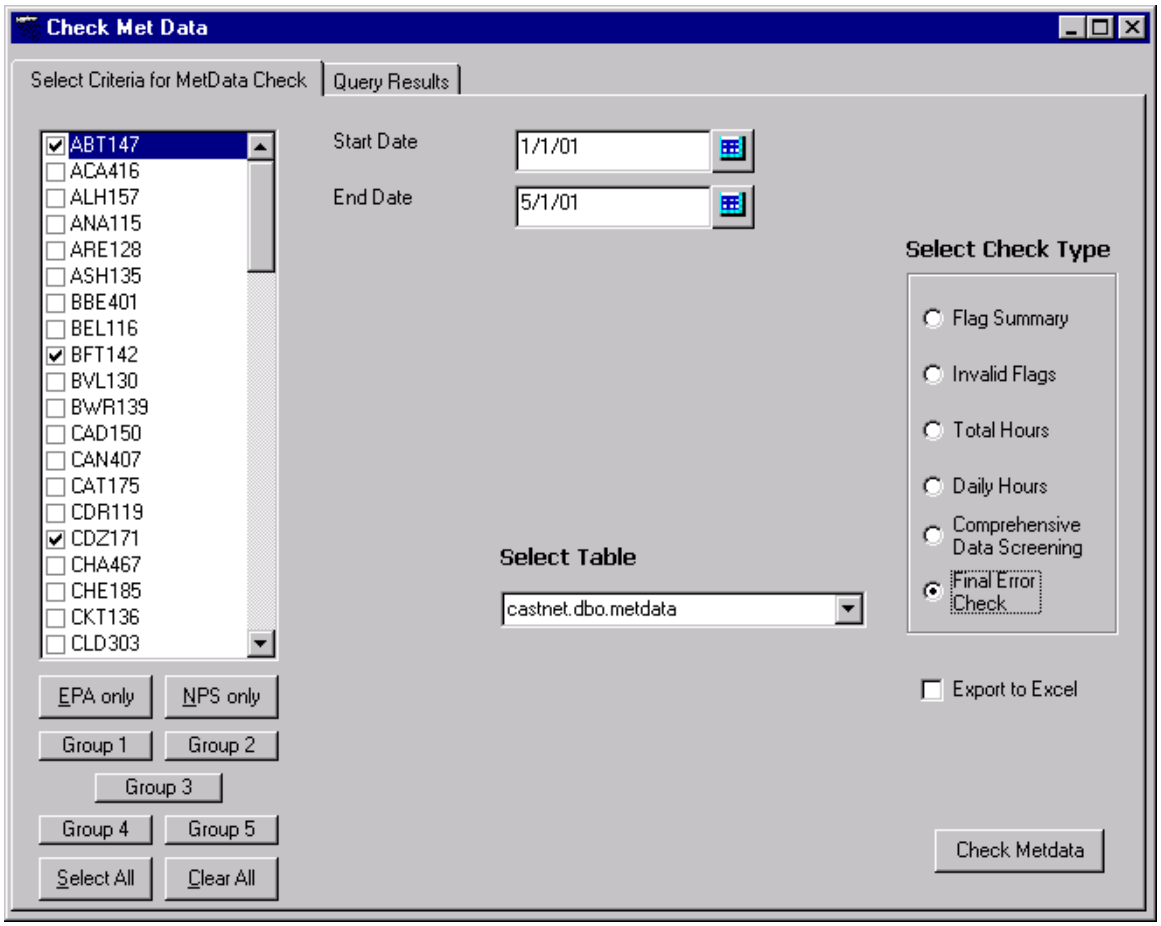
**Figure 78**

Values of points on a graph can be identified by clicking on the point. A graph can also be magnified by double-clicking on an individual graph. The "Valid Data Only" and "Use Raw Data" check boxes can be checked to view the desired data set.

### 6.4.16 MetData Check

The MetData check function is used to scan continuous data for QA purposes. Selecting the "MetData Check" option from the "Met Data" menu displays the following form (Figure 79).

**Figure 79**




On the "Select Criteria for MetData Check" tab, select the sites individually or use the buttons below the Site ID list to select specific groups of sites or all sites. Enter a start and end date in the "Start Date" and "End Date" boxes, respectively, or use the calendar button to the right of the boxes to select a date. The hour 00:00 is assumed for the start date, and the hour 23:00 is assumed for the end date. Next, select from which table to access data. Options present in the "Select Table" combo box include:

- castnet.dbo.metdata – historical continuous data
- castnet_working.dbo.metdata_l2 – continuous data that have not fully completed the validation process
- castnet_temp.dbo.nps_new – recently submitted NPS data

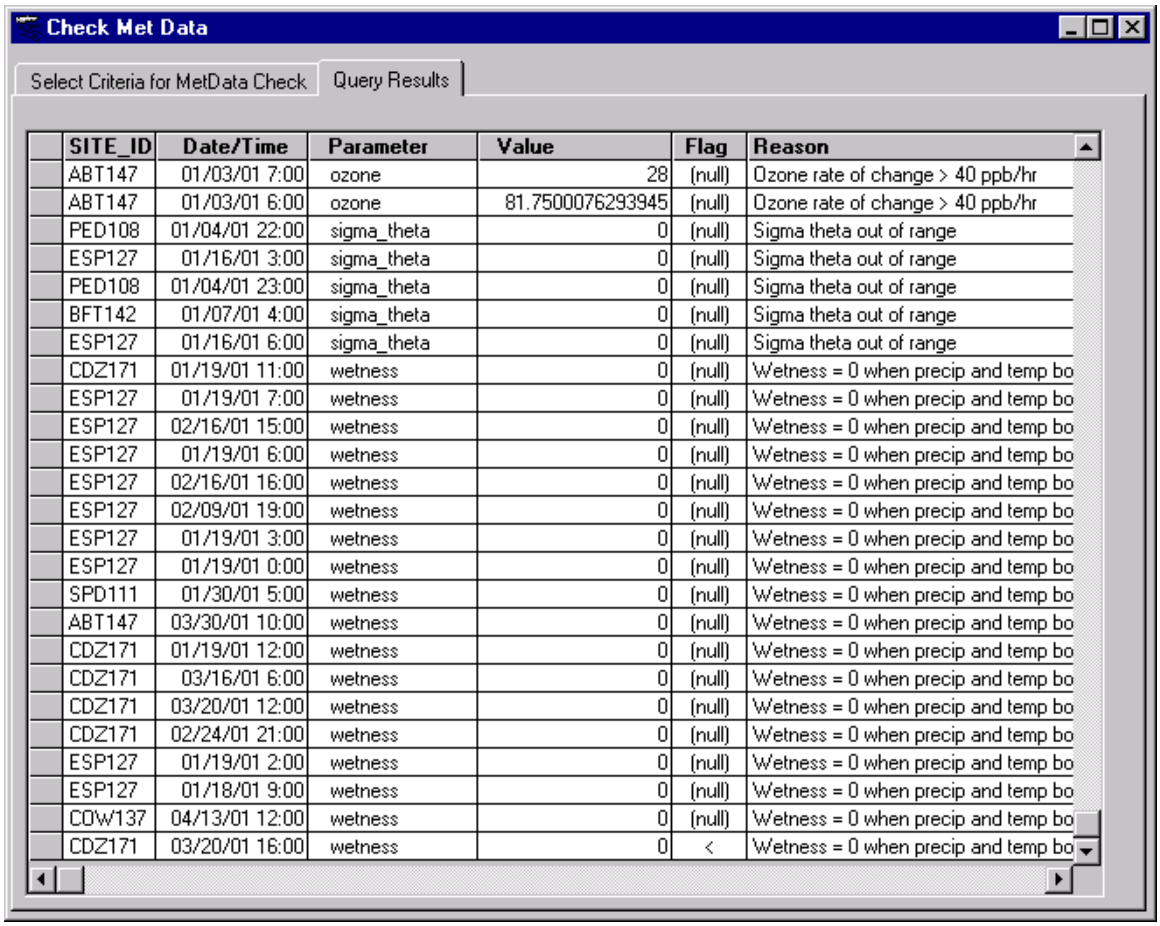
Finally, select the type of criteria to check from the "Select Check Type" radio buttons. Options include:

- Flag Summary – summarizes and displays all flags present for the site within the date range selected

- Invalid Flags – displays any invalid flags present in the data set
- Total Hours – displays the total number of hours (records) by site
- Daily Hours – displays any days where there are less than 24 hours (records)
- Comprehensive Data Screening – subjects the data set to the most stringent criteria available. This uses the same criteria as the "Screen Data" option in the Met Data Editor. Records failing the criteria are displayed on the "Query Results" tab.
- Final Error Check – less stringent criteria, used as a final check following all validation processes. Records failing the criteria are displayed on the "Query Results" tab.

Results can be exported to Excel™ if the "Export to Excel" option is selected. Click the "Check Metdata" button to produce the report. The results may be reviewed in the application's "Query Results" grid or in Excel™. Reports Results cannot be printed from the "Query Results" grid but may be printed from Excel™. Figure 80 shows the results of data screened by selecting the "Final Error Check" radio button.

**Figure 80**

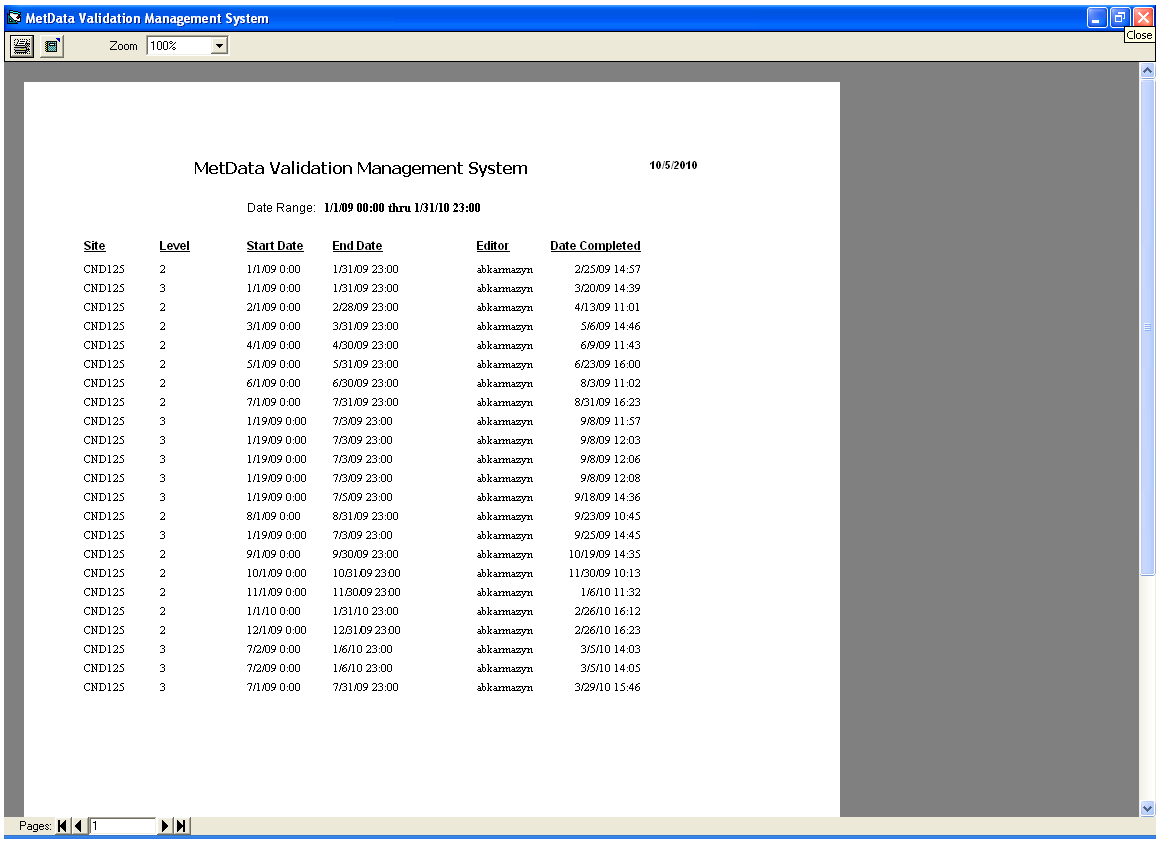



| SITE_ID | Date/Time | Parameter | Value | Flag | Reason |
|---|---|---|---|---|---|
| ABT147 | 01/03/01 7:00 | ozone | 28 | (null) | Ozone rate of change > 40 ppb/hr |
| ABT147 | 01/03/01 6:00 | ozone | 81.7500076293945 | (null) | Ozone rate of change > 40 ppb/hr |
| PED108 | 01/04/01 22:00 | sigma_theta | 0 | (null) | Sigma theta out of range |
| ESP127 | 01/16/01 3:00 | sigma_theta | 0 | (null) | Sigma theta out of range |
| PED108 | 01/04/01 23:00 | sigma_theta | 0 | (null) | Sigma theta out of range |
| BFT142 | 01/07/01 4:00 | sigma_theta | 0 | (null) | Sigma theta out of range |
| ESP127 | 01/16/01 6:00 | sigma_theta | 0 | (null) | Sigma theta out of range |
| CDZ171 | 01/19/01 11:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ESP127 | 01/19/01 7:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ESP127 | 02/16/01 15:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ESP127 | 01/19/01 6:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ESP127 | 02/16/01 16:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ESP127 | 02/09/01 19:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ESP127 | 01/19/01 3:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ESP127 | 01/19/01 0:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| SPD111 | 01/30/01 5:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ABT147 | 03/30/01 10:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| CDZ171 | 01/19/01 12:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| CDZ171 | 03/16/01 6:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| CDZ171 | 03/20/01 12:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| CDZ171 | 02/24/01 21:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ESP127 | 01/19/01 2:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| ESP127 | 01/18/01 9:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| COW137 | 04/13/01 12:00 | wetness | 0 | (null) | Wetness = 0 when precip and temp bo |
| CDZ171 | 03/20/01 16:00 | wetness | 0 | < | Wetness = 0 when precip and temp bo |

### 6.4.17 MetData Validation Management System

The MetData Validation Management System feature is used to archive Level 2 data by selecting the desired sites, month and year to be archived and then clicking on the "Archive as Level = 2" button on the lower right of the screen. Clicking the "Reports" button located below the "Archive" button brings up another screen for selection of several reporting options. Currently only Level 2 and Level 3 archive dates are displayed with this option despite the fact that buttons for Level 1 and Level 1x are included on the screen. To display a report select the desired site(s), pick the date range and select the "All Levels" option and click "Do Report". Figure 81 shows a report for site CND125.

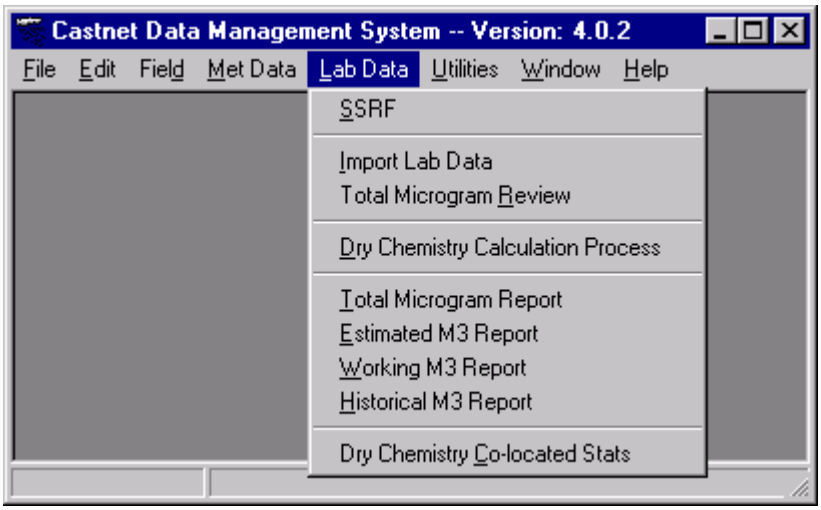
**Figure 81**



## 6.5 Lab Data Menu

Figure 82 shows the menu structure listed under the "Lab Data" top level menu option.

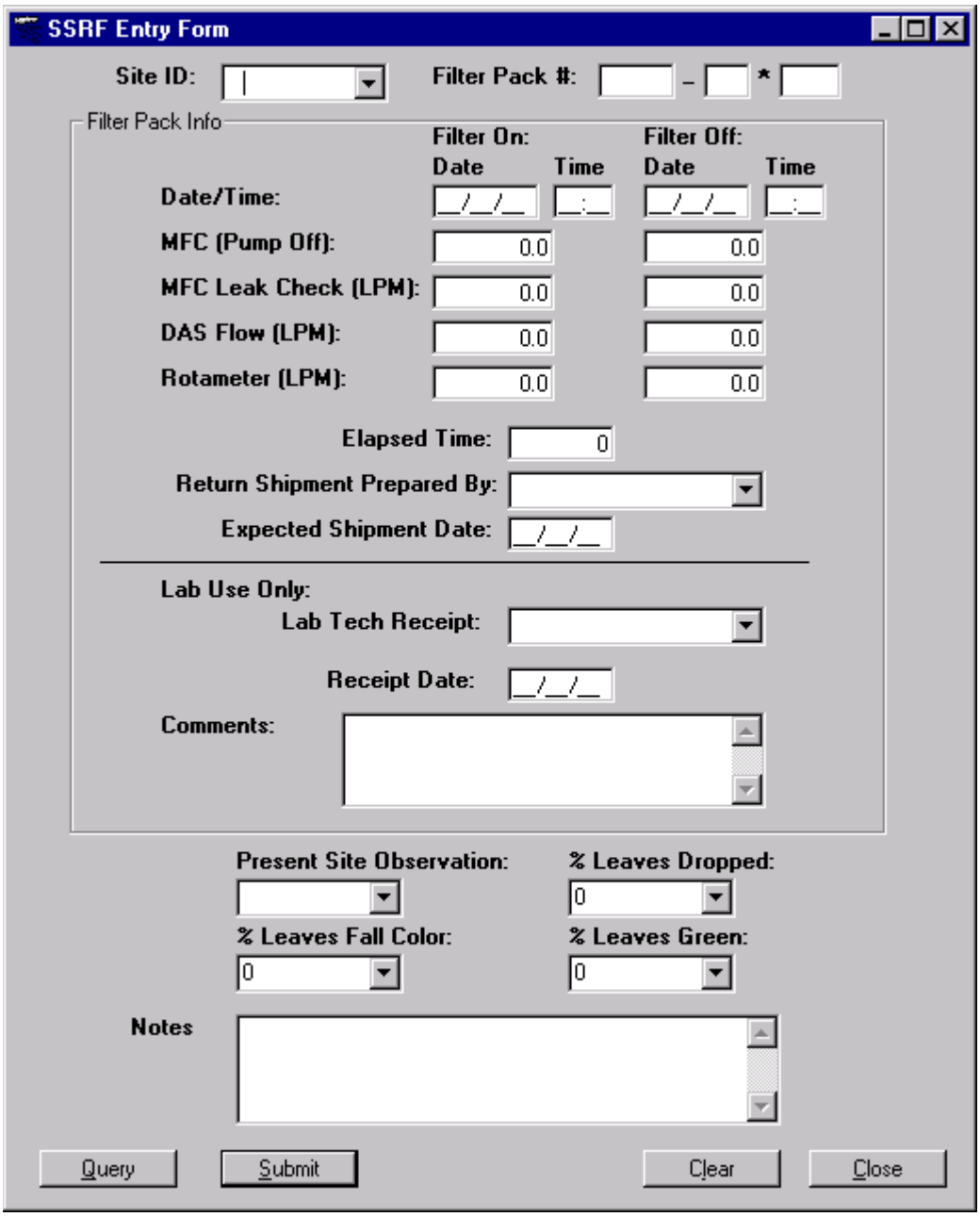
**Figure 82**




### 6.5.1 SSRF

Authorized personnel may enter data into a Site Status Report Form (SSRF) by selecting the "Lab Data / SSRF" menu option to display the "SSRF Entry Form" screen (Figure 83). Use the information recorded on the hard copy SSRF shipped from the site for entry into the electronic form. Begin by selecting a site from the "Site ID" combo box, and then use the tab key to move across fields. When the form is complete, click the "Submit" button or press the "Enter" key. The record will be added to the FILTER_PACK and LEAF_STATUS tables in the castnet database, and SSRF entry form fields will be cleared.

**Figure 83**



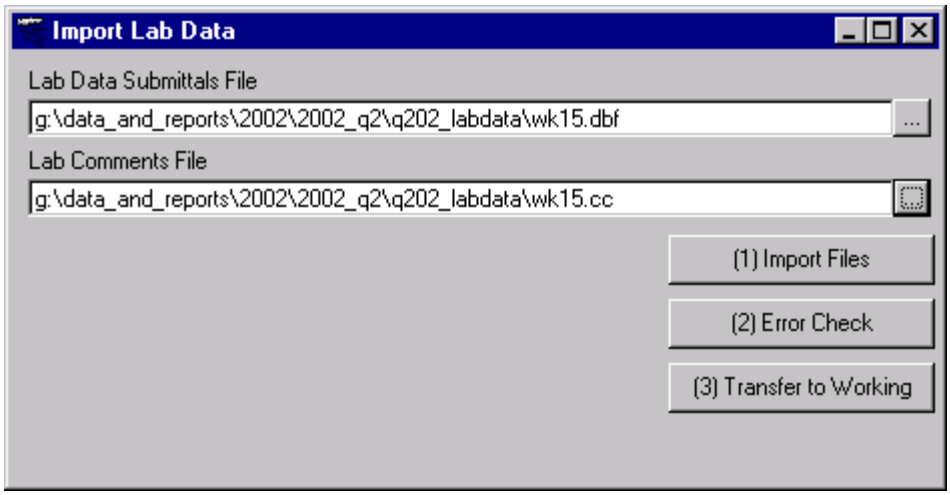

To edit a record after it has been submitted, type in the site and filter pack number. Click the "Query" button. The record, as it was entered, is displayed. After edits are made, click the "Update" button at the bottom of the form to update the record. The "Update" button does not appear on the form unless the user queries an existing record. Only authorized users may update SSRF records. Other users may use the "Query" button to view a record of choice.

To clear all fields on the form, click the "Clear" button at the bottom of the form. This feature can be used if there is a large amount of information to edit and the user would prefer to start over. To close the form, click the "Close" button located at the bottom of the form.

### 6.5.2 Import Lab Data

"Lab Data" records are submitted to the DMC weekly as a DBF database file (*.dbf) and a comment codes text file (*.cc) by CASTNET Laboratory Operations. To import the records into the LABDATA and LAB_COMMENTS tables (which are in the castnet_working database), select "Import Lab Data" from the "Lab Data" menu option (Figure 74) and the following form is displayed (Figure 84).

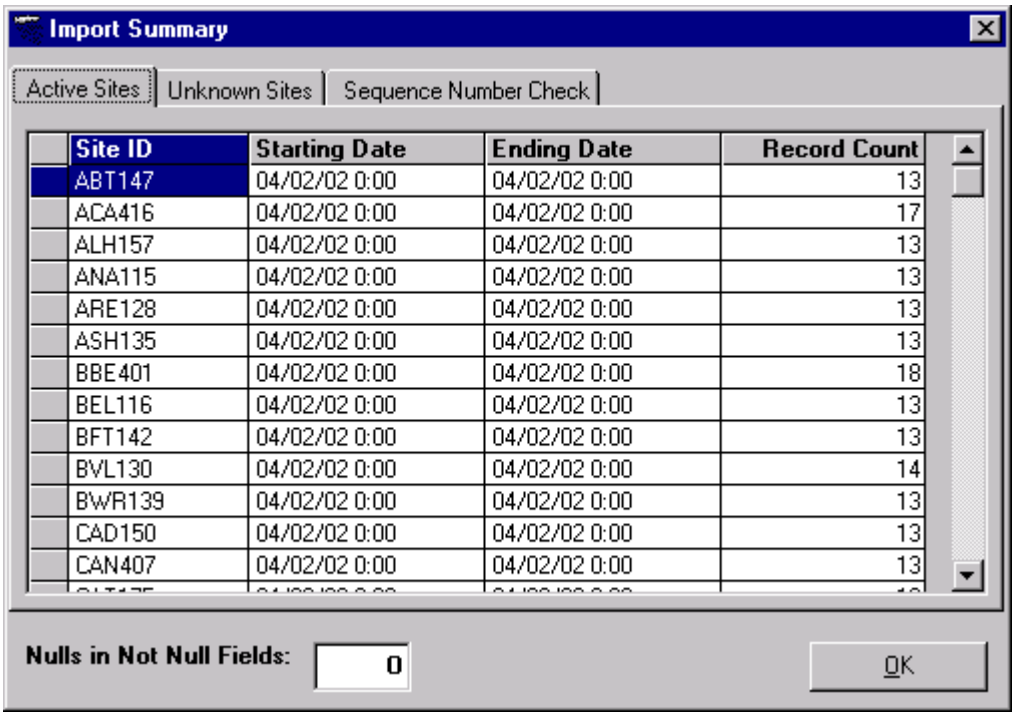
**Figure 84**




Click the button next to each text box and browse to specify the fully defined path and file name for the appropriate *.dbf and *.cc files. DBF filenames must be shorter than eight characters and therefore, in some cases, the file will need to be renamed for import. Once the fully defined path and file name for the files are listed in the text boxes, click the "(1) Import Files" button to import data and comments into staging tables. The application will provide a message indicating the number of records and comments imported.

Click the "(2) Error Check" button to screen the data being imported. Information will be provided concerning records with unknown Site IDs, incorrect the lab sequence numbers, and nulls in "Not Null" fields. Figure 85 shows the results of the error check process.

**Figure 85**

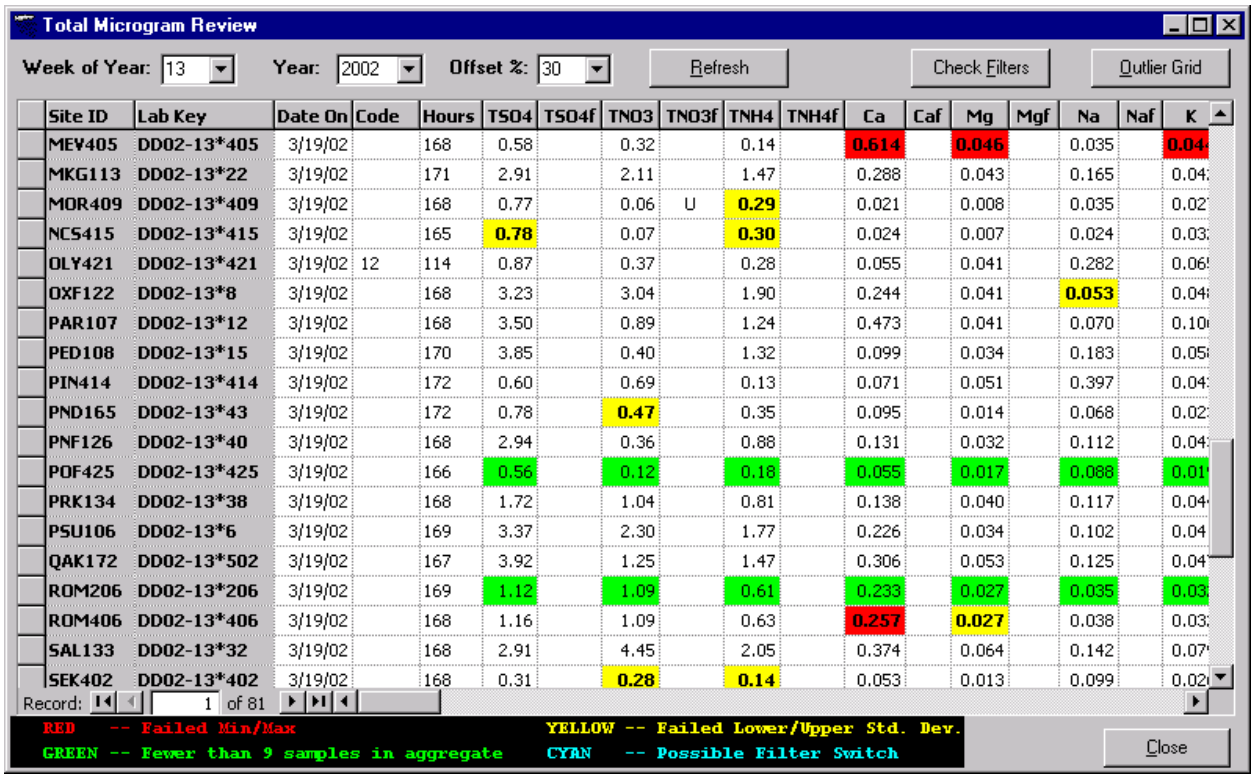



After the results of the error check have been reviewed and any problems have been resolved with the Laboratory Operations Manager (LOM), click the "(3) Transfer to Working" button to import the data (Figure 84). The application will produce a message to indicate a successful transfer. Otherwise, the application will produce error messages describing the problem (e.g., duplicate records between the submittal and the historical table).

### 6.5.3 Total Microgram Review

The "Total Microgram Review" tool was designed to permit early screening of laboratory records. Ideally it should be used immediately after import of the Lab Data files (see Section 6.5.2). To open the utility, select the "Total Microgram Review" menu option listed under the "Lab Data" menu (Figure 82). To load data into the grid, select a week to view from the "Week of Year" combo box, the year from the "Year" combo box, and, if desired, a different percent offset from the "Offset %" combo box (the default is 30%). Figure 86 shows the grid after the data have been loaded.

**Figure 86**




| Site ID | Lab Key | Date On | Code | Hours | TSO4 | TSO4f | TNO3 | TNO3f | TNH4 | TNH4f | Ca | Caf | Mg | Mgf | Na | Naf | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MEV405 | DD02-13*405 | 3/19/02 | | 168 | 0.58 | | 0.32 | | 0.14 | | 0.614 | | 0.046 | | 0.035 | | 0.04 |
| MKG113 | DD02-13*22 | 3/19/02 | | 171 | 2.91 | | 2.11 | | 1.47 | | 0.288 | | 0.043 | | 0.165 | | 0.04 |
| MOR409 | DD02-13*409 | 3/19/02 | | 168 | 0.77 | | 0.06 | U | 0.29 | | 0.021 | | 0.008 | | 0.035 | | 0.02 |
| NC5415 | DD02-13*415 | 3/19/02 | | 165 | 0.78 | | 0.07 | | 0.30 | | 0.024 | | 0.007 | | 0.024 | | 0.03 |
| OLY421 | DD02-13*421 | 3/19/02 | 12 | 114 | 0.87 | | 0.37 | | 0.28 | | 0.055 | | 0.041 | | 0.282 | | 0.06 |
| OXF122 | DD02-13*8 | 3/19/02 | | 168 | 3.23 | | 3.04 | | 1.90 | | 0.244 | | 0.041 | | 0.053 | | 0.04 |
| PAR107 | DD02-13*12 | 3/19/02 | | 168 | 3.50 | | 0.89 | | 1.24 | | 0.473 | | 0.041 | | 0.070 | | 0.10 |
| PED108 | DD02-13*15 | 3/19/02 | | 170 | 3.85 | | 0.40 | | 1.32 | | 0.099 | | 0.034 | | 0.183 | | 0.05 |
| PIN414 | DD02-13*414 | 3/19/02 | | 172 | 0.60 | | 0.69 | | 0.13 | | 0.071 | | 0.051 | | 0.397 | | 0.04 |
| PND165 | DD02-13*43 | 3/19/02 | | 172 | 0.78 | | 0.47 | | 0.35 | | 0.095 | | 0.014 | | 0.068 | | 0.02 |
| PNF126 | DD02-13*40 | 3/19/02 | | 168 | 2.94 | | 0.36 | | 0.88 | | 0.131 | | 0.032 | | 0.112 | | 0.04 |
| POF425 | DD02-13*425 | 3/19/02 | | 166 | 0.56 | | 0.12 | | 0.18 | | 0.055 | | 0.017 | | 0.088 | | 0.01 |
| PRK134 | DD02-13*38 | 3/19/02 | | 168 | 1.72 | | 1.04 | | 0.81 | | 0.138 | | 0.040 | | 0.117 | | 0.04 |
| PSU106 | DD02-13*6 | 3/19/02 | | 169 | 3.37 | | 2.30 | | 1.77 | | 0.226 | | 0.034 | | 0.102 | | 0.04 |
| QAK172 | DD02-13*502 | 3/19/02 | | 167 | 3.92 | | 1.25 | | 1.47 | | 0.306 | | 0.053 | | 0.125 | | 0.04 |
| ROM206 | DD02-13*206 | 3/19/02 | | 169 | 1.12 | | 1.09 | | 0.61 | | 0.233 | | 0.027 | | 0.035 | | 0.03 |
| ROM406 | DD02-13*406 | 3/19/02 | | 168 | 1.16 | | 1.09 | | 0.63 | | 0.257 | | 0.027 | | 0.038 | | 0.03 |
| SAL133 | DD02-13*32 | 3/19/02 | | 168 | 2.91 | | 4.45 | | 2.05 | | 0.374 | | 0.064 | | 0.142 | | 0.07 |
| SEK402 | DD02-13*402 | 3/19/02 | | 168 | 0.31 | | 0.28 | | 0.14 | | 0.053 | | 0.013 | | 0.099 | | 0.02 |

When the grid is loaded, the data are automatically screened using four different criteria. Data that do not meet the screening criteria are displayed with shaded grid cells. The color of the shaded grid cell is linked to the specific criterion failed during screening:

- Red – Data are screened against historical minimum and maximum monthly values for the site and analyte.
- Yellow – Data are screened against mean ± a specified number of standard deviations aggregated from historical values.
- Green – Fewer than nine samples in the aggregate are used for comparisons.
- Cyan – Possible filter switch suspected based on comparison of Teflon and nylon filter $SO_4^{2-}$ values (the Teflon value should always be greater than the nylon value).

The percent offset is used to widen the screening range in order to decrease the number of records coded as outliers. For screening the minimum and maximum and the mean ± the specified number of standard deviations, the upper and lower bounds are expanded by the percent offset. For example, if the maximum historical value for calcium (Ca) at MEV405 during Sample Week 13 is 0.28, using an offset of 30% screens values in the grid with a maximum historical value of 0.36 [0.28 + (0.28 * 30%)]. Therefore, in Figure 86, the calcium value for Week 13 of 2002 for MEV405 fails this criterion. If the percent offset is increased or decreased, the "Refresh" button can be used to re-screen the values and to re-load the grid.

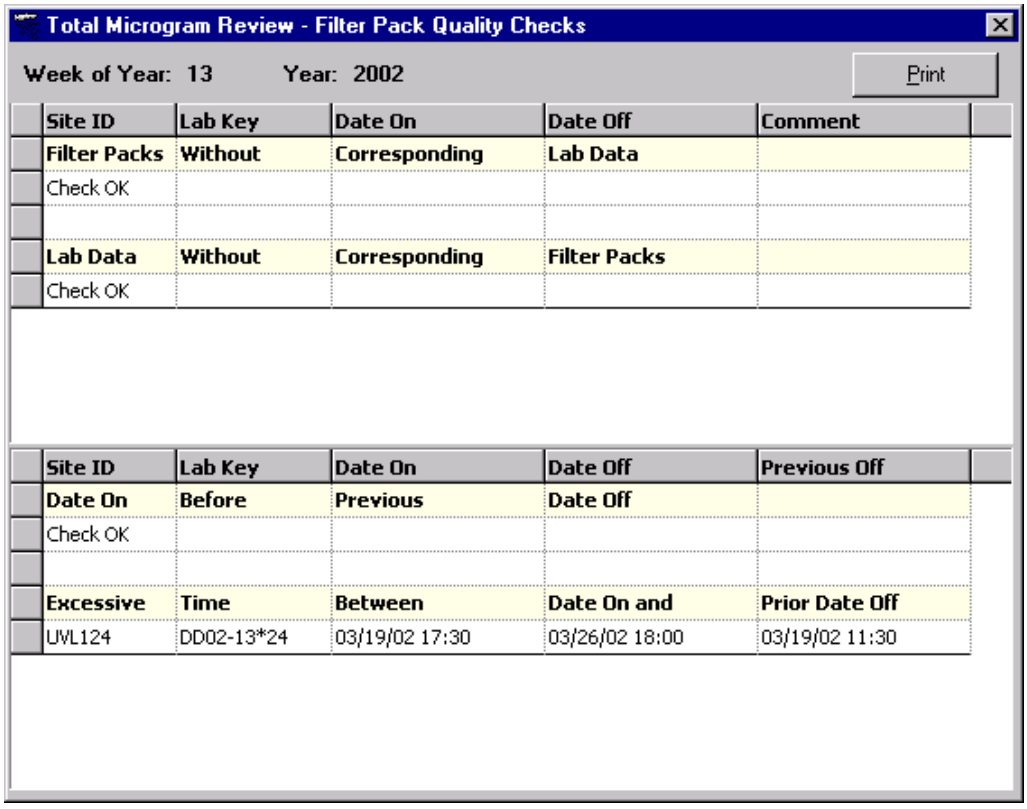
Data displayed in the grid are estimated atmospheric concentrations in micrograms per cubic meter ($\mu g/m^3$) calculated from the total microgram values, an assumed hourly flow rate for each site, and the number of hours the filter was installed. Historical values used for the screening come from the DRYCHEM_SUMMARY table in the castnet database. Aggregates are updated quarterly.

The number of standard deviations used to screen a specific value is determined based on a comparison of the mean to the standard deviation. If the standard deviation is less than or equal to one-third of the mean, use the mean ± 3 times the standard deviation. If the standard deviation is between one-third and one-half of the mean, use the mean ± 2 times the standard deviation. Finally, if the standard deviation is greater than one-half of the mean, use the mean ± the standard deviation.

Clicking the "Check Filters" button (Figure 86) runs a series of checks on the data displayed in the grid. Results are shown in a separate grid (Figure 87). The checks are as follows:

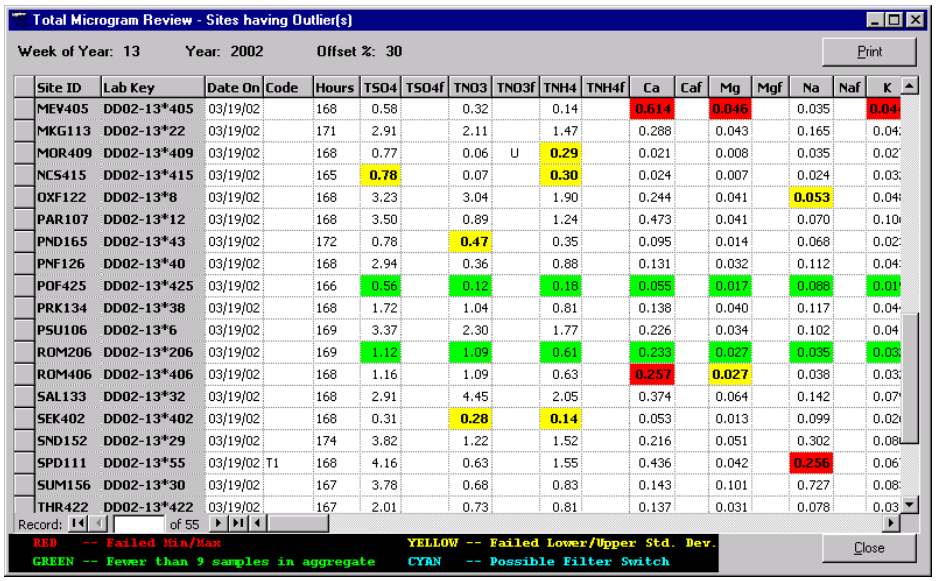
- Filter Pack Lab Keys without matching Lab Data Lab Keys for the given week
- Lab Data Lab Keys without matching Filter Pack Lab Keys for the given week
- Date on < Previous Date off for the given week
- Lab Key not matching correct Lab Sequence number
- Excessive time (> 2 hours) between Date On and previous Date Off for the given week

**Figure 87**



To extract all records that fail the screening process, click the "Outlier Grid" button (Figure 78) and a new "Sites having Outlier(s)" form is displayed (Figure 88).

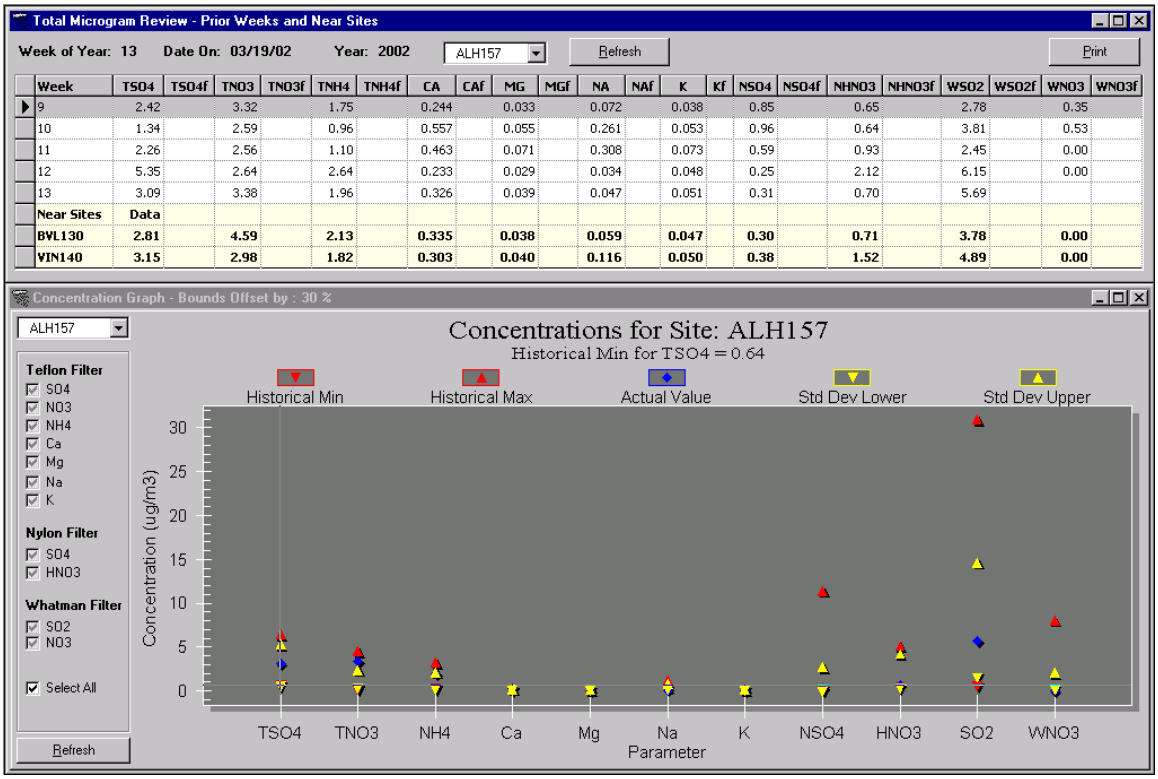
**Figure 88**




| Site ID | Lab Key | Date On | Code | Hours | TSO4 | TSO4f | TNO3 | TNO3f | TNH4 | TNH4f | Ca | Caf | Mg | Mgf | Na | Naf | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MEV405 | DD02-13*405 | 03/19/02 | | 168 | 0.58 | | 0.32 | | 0.14 | | 0.614 | | 0.046 | | 0.035 | | 0.04 |
| MKG113 | DD02-13*22 | 03/19/02 | | 171 | 2.91 | | 2.11 | | 1.47 | | 0.288 | | 0.043 | | 0.165 | | 0.04 |
| MOR409 | DD02-13*409 | 03/19/02 | | 168 | 0.77 | | 0.06 | U | 0.29 | | 0.021 | | 0.008 | | 0.035 | | 0.02 |
| NCS415 | DD02-13*415 | 03/19/02 | | 165 | 0.78 | | 0.07 | | 0.30 | | 0.024 | | 0.007 | | 0.024 | | 0.03 |
| OXF122 | DD02-13*8 | 03/19/02 | | 168 | 3.23 | | 3.04 | | 1.90 | | 0.244 | | 0.041 | | 0.053 | | 0.04 |
| PAR107 | DD02-13*12 | 03/19/02 | | 168 | 3.50 | | 0.89 | | 1.24 | | 0.473 | | 0.041 | | 0.070 | | 0.10 |
| PND165 | DD02-13*43 | 03/19/02 | | 172 | 0.78 | | 0.47 | | 0.35 | | 0.095 | | 0.014 | | 0.068 | | 0.02 |
| PNF126 | DD02-13*40 | 03/19/02 | | 168 | 2.94 | | 0.36 | | 0.88 | | 0.131 | | 0.032 | | 0.112 | | 0.04 |
| POF425 | DD02-13*425 | 03/19/02 | | 166 | 0.56 | | 0.12 | | 0.18 | | 0.055 | | 0.017 | | 0.088 | | 0.01 |
| PRK134 | DD02-13*38 | 03/19/02 | | 168 | 1.72 | | 1.04 | | 0.81 | | 0.138 | | 0.040 | | 0.117 | | 0.04 |
| PSU106 | DD02-13*6 | 03/19/02 | | 169 | 3.37 | | 2.30 | | 1.77 | | 0.226 | | 0.034 | | 0.102 | | 0.04 |
| ROM206 | DD02-13*206 | 03/19/02 | | 169 | 1.12 | | 1.09 | | 0.61 | | 0.233 | | 0.027 | | 0.035 | | 0.03 |
| ROM406 | DD02-13*406 | 03/19/02 | | 168 | 1.16 | | 1.09 | | 0.63 | | 0.257 | | 0.027 | | 0.038 | | 0.03 |
| SAL133 | DD02-13*32 | 03/19/02 | | 168 | 2.91 | | 4.45 | | 2.05 | | 0.374 | | 0.064 | | 0.142 | | 0.07 |
| SEK402 | DD02-13*402 | 03/19/02 | | 168 | 0.31 | | 0.28 | | 0.14 | | 0.053 | | 0.013 | | 0.099 | | 0.02 |
| SND152 | DD02-13*29 | 03/19/02 | | 174 | 3.82 | | 1.22 | | 1.52 | | 0.216 | | 0.051 | | 0.302 | | 0.08 |
| SPD111 | DD02-13*55 | 03/19/02 | T1 | 168 | 4.16 | | 0.63 | | 1.55 | | 0.436 | | 0.042 | | 0.256 | | 0.06 |
| SUM156 | DD02-13*30 | 03/19/02 | | 167 | 3.78 | | 0.68 | | 0.83 | | 0.143 | | 0.101 | | 0.727 | | 0.08 |
| THR422 | DD02-13*422 | 03/19/02 | | 167 | 2.01 | | 0.73 | | 0.81 | | 0.137 | | 0.031 | | 0.078 | | 0.03 |

Click the "Print" button in the upper right corner of this grid to create a hardcopy report of the samples with possible problems that need attention. Double clicking a row displays the "Prior Weeks and Near Sites" grid and the "Concentration Graph," (Figure 89).

**Figure 89**




The “Prior Weeks” section of the grid displays sample values from the past four weeks. The “Near Sites” section of the grid displays sample values from sites that are near to the site being researched for comparison with the current values. The “Concentration Graph” section displays the concentrations and screening values as a scatter plot. The “Teflon Filter,” “Nylon Filter,” and “Whatman Filter” lists of analytes located on the left side of the graph allow the user to select which analytes from which filters are displayed on the graph. Analytes are removed or added by clicking the appropriate boxes. By clicking the “Refresh” button after removing or adding analyte(s), the y-axis will automatically rescale. To view the value associated with a particular point, click on the point or use the arrow keys to move the crosshairs to the point of interest. The value is displayed at the top of the graph under the “Concentrations for Site” title.

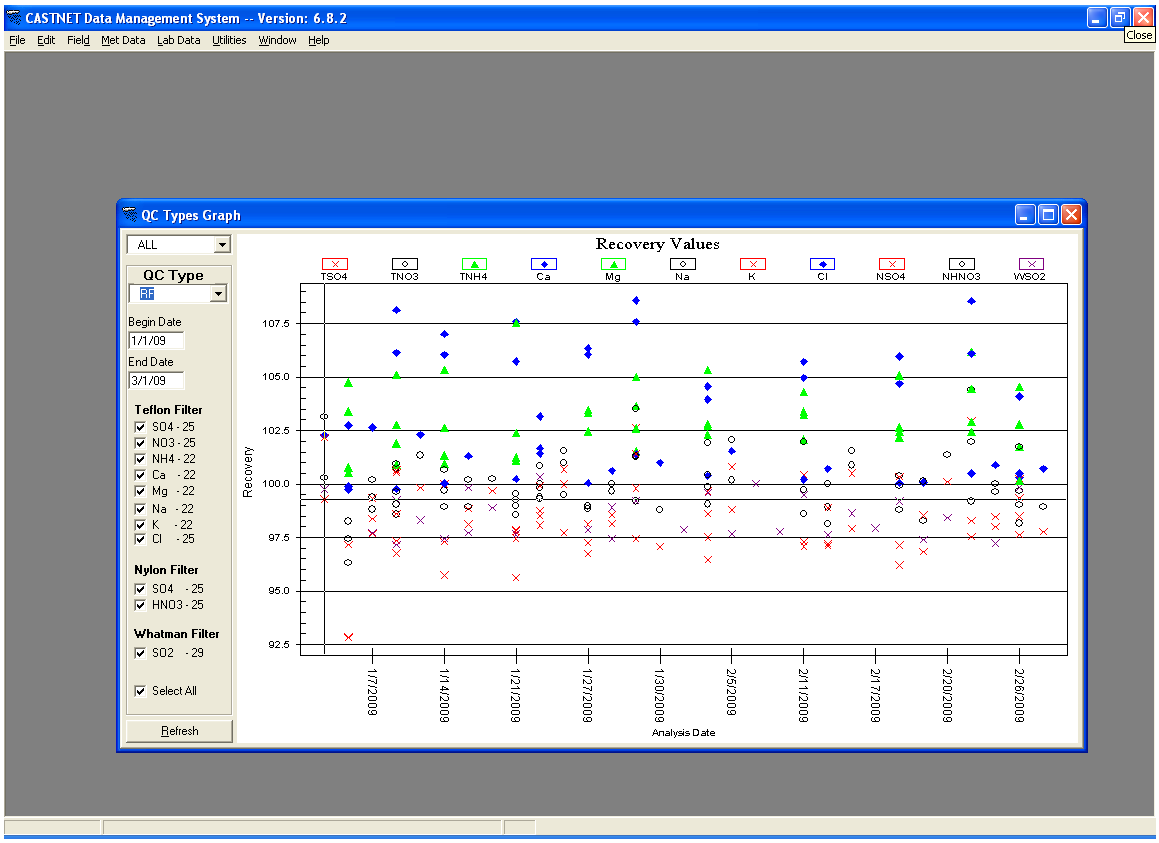
To change sites, select a different site from the combo box at the top left corner of the form and click the “Refresh” button. The “Prior Weeks and Near Sites” grids and the “Concentration Graph” will be updated with data for the selected site.

The “Prior Weeks and Near Sites” grid can be printed by clicking on the “Print” button located at the upper right corner of the grid. The “Concentration Graph” cannot be printed.

### 6.5.4 QC Type Analysis

The "QC Type Analysis" function, accessed by selecting the "Lab Data / QC Type Analysis" menu option, displays the results for all the laboratory QC samples for all sites and time periods for analytes of interest. Even though there is the option to select one or several sites instead of all sites, this function only works when all sites are selected, except for the "RP" QC type which can be selected for individual sites. The QC type can be selected by choosing the QC sample of interest in the QC sample selection box and by specifying the start and times as well as the analytes of interest. Figure 90 below shows an example of a graph for RF samples for the first quarter of 2009 for all analytes.

**Figure 90**

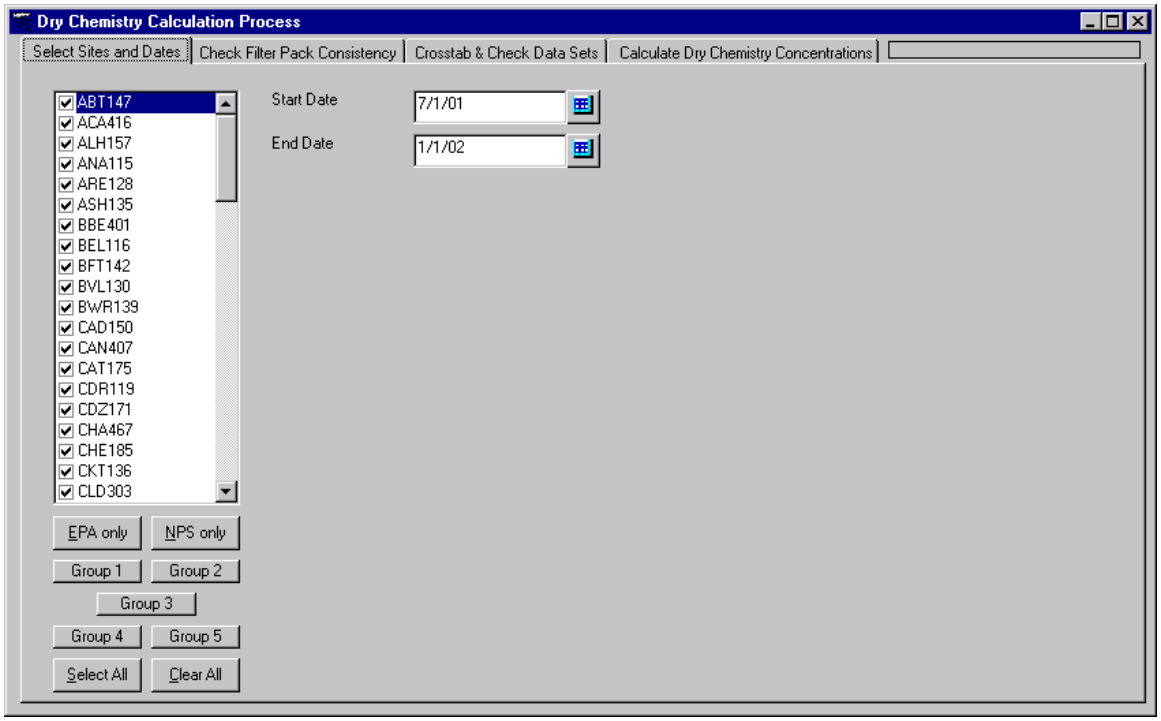



### 6.5.5 Dry Chemistry Calculation Process

The "Dry Chemistry Calculation Process" utility, accessed by selecting the "Lab Data / Dry Chemistry Calculation Process" menu option (Figure 82), calculates atmospheric concentrations by combining total microgram values, laboratory comments, and hourly flow rates. For a detailed description of the calculation, see Section 5.0, the Data Validation and Usability section, of the CASTNET QAPP (AMEC, 2011).

The calculation process is set up as a series of tabs on the "Dry Chemistry Calculation Process" form. The first tab, "Select Sites and Dates" is shown in Figure 91.

**Figure 91**

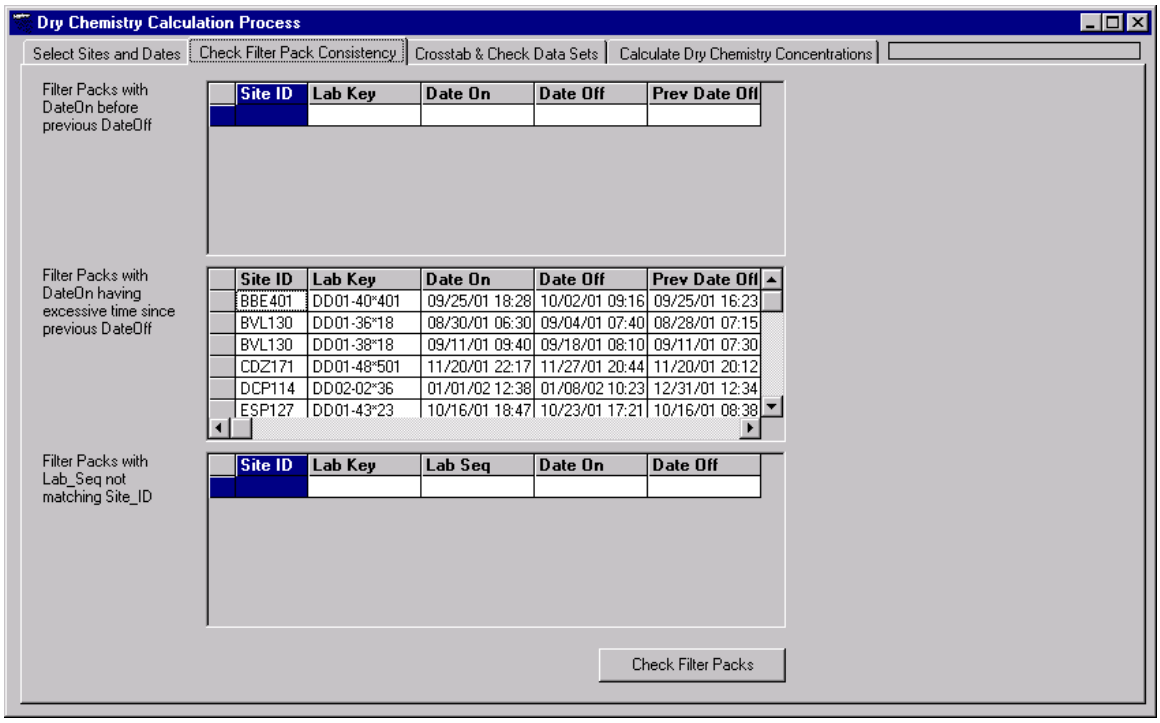



Select the sites individually or use the buttons below the Site ID list to select specific groups of sites or all sites. Enter a start and end date in the "Start Date" and "End Date" boxes or use the calendar button to the right of the boxes to select a date. The hour 00:00 is assumed for the start date, and the hour 23:00 is assumed for the end date. Users must take care when selecting the start and end dates in order to produce the specific records of interest since the date range selected is compared to the Date On value for each sample.

The second tab, "Check Filter Pack Consistency," is shown in Figure 92. Click the "Check Filter Packs" button to screen all selected records for:

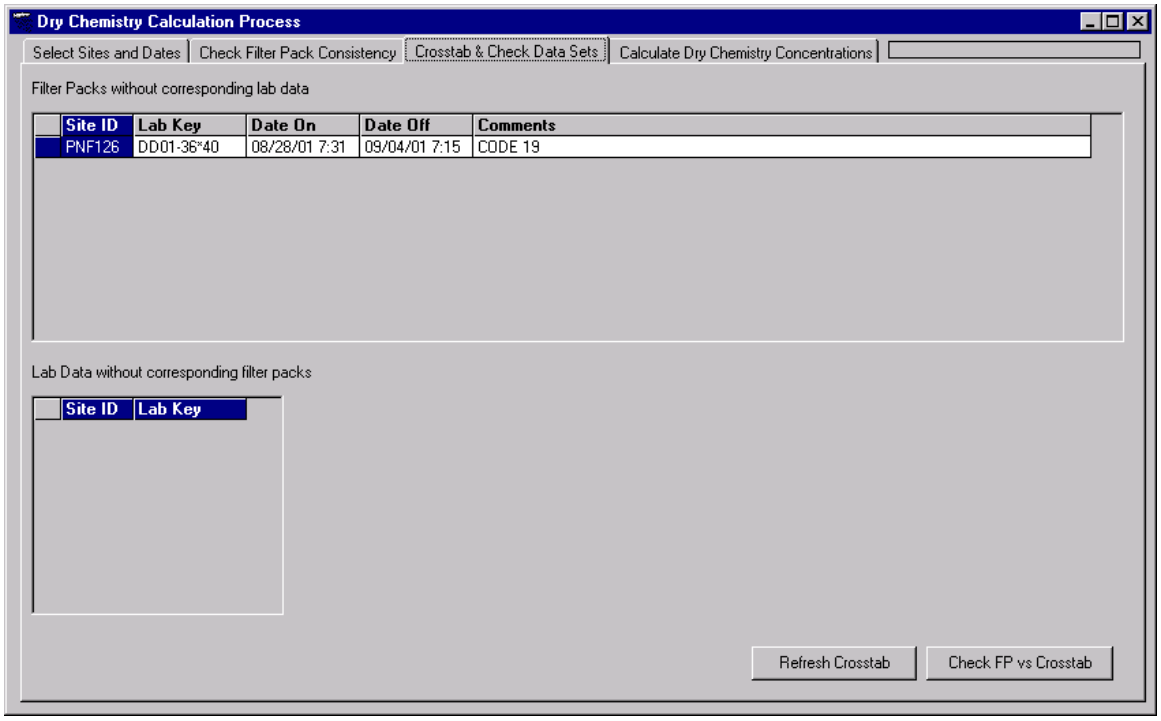
- Date On < previous Date Off for the sample
- Excessive time (> 2 hours) between Date On and previous Date Off for the sample
- Lab Keys that do not match correct Lab Sequence numbers

**Figure 92**



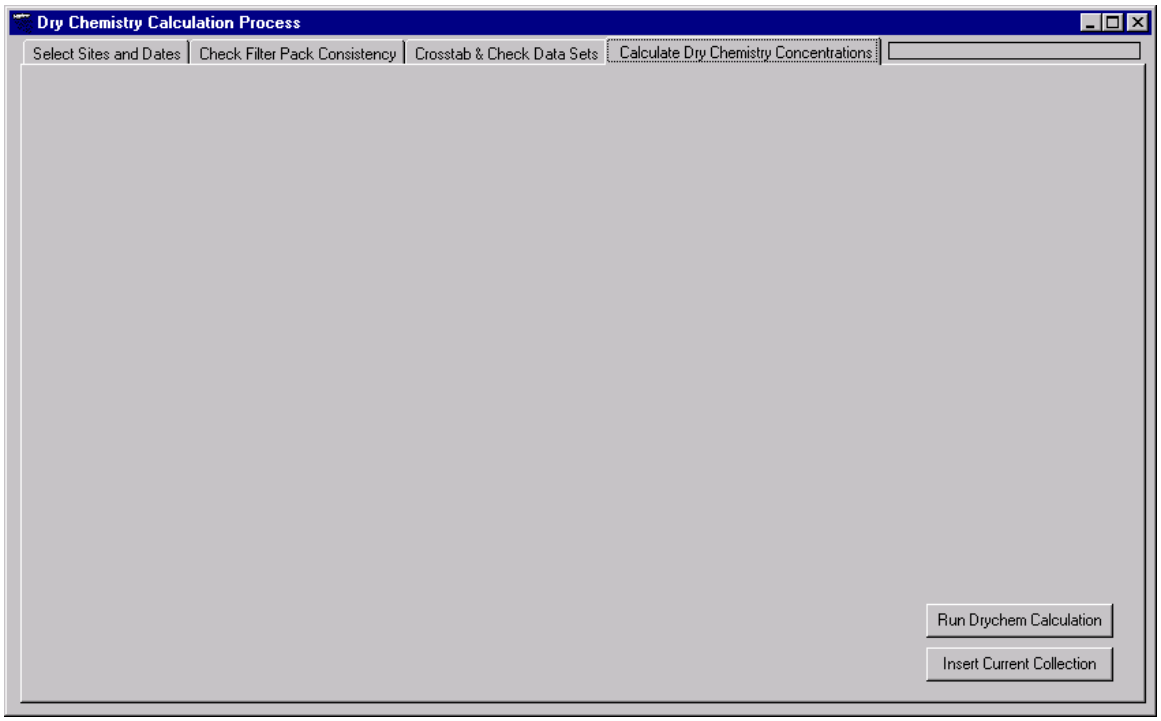

The third tab, "Crosstab & Check Data Sets," is shown in Figure 93. Click the "Refresh Crosstab" button to cross tabulate the laboratory data in preparation for combining it with the flow volume. The "Check FP vs Crosstab" button indicates samples that have filter pack information without matching "lab data," or samples that have "lab data" without matching filter pack information.

**Figure 93**




The fourth tab, "Calculate Dry Chemistry Concentrations," is shown in Figure 94. Click the "Run Drychem Calculation" button to initiate the calculation process. Existing temporary atmospheric concentration records are deleted before the new records are inserted into the working table (DRYCHEM_TEMP in castnet_working). The "Insert Current Collection" button inserts all calculated records from the working table into the historical table (DRYCHEM in castnet).

**Figure 94**




### 6.5.6 Atmospheric Concentration Reports

Six different atmospheric concentration reports are available as options under the "Lab Data" menu (Figure 82). They are as follows:

- Total Microgram Report – Displays total mass per filter results for analytical parameters for each filter type
- Estimated M3 Report – Calculates estimated atmospheric concentrations using assumed flow rates
- Working M3 Report – Displays atmospheric concentrations based on actual flow for standard or local conditions
- Historical M3 Report – Displays archived atmospheric concentrations for standard or local conditions

Because operation of each of the four reports is essentially the same, only the "Working M3 Report" menu option will be described in this section.

Select the "Working M3 Report" menu option to display the "CASTNET Dry Deposition Chem Mass Report" form shown in Figure 95. Select the sites individually or use the buttons below the Site ID list to select specific groups of sites or all sites. The date range for the report is set by quarter or month (e.g., fourth quarter) and year. Records are accessed based on the sample week

numbers associated with the selected quarter. Table 3 lists the sample week number ranges and associated quarters.

**Figure 95**

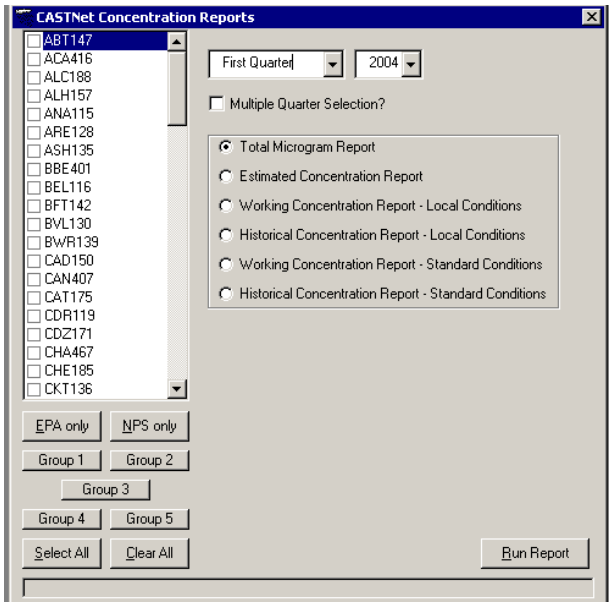
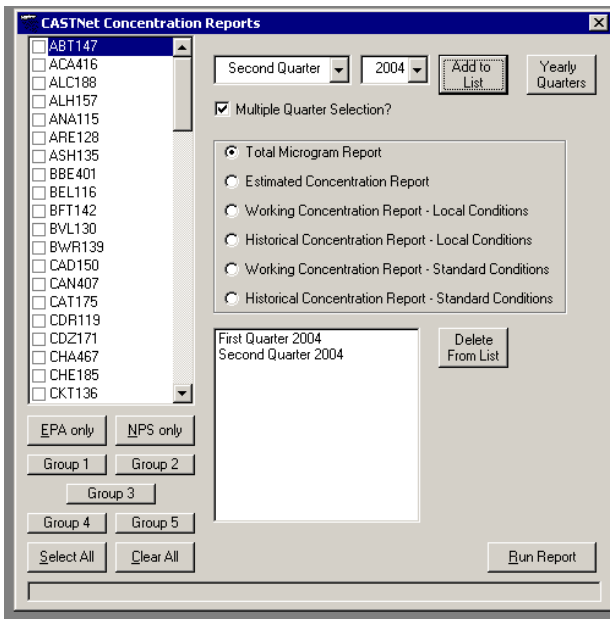



**Table 3**

| Sample Week Numbers | Associated Quarter |
|---|---|
| 1 – 13 | First Quarter |
| 14 – 26 | Second Quarter |
| 27 – 39 | Third Quarter |
| 40 – 52 | Fourth Quarter |

If only one quarter is desired, select the quarter and year from the combo boxes at the top of the form. If the desired time range consists of more than one quarter, click on the "Multiple Quarter Selection" box for a list box to be added to the form (Figure 96).

**Figure 96**




To select multiple quarters, choose a quarter and year using the appropriate combo boxes. Click the "Add to List" button. The selected quarter and year will then appear in the list box window. Continue this process until all desired quarters and years are selected. The "Yearly Quarters" button will automatically select all four quarters for a given year. Selected quarters can be deleted from the report by highlighting the desired quarter and clicking the "Delete From List" button. Once all sections have been completed, click the "Run Report" button to create the report.

An example of the Working M3 report is presented below (Figure 97). To print the report, click the printer icon (not shown).

**Figure 97**

**CASTNet Dry Deposition Concentration Report**

**Fourth Quarter 2001**

5/15/02

**Site Id:** ABT147

| | | | Teflon | | | | | | | Nylon | | Whatman | | | Flow | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Filter Pack Id | On Date/Time | Off Date/Time | SO4 ug/m3 | NO3 ug/m3 | NH4 ug/m3 | Ca ug/m3 | Mg ug/m3 | Na ug/m3 | K ug/m3 | SO4 ug/m3 | HNO3 ug/m3 | SO2 ug/m3 | NO3 ug/m3 | Comment Code | Valid Hours | Volume m3 |
| DD01-40*82 | 09/25/01 08:07 | 10/02/01 08:59 | 2.03 | 0.62 | 0.69 | 0.071 | 0.047 | 0.439 | 0.055 | 0.27 | 1.14 | 2.68 | 0.61 | 1X | 168 | 15.10 |
| DD01-41*82 | 10/02/01 09:31 | 10/09/01 07:15 | 5.15 | 1.17 | 1.81 | 0.296 | 0.065 | 0.249 | 0.084 | 0.34 | 3.17 | 4.55 | 0.76 | 1X | 166 | 14.91 |
| DD01-42*82 | 10/09/01 07:27 | 10/16/01 12:07 | 3.17 | 0.29 | 0.99 | 0.092 | 0.039 | 0.234 | 0.043 | 0.41 | 4.00 | 2.89 | 0.84 | 1X | 171 | 15.36 |
| DD01-43*82 | 10/16/01 12:20 | 10/23/01 06:58 | 2.53 | 0.73 | 0.89 | 0.121 | 0.042 | 0.234 | 0.053 | 0.39 | 2.73 | 4.32 | 0.62 | 1X | 162 | 14.56 |
| DD01-44*82 | 10/23/01 07:00 | 10/30/01 08:33 | 2.48 | 0.43 | 0.80 | 0.118 | 0.042 | 0.337 | 0.036 | 0.24 | 1.87 | 4.38 | 0.42 | 1X | 170 | 15.27 |
| DD01-45*82 | 10/30/01 08:33 | 11/06/01 09:16 | 2.19 | 1.91 | 0.84 | 0.135 | 0.078 | 0.613 | 0.052 | 0.36 | 0.93 | 2.83 | 0.49 | 1X | 169 | 15.18 |
| DD01-46*82 | 11/06/01 09:26 | 11/13/01 08:33 | 1.52 | 0.89 | 0.67 | 0.134 | 0.033 | 0.096 | 0.038 | 0.16 | 1.51 | 4.56 | 0.36 | 1X | 167 | 15.00 |
| DD01-47*82 | 11/13/01 08:35 | 11/20/01 07:46 | 3.75 | 4.01 | 2.18 | 0.223 | 0.096 | 0.631 | 0.086 | 0.25 | 2.44 | 13.65 | 1.39 | 1X | 167 | 15.00 |
| DD01-48*82 | 11/20/01 07:52 | 11/27/01 07:56 | 2.06 | 1.76 | 1.05 | 0.107 | 0.046 | 0.367 | 0.048 | 0.29 | 1.57 | 5.49 | 0.61 | 1X | 168 | 15.09 |
| DD01-49*82 | 11/27/01 08:09 | 12/04/01 08:16 | 3.34 | 1.28 | 1.33 | 0.069 | 0.043 | 0.300 | 0.046 | 0.33 | 1.64 | 3.64 | 0.60 | 1X | 168 | 15.09 |
| DD01-50*82 | 12/04/01 08:29 | 12/11/01 08:18 | 2.02 | 0.94 | 0.85 | 0.103 | 0.029 | 0.142 | 0.045 | 0.30 | 2.33 | 9.10 | 1.01 | 1X | 168 | 15.09 |
| DD01-51*82 | 12/11/01 08:29 | 12/18/01 07:31 | 2.14 | 1.40 | 1.00 | 0.045 | 0.040 | 0.356 | 0.051 | 0.39 | 0.83 | 3.80 | 0.57 | 1X | 167 | 15.00 |
| DD01-52*82 | 12/18/01 07:45 | 12/25/01 08:10 | 1.30 | 0.76 | 0.64 | 0.037 | 0.013 | 0.082 | 0.032 | 0.32 | 0.82 | 2.81 | 0.39 | 1X | 169 | 15.15 |
| **Filter Count:** | 13 | **Mean** | 2.59 | 1.24 | 1.06 | 0.119 | 0.047 | 0.314 | 0.051 | 0.31 | 1.92 | 4.98 | 0.67 | | | |
| | | **Std. Deviation** | 1.04 | 0.96 | 0.46 | 0.07 | 0.02 | 0.17 | 0.02 | 0.07 | 0.97 | 3.11 | 0.28 | | | |

Data Status Flags:
'L' less than 90% but greater than or equal to 75% of valid flow data
'I' invalid chemistry data
'U' value is less than detection limit
'M' missing or completely invalid flow data
'N' sample not analyzed
'R' re-run sample
'#' Both 'L' and 'U' status flags apply
'S' Both 'L' and 'R' status flags apply

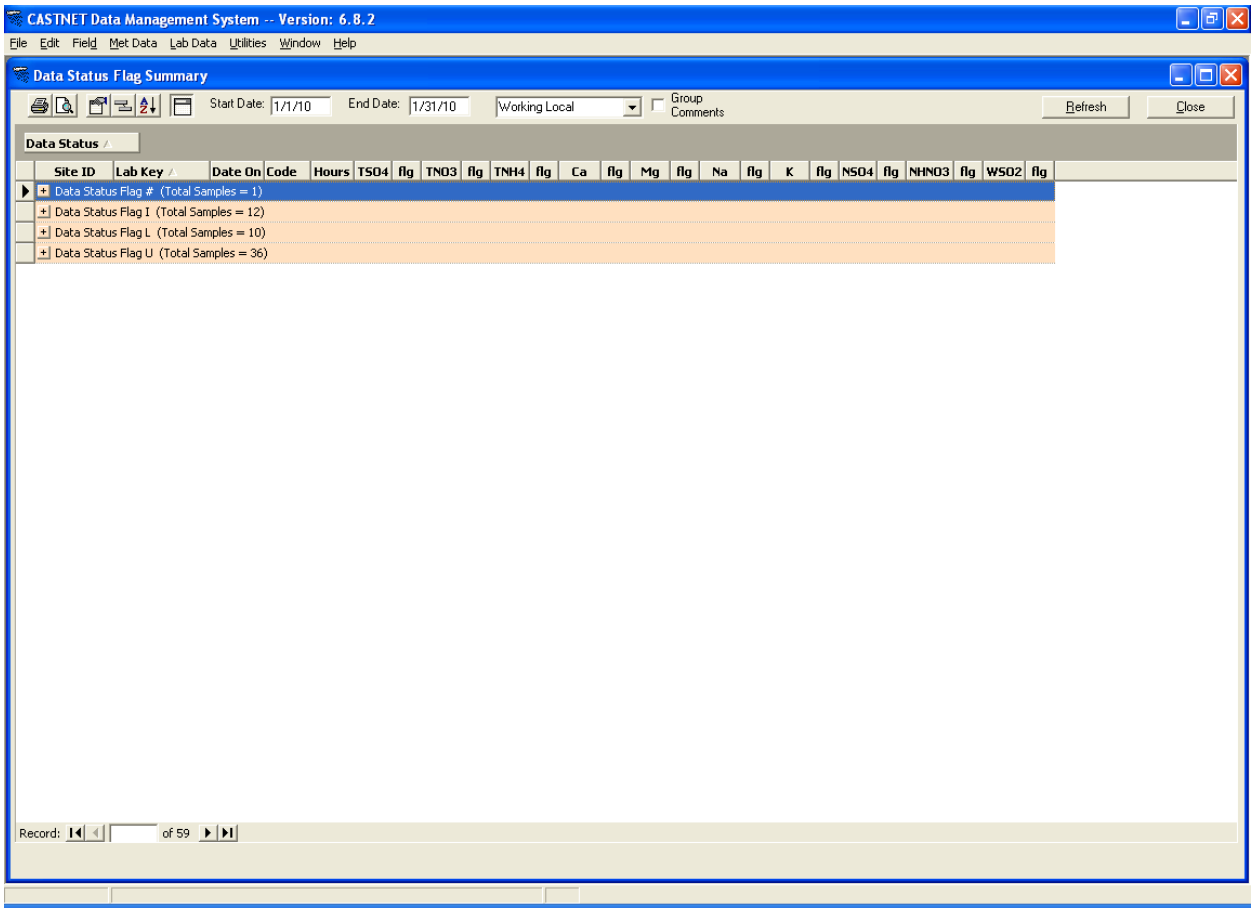
Comments Codes:
1 = unidentified debris/particles on filter
2 = torn; hole; ripped filter noted during unpacking
3 = excessively wet filter noted during unpacking
4 = excessively dirty filter noted during unpacking
5 = filter pack loose upon arrival, possible leakage during sample period
6 = apparent solenoid problem
7 = filter pack endcaps cracked/missing upon receipt
8 = outside of filter pack excessively dirty upon receipt
9 = support screen raised up, noted during unpacking
10 = insect inside filter pack; noted during unpacking
11 = laboratory accident
12 = filter pack on tower incorrect length of time
13 = filter pack not run in field
14 = unusual odor noticed during unpacking
15 = low extraction efficiency off filter
16 = on/off dates and times are assumed
17 = filter given to EPA for analysis
18 = field accident
19 = field equipment problem
20 = filter used for special study
21 = forest fire/agricultural activity in area
22 = site closed down
23 = SSRF not received with filter pack
24 = chain of custody incomplete or incorrect
25 = filter pack run on wrong week
26 = suspect value

Filter Type Abbreviation: T = Teflon; N = Nylon; W = Whatman

### 6.5.7 Data Status Flag Summary

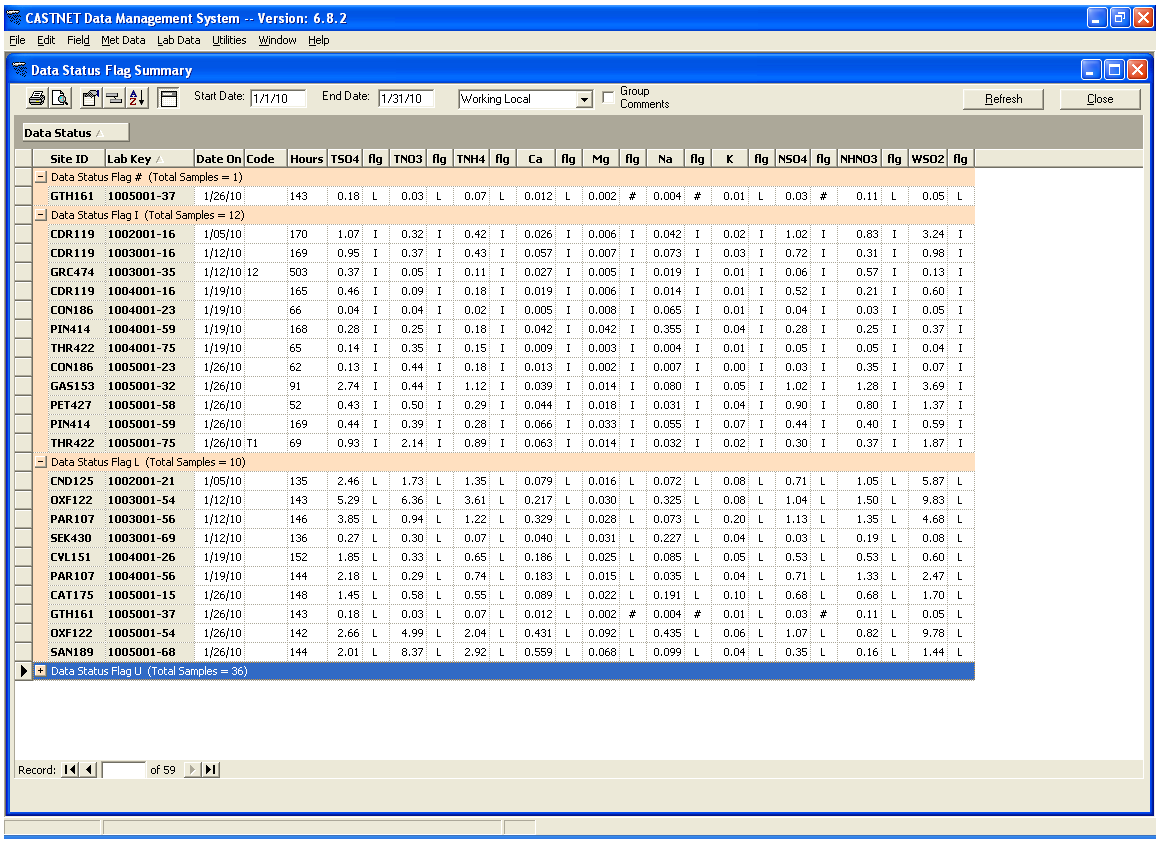
The "Data Status Flag Summary" function displays status flags such as "I", "L" or "U" for all samples analyzed within a selected date range. Status Flags can be displayed for six different types of data sets which can be selected by highlighting the desired data set on the drop down menu to the right of the "End Date" box. The results are displayed in summary form by clicking the "Refresh" box on the upper right of the screen (Figure 98).

**Figure 98**




Clicking the "+" box to the left of the "Data Status Flag" row brings up the detail screen where all the sites and sample ID's are listed for the specific type of flag. See Figure 99 below for an example.

**Figure 99**




### 6.5.8 Dry Chemistry Co-located Stats

The "Dry Chemistry Co-located Stats" utility calculates mean absolute relative percent difference (MARPD) values for the two pairs of collocated sites currently in operation. The MARPD values provide a measure of network precision and are included in quarterly and annual reports.

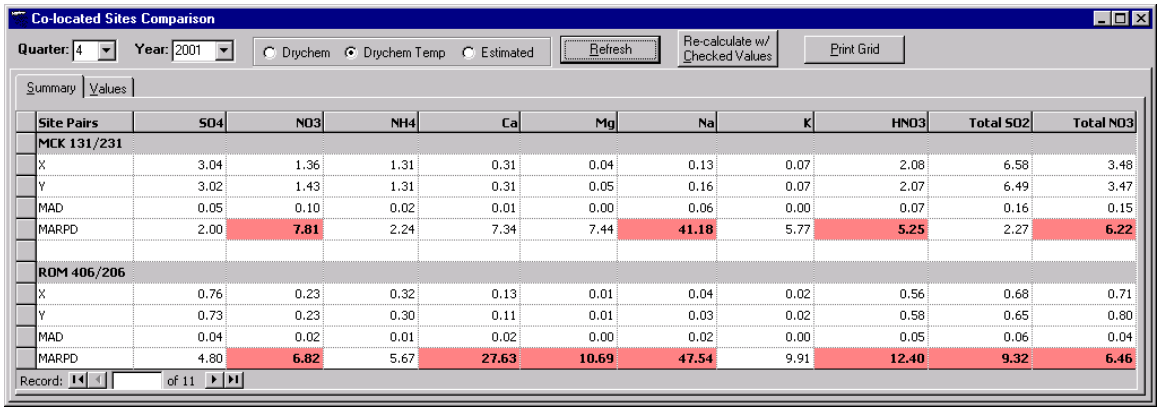
Select the "Dry Chemistry Co-located Stats" option from the "Lab Data" menu (Figure 82) to display the form shown in Figure 100. To load the grid with data, select the quarter and year from the combo boxes in the upper left corner of the form. The samples included with the selected quarter and year are determined by the sample week number associated with that quarter (Table 3). For example, sample weeks 40 through 52 are the sample weeks associated with fourth quarter. Select the appropriate radio button to indicate which data to use for the calculation. Data choices include:

- Drychem – historical atmospheric concentrations from the DRYCHEM table in the castnet database
- Drychem Temp – temporary atmospheric concentrations from the DRYCHEM_TEMP table in the castnet_working database

- Estimated – estimated atmospheric concentration values calculated using total microgram laboratory data in combination with assumed flow rates

Click the "Refresh" button to load the data into the grid. Values are automatically screened against the associated precision criteria for the analyte. For all analytes except ammonium (NH +4) and the four cations, calcium (Ca2+ ), magnesium (Mg2+ ), sodium (Na+ ), and potassium (K+ ), the MARPD value should be less than 5 percent. For NH +4 and the four cations, the MARPD should be less than 10 percent. Grid cells with values that fail the screening criteria are shaded bright pink.

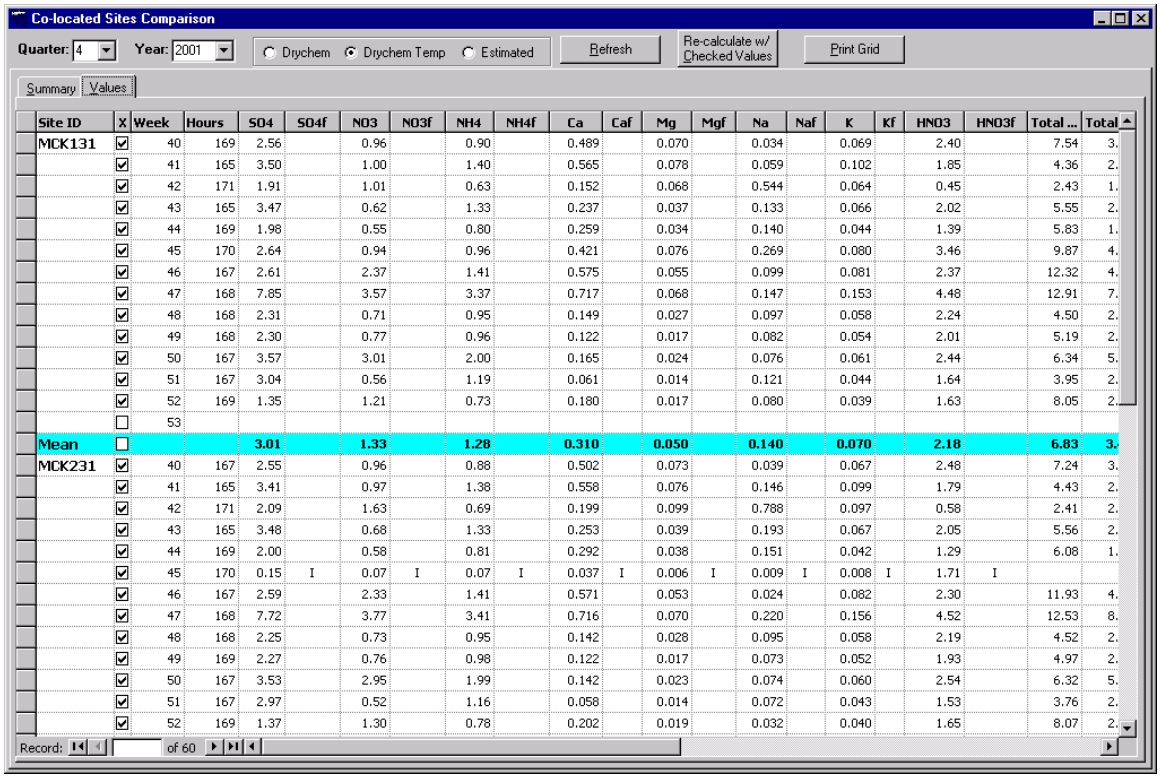
**Figure 100**




| Site Pairs | SO4 | NO3 | NH4 | Ca | Mg | Na | K | HNO3 | Total SO2 | Total NO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| MCK 131/231 | | | | | | | | | | |
| X | 3.04 | 1.36 | 1.31 | 0.31 | 0.04 | 0.13 | 0.07 | 2.08 | 6.58 | 3.48 |
| Y | 3.02 | 1.43 | 1.31 | 0.31 | 0.05 | 0.16 | 0.07 | 2.07 | 6.49 | 3.47 |
| MAD | 0.05 | 0.10 | 0.02 | 0.01 | 0.00 | 0.06 | 0.00 | 0.07 | 0.16 | 0.15 |
| MARPD | 2.00 | **7.81** | 2.24 | 7.34 | 7.44 | **41.18** | 5.77 | **5.25** | 2.27 | **6.22** |
| | | | | | | | | | | |
| ROM 406/206 | | | | | | | | | | |
| X | 0.76 | 0.23 | 0.32 | 0.13 | 0.01 | 0.04 | 0.02 | 0.56 | 0.68 | 0.71 |
| Y | 0.73 | 0.23 | 0.30 | 0.11 | 0.01 | 0.03 | 0.02 | 0.58 | 0.65 | 0.80 |
| MAD | 0.04 | 0.02 | 0.01 | 0.02 | 0.00 | 0.02 | 0.00 | 0.05 | 0.06 | 0.04 |
| MARPD | 4.80 | **6.82** | 5.67 | **27.63** | **10.69** | **47.54** | 9.91 | **12.40** | **9.32** | **6.46** |

The second tab on the form, "Values," shows the individual weekly values for each of the collocated sites included in the MARPD calculation (Figure 101).

**Figure 101**



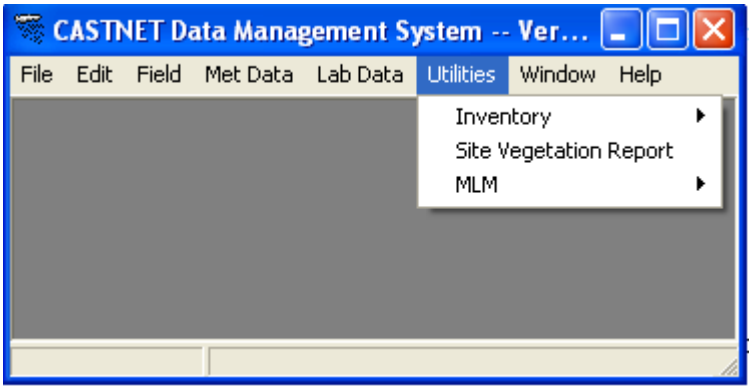

| Site ID | X | Week | Hours | SO4 | SO4f | NO3 | NO3f | NH4 | NH4f | Ca | Caf | Mg | Mgf | Na | Naf | K | Kf | HNO3 | HNO3f | Total ... | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MCK131 | ☑ | 40 | 169 | 2.56 | | 0.96 | | 0.90 | | 0.489 | | 0.070 | | 0.034 | | 0.069 | | 2.40 | | 7.54 | 3. |
| | ☑ | 41 | 165 | 3.50 | | 1.00 | | 1.40 | | 0.565 | | 0.078 | | 0.059 | | 0.102 | | 1.85 | | 4.36 | 2. |
| | ☑ | 42 | 171 | 1.91 | | 1.01 | | 0.63 | | 0.152 | | 0.068 | | 0.544 | | 0.064 | | 0.45 | | 2.43 | 1. |
| | ☑ | 43 | 165 | 3.47 | | 0.62 | | 1.33 | | 0.237 | | 0.037 | | 0.133 | | 0.066 | | 2.02 | | 5.55 | 2. |
| | ☑ | 44 | 169 | 1.98 | | 0.55 | | 0.80 | | 0.259 | | 0.034 | | 0.140 | | 0.044 | | 1.39 | | 5.83 | 1. |
| | ☑ | 45 | 170 | 2.64 | | 0.94 | | 0.96 | | 0.421 | | 0.076 | | 0.269 | | 0.080 | | 3.46 | | 9.87 | 4. |
| | ☑ | 46 | 167 | 2.61 | | 2.37 | | 1.41 | | 0.575 | | 0.055 | | 0.099 | | 0.081 | | 2.37 | | 12.32 | 4. |
| | ☑ | 47 | 168 | 7.85 | | 3.57 | | 3.37 | | 0.717 | | 0.068 | | 0.147 | | 0.153 | | 4.48 | | 12.91 | 7. |
| | ☑ | 48 | 168 | 2.31 | | 0.71 | | 0.95 | | 0.149 | | 0.027 | | 0.097 | | 0.058 | | 2.24 | | 4.50 | 2. |
| | ☑ | 49 | 168 | 2.30 | | 0.77 | | 0.96 | | 0.122 | | 0.017 | | 0.082 | | 0.054 | | 2.01 | | 5.19 | 2. |
| | ☑ | 50 | 167 | 3.57 | | 3.01 | | 2.00 | | 0.165 | | 0.024 | | 0.076 | | 0.061 | | 2.44 | | 6.34 | 5. |
| | ☑ | 51 | 167 | 3.04 | | 0.56 | | 1.19 | | 0.061 | | 0.014 | | 0.121 | | 0.044 | | 1.64 | | 3.95 | 2. |
| | ☑ | 52 | 169 | 1.35 | | 1.21 | | 0.73 | | 0.180 | | 0.017 | | 0.080 | | 0.039 | | 1.63 | | 8.05 | 2. |
| | ☐ | 53 | | | | | | | | | | | | | | | | | | | |
| **Mean** | ☐ | | | **3.01** | | **1.33** | | **1.28** | | **0.310** | | **0.050** | | **0.140** | | **0.070** | | **2.18** | | **6.83** | **3.** |
| MCK231 | ☑ | 40 | 167 | 2.55 | | 0.96 | | 0.88 | | 0.502 | | 0.073 | | 0.039 | | 0.067 | | 2.48 | | 7.24 | 3. |
| | ☑ | 41 | 165 | 3.41 | | 0.97 | | 1.38 | | 0.558 | | 0.076 | | 0.146 | | 0.099 | | 1.79 | | 4.43 | 2. |
| | ☑ | 42 | 171 | 2.09 | | 1.63 | | 0.69 | | 0.199 | | 0.099 | | 0.788 | | 0.097 | | 0.58 | | 2.41 | 2. |
| | ☑ | 43 | 165 | 3.48 | | 0.68 | | 1.33 | | 0.253 | | 0.039 | | 0.193 | | 0.067 | | 2.05 | | 5.56 | 2. |
| | ☑ | 44 | 169 | 2.00 | | 0.58 | | 0.81 | | 0.292 | | 0.038 | | 0.151 | | 0.042 | | 1.29 | | 6.08 | 1. |
| | ☑ | 45 | 170 | 0.15 | I | 0.07 | I | 0.07 | I | 0.037 | I | 0.006 | I | 0.009 | I | 0.008 | I | 1.71 | I | | |
| | ☑ | 46 | 167 | 2.59 | | 2.33 | | 1.41 | | 0.571 | | 0.053 | | 0.024 | | 0.082 | | 2.30 | | 11.93 | 4. |
| | ☑ | 47 | 168 | 7.72 | | 3.77 | | 3.41 | | 0.716 | | 0.070 | | 0.220 | | 0.156 | | 4.52 | | 12.53 | 8. |
| | ☑ | 48 | 168 | 2.25 | | 0.73 | | 0.95 | | 0.142 | | 0.028 | | 0.095 | | 0.058 | | 2.19 | | 4.52 | 2. |
| | ☑ | 49 | 169 | 2.27 | | 0.76 | | 0.98 | | 0.122 | | 0.017 | | 0.073 | | 0.052 | | 1.93 | | 4.97 | 2. |
| | ☑ | 50 | 167 | 3.53 | | 2.95 | | 1.99 | | 0.142 | | 0.023 | | 0.074 | | 0.060 | | 2.54 | | 6.32 | 5. |
| | ☑ | 51 | 167 | 2.97 | | 0.52 | | 1.16 | | 0.058 | | 0.014 | | 0.072 | | 0.043 | | 1.53 | | 3.76 | 2. |
| | ☑ | 52 | 169 | 1.37 | | 1.30 | | 0.78 | | 0.202 | | 0.019 | | 0.032 | | 0.040 | | 1.65 | | 8.07 | 2. |

Samples can be removed from the calculation if there appears to be a problem with the concentrations for that week. To recalculate the MARPD values without the suspect concentrations, click the boxes next to the sample week numbers to be included in the recalculation. To recalculate the statistics, click the “Recalculate w/Checked Values” button at the top of the form. This procedure removes the values for calculation purposes, only. The actual values remain valid in the database. To print either grid, click the “Print Grid” button at the top of the form.

## 6.6 Utilities Menu

Figure 102 shows the menu structure listed under the "Utilities" top level menu option.

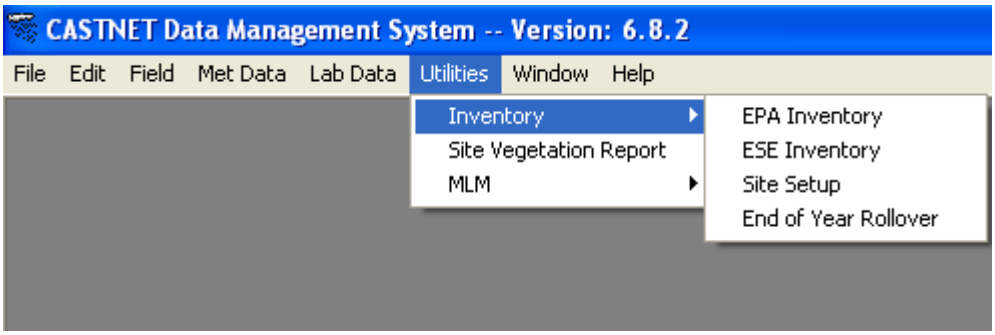
**Figure 102**




### 6.6.1 Inventory

Figure 103 shows the menu structure under the "Utilities / Inventory" menu option.

**Figure 103**

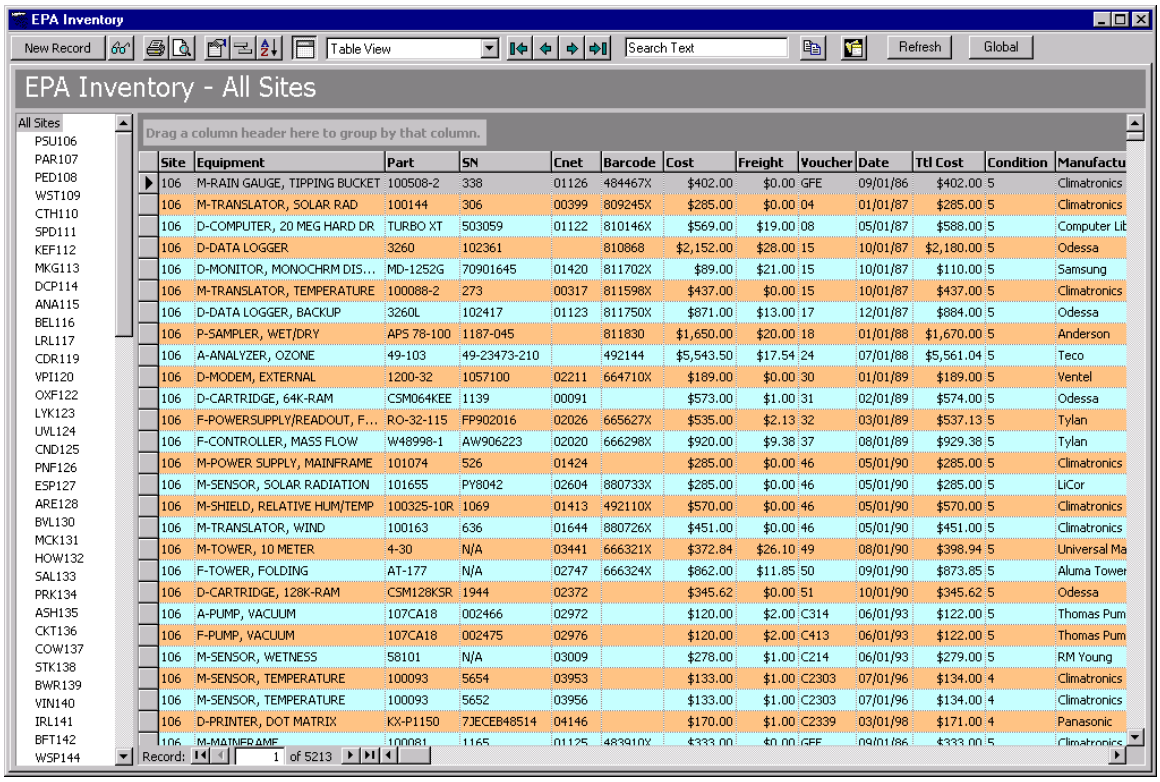



The Inventory module is used to track property and equipment used by the CASTNET project. The functionality of the first three items listed under the "Inventory" menu option ("EPA Inventory," "ESE Inventory," and "Site Setup") is very similar. Therefore only the operation of the "EPA Inventory" grid will be described. Specific differences are noted if required for operation of the other two grids.

### 6.6.2 Viewing the EPA Inventory Grid

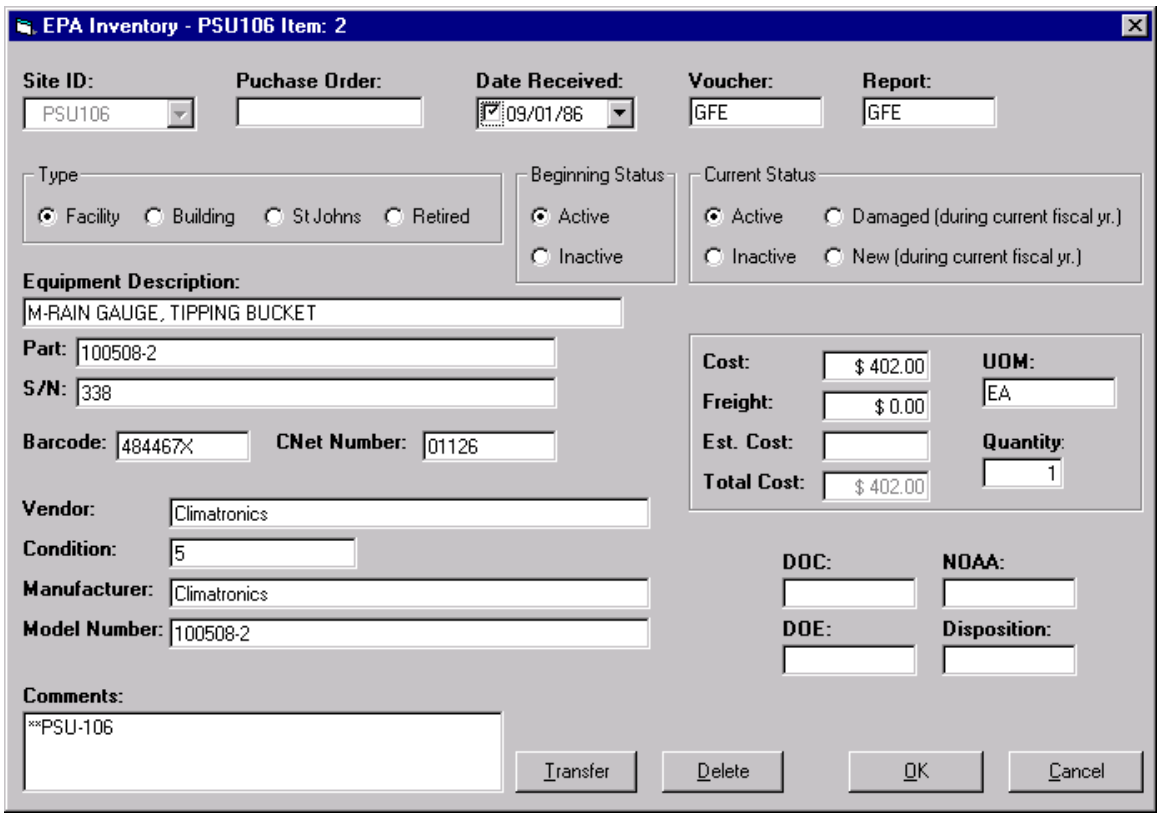
Select the "EPA Inventory" option from the "Utilities / Inventory" menu to display the form shown in Figure 104. By default, all records are displayed in numerical order by site. (For the "ESE Inventory" and "Site Setup" grids, records are ordered by location and class, respectively.)

**Figure 104**




Double-click on a specific record or highlight the record and then click the eyeglasses icon on the button bar to display information for that specific record as a detail view form (Figure 105). Click “OK” to close the form.

**Figure 105**




To add a record to the database, click the "New Record" button in the upper left corner of the "EPA Inventory" form (Figure 104). This pulls up a blank form like the one shown in Figure 105. Enter data into the required fields and click "OK" to add the record to the database.

To delete a record from the database, open the detail view form by double clicking on the record or by highlighting the record and clicking the eyeglasses icon on the button bar in the upper left corner of the "EPA Inventory" form (Figure 104). This will display a form like the one in Figure 105. Click the "Delete" button to delete the record. Click the "OK" button to complete the delete process.

To update a record, open the detail view form for a record (Figure 105). Change information specific to any field. Click the "OK" button to update the record.

To transfer a record in the EPA Inventory grid, open the detail view form for a record (Figure 105). Click the "Transfer" button. A form will display which asks "Yes" or "No" to confirm the transfer of the current item. Click the "Yes" button. Then click the arrow to select the location (site) the record should transfer to and click "OK" to complete the transfer.

Records are transferred through multiple means. The transfer points include:

- Logbooks
  - Receiving In: Records are updated to track equipment being received.
  - Shipping Out: Records are updated to track equipment being shipped out.
- Inventory sheets
  - Specific inventory sheets from a site location track equipment location.

(To transfer a record in the ESE Inventory grid, highlight the specific record. Transfer the record by changing information in the "location" field. Press the "Enter" key to complete the transfer.)

Click on a specific site located in the vertical listing on the far left of the "EPA Inventory" form to sort the records for that site. (For the "ESE Inventory" and "Site Setup" grids, use location and class, respectively.) Drag a column header (horizontal listing) directly above the listing of column headers. Place column header back to original location to undo the filter.

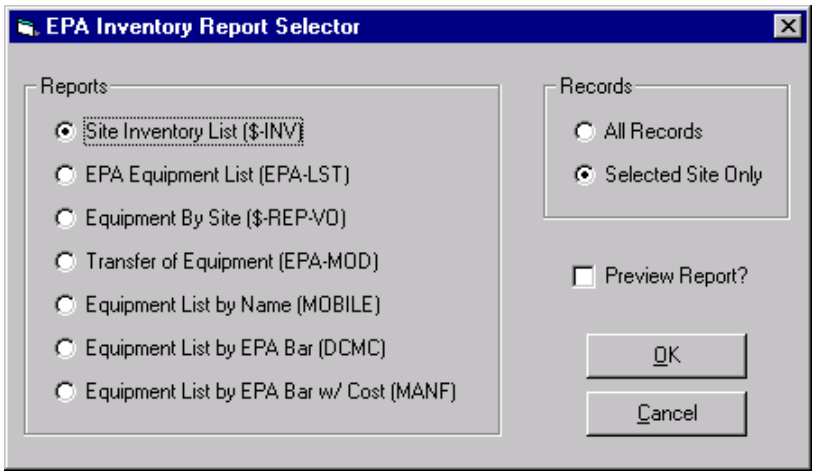
### 6.6.3 Report Generation

From the "EPA Inventory" screen (Figure 104), sort the records for a specific site by clicking on the Site ID in the far left column. (For the "ESE Inventory" and "Site Setup" grids, use location and class, respectively.) Click the report icon, enlarged for detail in Figure 106, to display the "Inventory Report Selector" form.

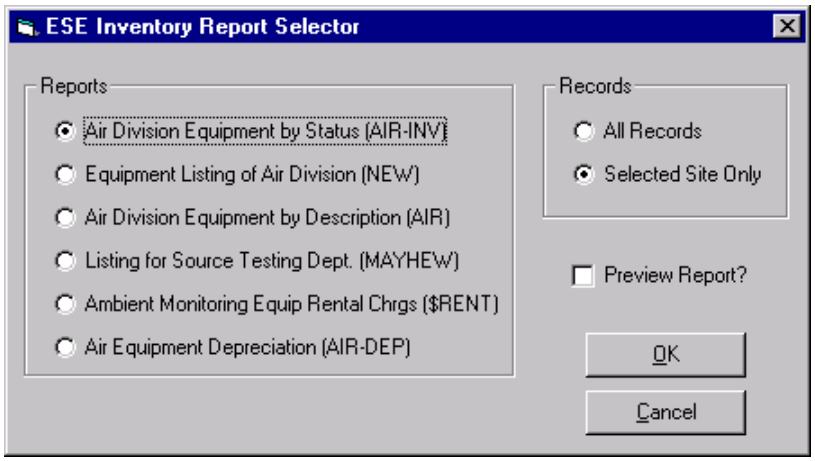
**Figure 106**

Designate a specific report from among the list by clicking on the radio button next to the report name. Possible report selections for the EPA Inventory data are shown in Figure 107. Report selections for the ESE Inventory data are shown in Figure 108. Finally, report selections for the Site Setup data are shown in Figure 109.

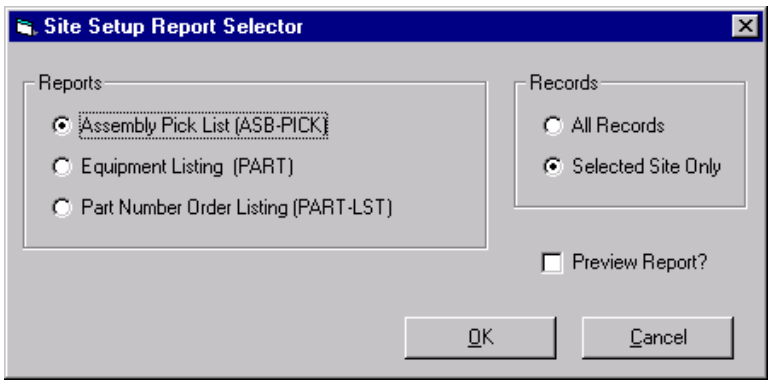
## Figure 107




## Figure 108




## Figure 109



Choose either the "All Records" or "Selected Site Only" option by clicking the radio button next to the desired selection. To preview the report on screen before printing, check the "Preview Report" box, and click "OK" to create the report. To print the report after previewing, click the "Print" button at the top of the report.

### 6.6.4 End of Year Rollover

This option is used only by the Custodial Property Manager (CPM) at the end of each fiscal year. To update all records to reflect the fiscal year rollover, select the "End of Year Rollover" option from the "Utilities / Inventory" menu and answer "Yes" to all prompts.

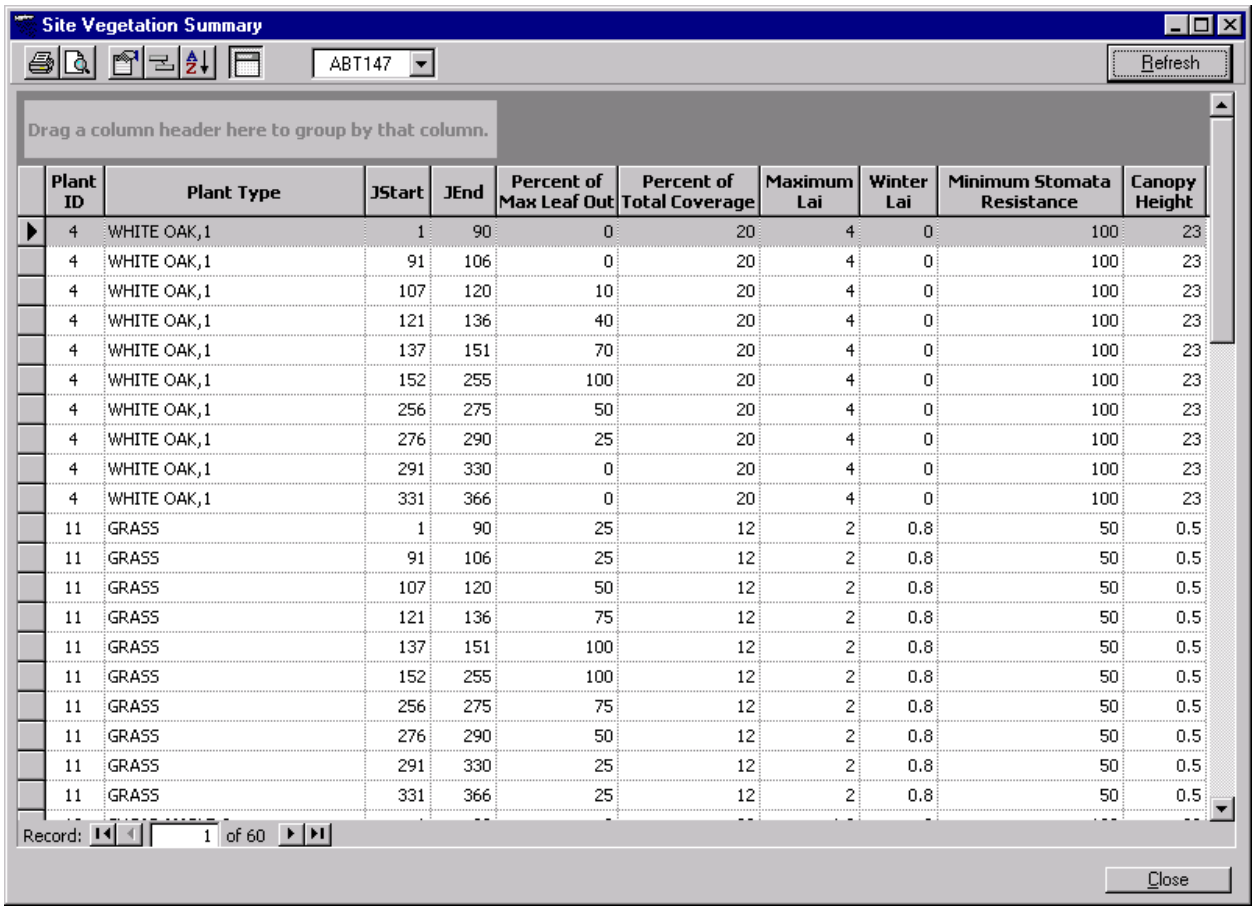
### 6.6.5 Aggregation Utility

This selection from the "Utilities" menu option (Figure 102), which is only available to the database administrator, is used to recalculate the weekly, monthly and quarterly averages present in the DRYCHEM_SUMMARY and METDATA_SUMMARY. The tables are repopulated quarterly.

### 6.6.6 Site Vegetation Report

To access site vegetation profiles stored in the Microsoft® SQL Server™ 7.0 database for use by the Multi-Layer Model (MLM), select the "Site Vegetation Report" option from the "Utilities" menu (Figure 102). The form displayed is shown in Figure 110. To access data for a site, select the site from the combo box at the top of the form. Data automatically refresh when a new site is selected. To print the grid, click the printer icon in the upper left corner of the form.

**Figure 110**




| Plant ID | Plant Type | JStart | JEnd | Percent of Max Leaf Out | Percent of Total Coverage | Maximum Lai | Winter Lai | Minimum Stomata Resistance | Canopy Height |
|---|---|---|---|---|---|---|---|---|---|
| 4 | WHITE OAK,1 | 1 | 90 | 0 | 20 | 4 | 0 | 100 | 23 |
| 4 | WHITE OAK,1 | 91 | 106 | 0 | 20 | 4 | 0 | 100 | 23 |
| 4 | WHITE OAK,1 | 107 | 120 | 10 | 20 | 4 | 0 | 100 | 23 |
| 4 | WHITE OAK,1 | 121 | 136 | 40 | 20 | 4 | 0 | 100 | 23 |
| 4 | WHITE OAK,1 | 137 | 151 | 70 | 20 | 4 | 0 | 100 | 23 |
| 4 | WHITE OAK,1 | 152 | 255 | 100 | 20 | 4 | 0 | 100 | 23 |
| 4 | WHITE OAK,1 | 256 | 275 | 50 | 20 | 4 | 0 | 100 | 23 |
| 4 | WHITE OAK,1 | 276 | 290 | 25 | 20 | 4 | 0 | 100 | 23 |
| 4 | WHITE OAK,1 | 291 | 330 | 0 | 20 | 4 | 0 | 100 | 23 |
| 4 | WHITE OAK,1 | 331 | 366 | 0 | 20 | 4 | 0 | 100 | 23 |
| 11 | GRASS | 1 | 90 | 25 | 12 | 2 | 0.8 | 50 | 0.5 |
| 11 | GRASS | 91 | 106 | 25 | 12 | 2 | 0.8 | 50 | 0.5 |
| 11 | GRASS | 107 | 120 | 50 | 12 | 2 | 0.8 | 50 | 0.5 |
| 11 | GRASS | 121 | 136 | 75 | 12 | 2 | 0.8 | 50 | 0.5 |
| 11 | GRASS | 137 | 151 | 100 | 12 | 2 | 0.8 | 50 | 0.5 |
| 11 | GRASS | 152 | 255 | 100 | 12 | 2 | 0.8 | 50 | 0.5 |
| 11 | GRASS | 256 | 275 | 75 | 12 | 2 | 0.8 | 50 | 0.5 |
| 11 | GRASS | 276 | 290 | 50 | 12 | 2 | 0.8 | 50 | 0.5 |
| 11 | GRASS | 291 | 330 | 25 | 12 | 2 | 0.8 | 50 | 0.5 |
| 11 | GRASS | 331 | 366 | 25 | 12 | 2 | 0.8 | 50 | 0.5 |

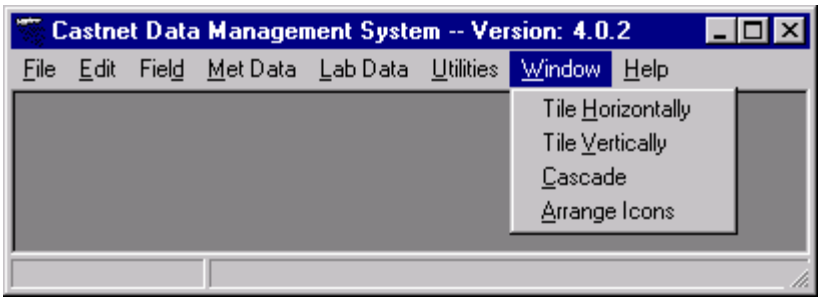
### 6.6.7 MLM

Provides links to the Wdrydep.exe and Lab_key.exe programs. Not currently in use.

## 6.7 Window Menu

Figure 111 shows the menu structure listed under the "Window" top level menu option.

**Figure 111**

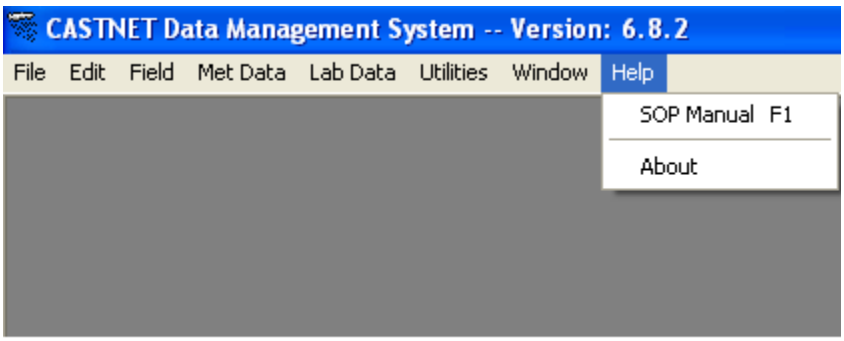


Choices under the "Window" menu option allow the user to position windows or icons in various ways on the monitor screen as indicated by the subheadings.

### 6.7.1 HELP MENU

Figure 112 shows the top level menu structure listed under the "Help" menu option.

**Figure 112**




### 6.7.2 SOP Manual F1

This menu selection is designated for future development and is not currently functional.

### 6.7.3 About

Displays the current version number.

## 7.0 REFERENCES

AMEC E&I, Inc. (AMEC). 2011. *Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan, Revision* 8.0. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

AMEC E&I, Inc. (AMEC). 2011. *Clean Air Status and Trends Network (CASTNET) Software Management Plan*. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

## 8.0 ATTACHMENTS

This SOP does not contain attachments.

# TITLE: HARDWARE MAINTENANCE PLAN

Effective Date: 11-9-11

Prepared by: Christopher M. Rogers
Data Management, Analysis, Interpretation, and Reporting Manager

Reviewed by: Marcus O. Stewart
Project QA Manager

Approved by: Holton K. Howell
Project Manager

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|---|---|---|---|
| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Mgr | 10/26/12 | |
| MS | QA Mgr | 10/30/13 | |
| MS | QA Mgr | 10/23/15 | |
| | | | |
| | | | |

# HARDWARE MAINTENANCE PLAN

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide consistent guidance to AMEC E&I, Inc. (AMEC) Clean Air Status and Trends Network (CASTNET) Data Management Center (DMC) personnel for the maintenance of computer hardware used to complete tasks for CASTNET, including the CASTNET servers, staff workstations, and AMEC corporate servers.

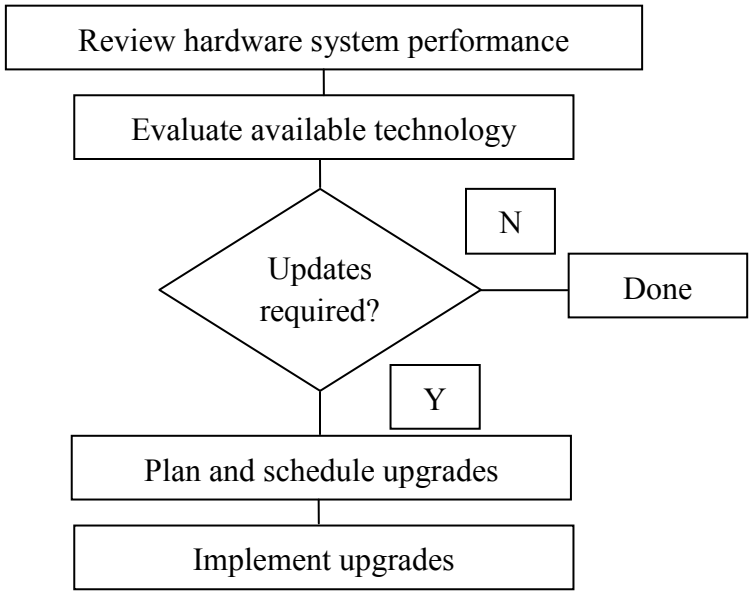
## 2.0 SCOPE

These processes apply to the maintenance of computer hardware associated with the operation of the CASTNET servers, staff workstations operating the CASTNET Data Management System Application, and the AMEC Wide Area Network (WAN) servers.

## 3.0 SUMMARY

The maintenance of computer hardware used to complete tasks for CASTNET involves the routine evaluation of the various hardware platforms with respect to performance, compatibility, capacity, availability, and speed and the comparison to the latest available technology in order to consider productivity enhancements. Figure 1 illustrates the steps in the annual evaluation of hardware. Preventative maintenance includes utilizing the latest virus protection and defragmenting all hard drives.

**Figure 1** Evaluation of Hardware



## 4.0 MATERIALS

Laptop or personal computer
SQL Server 7.0 server: Dell PowerEdge 1800
SQL Server 7.0-related software
Oracle 11g database server: Dell PowerEdge 2900
Oracle 11g database-related software
LoggerNet polling software server: Dell PowerEdge SC1430
Permissions and access to utilized databases

## 5.0 SAFETY

The same level of care and caution should be exercised while using the laptop/computer as would be taken when using any electrically powered device. Keep all cords out of walkways. If needed, use appropriately rated extension cords and surge protectors, and do not overload the electrical circuit. Keep liquids and food away from the computer and keyboard.

Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using the computer. Take breaks regularly to allow muscles to relax and to promote blood flow, including standing up, briefly walking around the room, and stretching to counteract the repetitive motion activities and extended periods of sitting.

## 6.0 PROCEDURES

### 6.1 Maintenance of the CASTNET Server

Two CASTNET servers are dedicated to support the data collection, validation, and archival processes required to meet CASTNET data and reporting objectives. One server houses the SQL database management system and one houses Oracle, a Dell PowerEdge 1800 for the SQL database and a Dell PowerEdge 2900 for the Oracle database. In addition, a Dell PowerEdge SC1430 is dedicated to supporting Cambell's LoggerNet polling software. For more information concerning CASTNET objectives and operation of the DMC, see Appendix 6 of this QAPP.

#### 6.1.1 Routine Hardware Evaluation

Annually, the DMAIRM and DMC staff evaluates the hardware platform used for the CASTNET servers. This evaluation includes assessment of the operating system with respect to hardware performance and compatibility, hard drive storage capacity and availability, processor speed, and random access memory (RAM). After comparison of the current server setup and performance to that of the latest available technology, plans for modifications and/or upgrades are compiled along with an implementation schedule. For additional information concerning procedures

established for changes to hardware configurations, see the CASTNET Quality Management Plan (QMP), which is given as Appendix 8 of this QAPP.

### 6.1.2 Defragmentation of CASTNET Server Hard Drives

AMEC's Information Technology (IT) staff recommends defragmenting all hard drives on servers with Microsoft® operating systems on a monthly basis. A Window tool called Disk Defragmenter is employed to defragment all hard drives on the CASTNET servers, which uses Microsoft® Windows NT® Server 2003 and 2008 operating systems.

### 6.1.3 Use of Virus Scanning Software on the CASTNET Server

AMEC IT uses Norton AntiVirus virus scanning software on all servers (including the CASTNET servers). Hard drives are scanned weekly. On a regular basis, all servers on the AMEC network (including CASTNET servers) are automatically updated with new signature files and security patches to allow for detection and removal of new viruses.

## 6.2 Maintenance of User Workstations

### 6.2.1 Routine Hardware Evaluation

User workstation hardware configurations are evaluated annually by AMEC IT staff based on minimum workstation specifications established for the company. The current standard configuration for new acquisitions is a 1.60 GHz Pentium Dual Core with 1 GB memory, 89 GB hard drive, integrated gigabit network interface card, speakers, and a flat screen monitor capable of a minimum resolution of 1024 x 768 pixels. Workstations are replaced after approximately three years of use to ensure usability and compatibility with current systems and software.

The DMAIRM works with AMEC IT staff to ensure that user workstations will successfully operate the CASTNET Data Management System Application.

### 6.2.2 Defragmentation of User Workstation Hard Drives

As with the CASTNET servers, AMEC's IT staff recommends that users manually defragment their workstations on a monthly basis using the software included with the work station's operating system.

### 6.2.3 User Workstation Antivirus Software

Each workstation has Norton AntiVirus software installed and running. Local hard drives are scanned for viruses continually during operation via AntiVirus. Virus signatures are updated through the internal network. Each time the AMEC IT staff updates the internal network virus signatures, workstation virus signatures are updated the first time a workstation attaches to the internal network.

## 6.3 Maintenance of AMEC Servers on the AMEC WAN

Office servers on the AMEC WAN are maintained and managed solely by AMEC IT staff, which continually evaluates the hardware configuration of the office servers. Office servers are

routinely backed up via tape drives. Virus scanning is accomplished on all servers using Norton AntiVirus. Scheduled virus scans of hard drives occur weekly. Servers are automatically updated on a regular basis with new signature files and security patches to allow for detection and removal of new viruses.

### 6.4 Provisions for System Downtime

As much as possible, system downtime is scheduled in advance for periods when activity is minimal. System downtime may be caused by hardware or software upgrades or by other reasons that restrict user access to the CASTNET server or AMEC WAN servers. The following is an example of how such an event would be handled by either the DOM, in the case of the CASTNET server, or the AMEC IT staff. If the AMEC IT staff is scheduled to update the e-mail system for the company, causing a disruption of server accessibility, a broadcast e-mail is sent to all employees specifying what the update involves, why it is necessary, and when it will be performed. Information concerning possible work-related conflicts is requested in the e-mail. Most updates to either the CASTNET server or AMEC IT office servers are scheduled for weekend days.

Unscheduled system downtime is communicated first by e-mail, if available, and second by verbal communication. For example, if a power outage occurs at the Gainesville, FL office requiring the CASTNET server to be shut down because the uninterruptable power supply (UPS) is nearing the end of its support time, verbal communication within the Gainesville office and telephone communication with personnel in the Jacksonville, FL office would be used to inform all users of the potential loss of access to the CASTNET server. If the CASTNET server is shut down, once power is restored and all systems are again operational, an e-mail is sent to all users indicating that the problem has been resolved and that the CASTNET server is once again accessible.

## 7.0 ATTACHMENTS

This SOP does not contain attachments.

# TITLE: SOFTWARE MANAGEMENT PLAN

Effective Date: 11-9-11

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|---|---|---|---|
| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Mgr | 10/29/12 | |
| MJ | QA Mgr | 10/30/13 | |
| MS | QA Mgr | 10/22/15 | |
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# SOFTWARE MANAGEMENT PLAN

## 1.0 PURPOSE

This Software Management Plan (SMP) is furnished to provide consistent guidance to AMEC E&I, Inc. (AMEC) Clean Air Status and Trends Network (CASTNET) Data Management Center (DMC) staff for acquiring software capabilities and related services through in-house development, commercial off-the-shelf (COTS) purchase, or via subcontract with other software development firms.

The purpose of this SMP is to define CASTNET's software management processes and the responsibilities, standards, procedures, and organizational relationships for all software management activities associated with CASTNET, including software acquisition and development practices, standards, and technical procedures. It further establishes management, engineering, and quality assurance (QA) requirements for providers of software (both internal and external). Throughout this SOP the term "provider" is used to refer to developers and providers of software and software services, regardless of the nature of their organization or their affiliation with CASTNET.

## 2.0 SCOPE

CASTNET's primary goal is to function effectively as a national, long-term deposition monitoring network that provides information for assessing the effectiveness of current and future emission reductions mandated under the Clean Air Act. To meet this goal, CASTNET was designed to fulfill the following objectives:

1. To monitor the status and trends in air quality and atmospheric deposition;
2. To provide atmospheric data on the dry deposition component of total acid deposition, rural ground-level ozone ($O_3$), and other forms of atmospheric pollution that enter the environment as particles and gases; and
3. To assess and report on geographic patterns and long-term, temporal trends in ambient air pollutant concentrations and acid deposition.

In order to meet these data and reporting objectives, CASTNET DMC personnel use relational databases that house the data collected by the network and computer programs that validate and analyze these data, including the tools and models used in the validation and analysis processes. Three key software components are used to perform these tasks:

- The CASTNET databases,
- The CASTNET Data Management System Application (CDMSA), and
- The Multi-Layer Model (MLM).

These three systems comprise the majority of the software used by CASTNET to manage and analyze data and provide analyses. CASTNET's management processes pertaining to the software acquired by CASTNET to satisfy its data analysis and reporting requirements are

established by this SMP. It also establishes requirements to be satisfied by the providers of all software purchased, contractually acquired, developed, or maintained for the support or execution of CASTNET. Its provisions apply to all government organizations, in-house activities, and contractors providing software capabilities and/or support to CASTNET. This SMP does not apply to software or hardware interfaces, capabilities, and schedules that are not specifically developed or modified to support CASTNET, except for those software/hardware interfaces to CASTNET-supported capabilities and schedules for the availability of support.

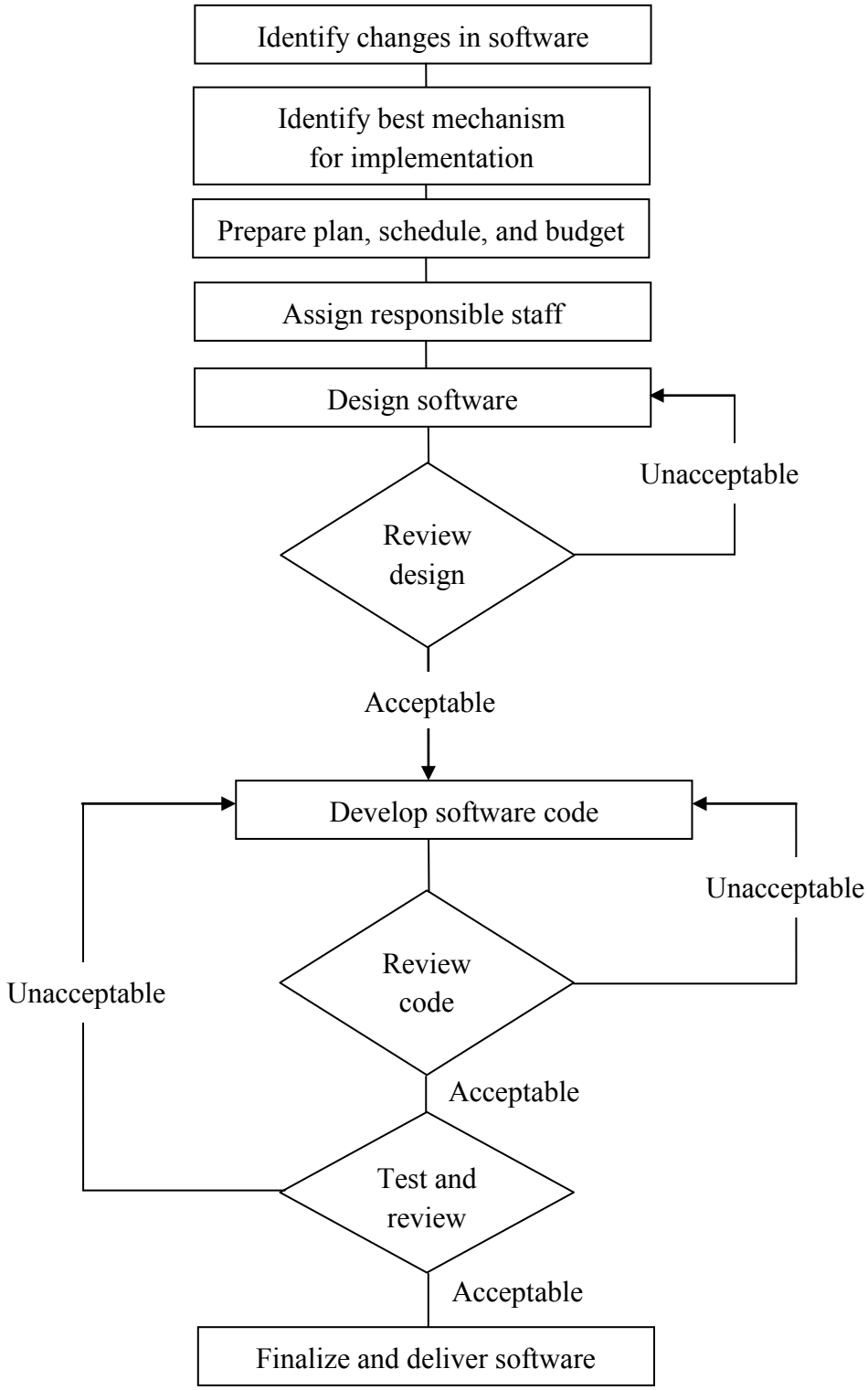
The term "software," as used in this document, includes code, documentation, associated data, and "firmware," which is software installed in a medium that cannot be dynamically changed. For the purposes of this document, the CASTNET databases are referred to as the "SQL database and the Oracle database," the data validation and analysis application as the "CASTNET Data Management System Application," and the Multi-Layer Model as the "MLM." Together these components represent the CASTNET data management system.

All systems and software used for CASTNET should be considered Type III, User Owned Information Systems. According to EPA's Office of Information Resource Management (OIRM), Type III systems are unique, standalone systems developed to improve the efficiency or effectiveness of operations for a single user or a small group of users. The CASTNET databases, the CDMSA, and the MLM are used almost exclusively by people working on CASTNET, not by EPA employees or outside users. The total number of users is approximately 20.

## 3.0 SUMMARY

Various software tools are used to manage, analyze, and model the variety of CASTNET data. Software is an integral part of the project. This SOP provides the procedures for the acquisition, development, review, and testing software achieved through in-house development, COTS purchase, or using outside subcontractors. Figure 1 provides an overview of the steps that need to be completed in order to utilize a new software package on CASTNET.

**Figure 1** Implementation of Software Changes



## 4.0 MATERIALS

Laptop or personal computer
SQL Server 7.0 hardware
SQL Server 7.0-related software
Oracle 11g database hardware
Oracle 11g database-related software
Permissions and access to utilized databases

## 5.0 SAFETY

The same level of care and caution should be exercised while using the laptop/computer as would be taken when using any electrically powered device. Keep all cords out of walkways. If needed, use appropriately rated extension cords and surge protectors, and do not overload the electrical circuit. Keep liquids and food away from the computer and keyboard.

Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using the computer. Take breaks regularly to allow muscles to relax and to promote blood flow, including standing up, briefly walking around the room, and stretching to counteract the repetitive motion activities and extended periods of sitting.

## 6.0 PROCEDURES

### 6.1 Planning

Planning is a crucial part of software development and management. Planning for CASTNET software is usually done on an as-needed basis once software requirements are identified. Typically, software requirements are identified through one of two mechanisms. First, users of the current software identify improvements or enhancements that would make existing products more efficient for CASTNET requirements. Second, software requirements change as data requirements, updated technology, or improvements in the science underlying the MLM change.

Once changes in software requirements are identified, planning for implementation begins. The planning process is typically a 5-step process:

1. Discussion among DMC staff on how best to implement the changes;
2. Identification of the best mechanism for implementing the changes (e.g., in-house, COTS, or via subcontract with other software development firms);
3. Development of an implementation schedule;
4. Determination of cost and funding mechanisms; and
5. Assignment of DMC staff responsible for oversight of implementation.

### 6.1.1 Project Resources

#### 6.1.1.1 Contractor Facilities

The AMEC DMC provides the repository for CASTNET data, including raw data that have been collected but not yet validated and data that have been validated using various validation schemes (e.g., Level 1, Level 2, or Level 3). The AMEC DMC also provides the hardware, database management software, data security, and computer programming necessary to manage, maintain, and deliver the CASTNET data. The subsections that follow detail the database management system used for CASTNET; validation, verification, and documentation of data; documentation and version control procedures used to develop major computer programming code; and a discussion of the data security procedures used to provide access and system backup for the CASTNET database management system.

#### 6.1.1.2 Laboratory Software

The AMEC analytical chemistry laboratory in Gainesville, FL that serves CASTNET is responsible for its own software products. In particular, the laboratory is responsible for application and maintenance of its Laboratory Information Management System (LIMS). The laboratory uses a commercial LIMS called the Element® Data System (Element®) to manage all analytical chemistry from CASTNET and other projects.

#### 6.1.1.3 Government Furnished Equipment, Software, and Services

Government furnished equipment is not currently used by CASTNET to manage data or to develop computer program code. Should government furnished equipment be supplied in the future, this section will be revised accordingly.

#### 6.1.1.4 Personnel

The personnel utilized in the development of software for CASTNET are staff members of the DMC, technical advisors and subcontractors (e.g., for specialty programming on the CDMSA). The DMC staff has overall responsibility for implementing the SMP.

#### 6.1.1.5 Organizations Responsible for Design, Implementation, Configuration Management, Reliability, and Quality Assurance

The DMC staff has overall responsibility for the design, implementation, reliability, and QA of all software managed under this plan. AMEC's information technology (IT) group has overall responsibility for hardware configuration management. Software configuration management is the responsibility of the DMC staff. The Gainesville Laboratory is responsible for the LIMS. The Project QA Manger is responsible for QA of information generated by the software utilized for CASTNET.

### 6.1.2 Review Responsibilities

While review responsibilities belong to the CASTNET Data Management, Analysis, Interpretation, and Reporting Manager (DMAIRM) and DMC staff, overall responsibility resides with the DMAIRM. The CASTNET Project Manager and CASTNET Project QA Manager also review all recommendations from the DMC staff concerning software development. Consensus approval by the Project Manager, the QA Manager, and the DMAIRM is required before software development commences.

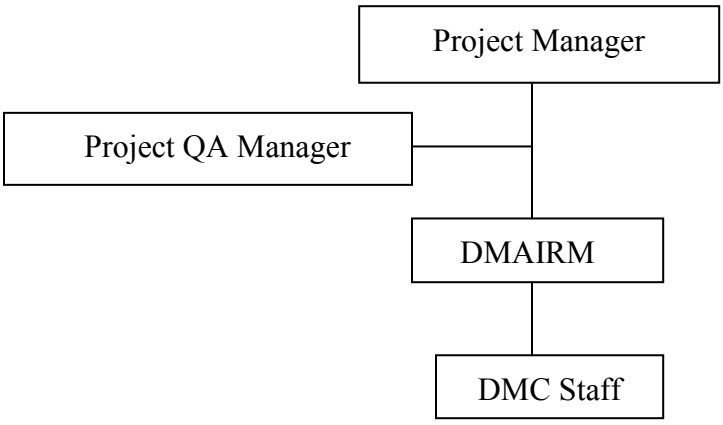
### 6.1.3 Software Development

This section describes the organizational structure, personnel, resources, software development tools, techniques, methodologies, and standards/forms involved in the software management planning process.

#### 6.1.3.1 Organization Structure

The DMAIRM heads the planning process for all software development efforts and oversees the DMC staff. The DMAIRM reports to the Project Manager. The Project QA Manager reviews work products for QA purposes. Figure 2 depicts the organizational structure as it applies to software planning and management:

**Figure 2** SMP Organizational Structure for CASTNET



#### 6.1.3.2 Personnel

Personnel involved in the planning process include the DMAIRM and DMC staff, subcontractors, and technical end users. Oversight of all subcontractors' involvement is the responsibility of the Project Manager and the DMAIRM. DMC staff is utilized to plan, test, review, and develop software for CASTNET. Technical end users are involved in planning for enhancements to existing software and for detailing problems with current software products.

#### 6.1.3.3 Resources

Resource planning is the responsibility of the DMAIRM. He provides recommendations to the Project Manager on any resources not readily available through either in-house or subcontracted services that are required to complete software projects. Resource planning occurs annually with an interim review every six months to ensure no pressing resource needs exist.

#### 6.1.3.4 Software Development Tools, Techniques, Methodologies and Standards/Forms

Planning for the acquisition of software development tools, techniques, methodologies, and standards/ forms occurs annually and on an as-needed basis throughout the year.

### 6.2 Management Controls

The DMAIRM is responsible for the successful management of CASTNET's software acquisitions, including verifying that the software meets project requirements, is delivered on schedule, and is within budget. These management responsibilities also include the development and maintenance of this SMP. Additional responsibilities of the DMAIRM include, but are not restricted to, the following:

- Authorizing and approving all matters pertaining to software acquisitions.
- Reviewing and approving each provider's SMP.
- Ensuring that software size, effort, and schedule re-estimations are made and analyzed at the conclusion of each software development phase.
- Serving as chairperson at all software development phase transition reviews and ensuring that all review items are resolved.
- Reviewing and determining if each life-cycle phase has been successfully completed. If so, then directing the provider to begin the work of the next phase.
- Monitoring provider staffing and staff changes to ensure continuity and sufficiency of expertise needed to meet schedule requirements.
- Reviewing provider progress reports that present current status, accomplishments for the reporting period, planned achievements for the next period, issues, problems, and concerns. Using the information in the reports, the DMAIRM will identify software management problems needing resolution.

- Monitoring the products and processes of any provider's software subcontractors to ensure end-to-end quality. Management of subcontractors is a prime contractor (provider) responsibility.
- Ensuring that provider software is delivered in accordance with the agreed upon schedule.
- Developing and maintaining external interfaces in conjunction with the DMC staff.
- Providing technical direction to software providers and support to contractors, especially on issues that may potentially have long-term effects on system schedules and costs.
- Approving or disapproving waiver requests submitted by providers and assessed by the DMC staff.

### 6.2.1 Project Schedule, Reviews, and Report Controls

Once software projects are underway, the software project schedule is reviewed and discussed on a weekly basis as part of the AMEC CASTNET Coordination Meeting. Deviations from the schedule are noted, and action plans to address schedule deviations are developed. Project reviews and report controls occur on a similar schedule with routine program evaluations held annually.

#### 6.2.1.1 Work Plan

Work plans are not typically prepared for in-house software development projects; however, work performed under subcontract will usually require a work plan. The work plan is reviewed by the DMC staff and DMAIRM, and modifications or changes are discussed with the subcontractor before work can proceed. Once approved, the work plan governs the software development process.

#### 6.2.1.2 Activity Networks and Dependencies

Activity networks and dependencies are not prepared for software developed as a part of CASTNET. The size and scope of CASTNET-related software does not justify the cost of such development.

#### 6.2.1.3 Risk Areas

Risk areas for software developed for CASTNET include catastrophic data loss, virus infection, and network infiltration. These risk areas are managed by the AMEC IT group.

### 6.2.2 Risk Management

#### 6.2.2.1 New Technologies

New technologies are not normally utilized in software developed for CASTNET. Only proven programming techniques, products, and procedures are utilized. New technology (in the form of improved science) is incorporated into the MLM, but only after testing.

#### 6.2.2.2 Backup – Recovery

Weekly scheduled backups of the SQL Server and Oracle 11g databases are created for all CASTNET-related data. For information that is updated several times per day, daily incremental backups are also performed. After the backups are complete, the files created by the backup process are archived to other severs located in AMEC's Gainesville, FL office. These Gainesville office servers are backed up daily via tape drive, a process that is managed by AMEC IT staff. Servers are backed up to the tape drive with an incremental backup Monday through Thursday and a full backup on Friday. Specifically, the file servers are backed up nightly by one 200GB autoloader LTO2 tape drive (with the capability of holding six 200GB tapes). The grandfather/father/son backup rotation scheme is used, with permanent archiving of the tapes every four weeks and a dual copy stored in off-site secured storage.

AMEC protocol calls for a 12 tape rotation, which is separated into 6 weekly and 6 archival tapes. Every four weeks, an archival tape is used for the full and four subsequent incremental backups. This archival tape is stored in a secure location off-site. Annually, an end-of-year tape is created, which is stored at the AMEC Alpharetta, GA office.

Critical software and electronic documents are backed up to tape and archived onto CD or DVD. Multiple copies are stored off-site to ensure that a version will be available for rapid restoration should a disaster occur. For example, copies of the Microsoft SQL Server software currently used to manage the database are maintained in both the Jacksonville and Gainesville, FL offices. Should a disaster occur that renders the CASTNET server inoperable, the software will be rapidly re-loaded onto another server, and the data restored from the archived backup files. AMEC estimates that the data management system could be redeployed within 24 hours following a server failure or catastrophic event and, depending on the age of the backups, the database could be fully repaired and in production mode within 24 hours to 1 week. Other program-critical software is maintained in a similar way. The CDMSA is housed on both the Jacksonville and Gainesville main servers, and the current version is backed up nightly using the tape backup system. Therefore, server failure or a catastrophic event will have minimal effect on the CDMSA. Documents and reports prepared during CASTNET are stored on the Jacksonville or Gainesville AMEC server and are subject to the same daily tape backup procedure. AMEC uses CentricProject, a Web-based electronic document management system, to electronically archive these documents.

Although not strictly a data backup system, a Redundant Array of Independent Disks (RAID) subsystem is included in the CASTNET-dedicated server at AMEC. A RAID subsystem increases performance and/or provides greater fault tolerance and provides protection against data loss from physical drive failure. The servers that hose the SQL and Oracle databases use RAID5, which provides a striped set with distributed parity. The LoggerNet server uses RAID1.

#### 6.2.2.3 Manual Procedures and Forms

Manual procedures are not typically used in the development of software products. Documentation of other (i.e., non-software development) manual procedures and forms for data handling is provided in other appendices to this QAPP (e.g., Appendix 1, Field SOP, and Appendix 6, Data SOP).

### 6.3 Software Product Assurance

CASTNET utilizes a software assurance program that includes QA, verification and validation, quality engineering, safety assurance, and security and privacy assurance. The DMAIRM is responsible for the planning and execution of the QA program. The following subsections detail CASTNET's software product assurance program and specify software QA requirements for software providers.

Included in each provider's required SMP are details of their software QA program in accordance with the above-stated requirements.

#### 6.3.1 Software Independent Verification and Validation

Whenever possible, independent verification and validation of the software performance is completed. This typically occurs in one of two ways. First, when developing software for the CDMSA, an underlying test database is used to independently confirm the functionality of the software. Second, with regard to the CASTNET database itself, independent audits are performed on a routine basis.

#### 6.3.2 Software Security

All electronic products (software products, databases, and documents) are housed on the AMEC wide area network (WAN) or server network and are subject to automated data backup systems, virus protection, and network firewalls.

#### 6.3.3 Software Reliability and Quality Control

Software reliability and quality control are exercised in the testing and review phase. Please see Sections 6.3.7 and 6.3.8 for a review of those procedures.

#### 6.3.4 Software Interface Definition

All software developed for CASTNET must utilize standard Microsoft® Windows® interface definitions since Windows® is the standard interface for AMEC.

#### 6.3.5 Software Waivers to Policy and Procedures

The DMC staff reviews all requests for waivers to software policy and procedures. After completing its review, the DMC staff informs the DMAIRM of its recommendation as to

whether or not a waiver should be granted. The DOM has sole authority to grant waivers. Requests are accepted infrequently.

#### 6.3.5.1 Permanent Waivers

For software that performs crucial functions, a permanent waiver is only granted after thorough review by DMC staff to ensure that the waiver is necessary. Typically, a permanent waiver is granted only when it would be too time or cost consuming to implement an alternative strategy.

#### 6.3.5.2 Temporary Waivers

For software that performs crucial functions, a temporary waiver is only granted after thorough review by DMC staff to ensure that the waiver is necessary. Typically, a temporary waiver is granted only when project requirements would not be met and a tool under development has not completed testing and review.

#### 6.3.5.3 Tools and Standards Waivers

Tools and standards waivers are only granted when the functionality of an alternative tool is substantially higher or when there is no corresponding functionality in the current standard.

### 6.3.6 Data Administration

Data administration is handled by the DMC staff, which is responsible for all data administration activities. The AMEC DMC is the repository for CASTNET data, including raw data that have been collected but not validated, and data that have been validated using various validation schemes (e.g., Level 1, Level 2, and Level 3). The AMEC DMC also provides the hardware, CDMSA software, data security, and computer programming necessary to manage, maintain, and deliver the CASTNET data. The CASTNET DMC uses Microsoft SQL™ and Oracle 11g database management systems for maintaining the CASTNET data. These systems provide a robust environment for handling the data and an option for future expansion.

### 6.3.7 Quality Assurance

The QA program and the testing program (see Section 6.3.8) operate in essentially the same manner since QA during the testing phase reduces problems once the software becomes operational.

#### 6.3.7.1 Program Monitoring

The DMC staff performs all program monitoring.

#### 6.3.7.2 Quality Reviews

Quality reviews are conducted by both the DMC staff and the QA Manager. The QA Manger provides general oversight on the QA process.

#### 6.3.7.3 Reporting and Control

Reporting and control of the QA process as it relates to software development and management resides with the DMAIRM. With the exception of data handling and SOP, QA reports for software development and management are issued on an as-needed basis. QA controls are exercised throughout the development and management process using the iterative feedback mechanisms described in Sections 6.3.7.5 and 6.3.7.6.

#### 6.3.7.4 Reviews

Reviews are conducted by the DMC staff. The types and frequencies of these reviews are discussed in the following subsections. After each type of review is completed, the results of the review, together with any recommendations by the DMC staff, are provided to the DMAIRM.

**System Requirements Reviews**

With respect to the CDMSA, reviews are conducted monthly during the DMC staff meetings to both ensure that the application is functioning correctly and to develop items for future enhancement. The database and the MLM are reviewed annually to ensure proper operation and to evaluate whether or not updates to those components are required.

**Preliminary Design Review**

Preliminary design reviews are only conducted when major components are added to the CDMSA, the CASTNET database structure is changed significantly, or an improved version of the MLM code base is released. This review is handled by the DMC staff.

**Critical Design Review**

Once the preliminary design review is completed, a critical design review is conducted to ensure that changes do not have cascading repercussions for other systems. For example, when database structures are modified, they are evaluated to determine the potential impacts on the CDMSA, and any critical flaws are reviewed and evaluated to minimize change to other systems.

**Code Reviews**

The DMC staff performs all code reviews with the exception of the MLM code. MLM core code is generally reviewed under a peer review process. The incorporation of the MLM core code into the MLM front end software is checked against previous MLM runs to ensure consistency among the new and old versions. The DMAIRM is notified of any inconsistencies.

#### 6.3.7.5 Development Testing and Evaluation Review

Development testing and evaluation review are iterative processes closely coupled with the operational testing and review phase. The primary difference is that development testing and review reside primarily with the programmers responsible for software development, while

operational testing and review reside with some, or even all, of the end users in a "beta" testing phase. The steps used in this process are as follows:

- Low-level programmer testing and review (Level A): A programmer performs a QA check immediately following software modifications. The purpose of this Level A review system is to ensure, at a low level, that code modifications produce the desired software behavior and do not adversely impact the behaviors of other subroutines or code modules. Immediately following modifications, the programmer performs a full compile of the software code, and exercises the software features that are immediately affected by the modifications. Level A problems are remedied immediately.
- Mid-level technician/programmer testing and review (Level B): A programmer or technician performs systems tasks to:
    1. Exercise routine software features to ensure that the software functions as anticipated;
    2. Quantitatively check the software output. These checks may be automated to some degree. These checks are established to exercise functions and features; and
    3. Establish one or more sets of standard test data to quantitatively assess the output results.

    Level B problems are remedied before proceeding to Level C review. Level C review is part of the operational testing and review cycle.

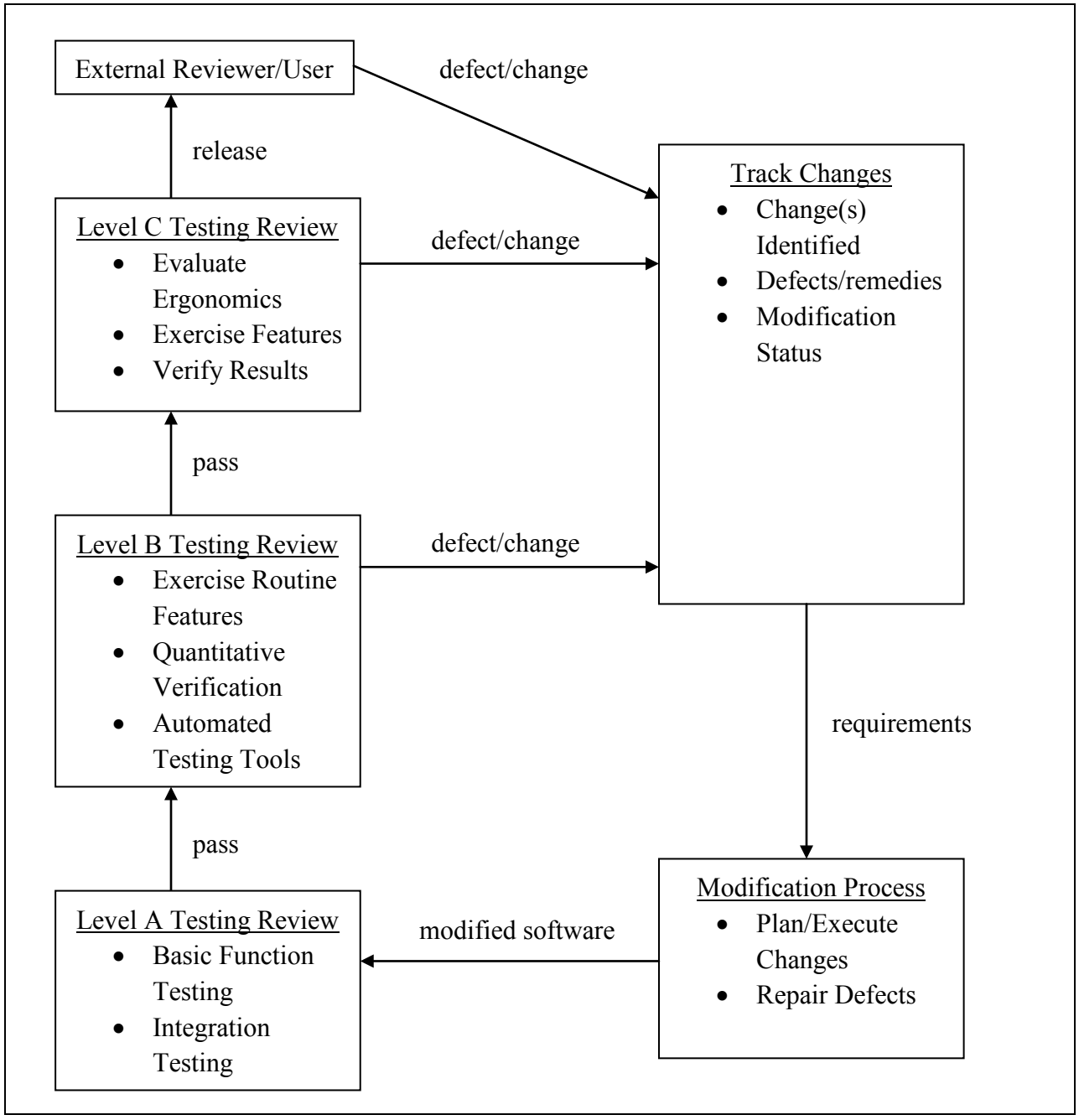
#### 6.3.7.6 Operational Testing and Evaluation Review

The operational testing and evaluation review is performed as follows:

- High-level end user testing and review (Level C): As a representative of software end users, a scientist or engineer reviews the software. The purpose of this review is to evaluate software ergonomics, exercise software features to ensure the absence of software bugs, and verify the reasonableness of output results.
- Tracking changes: When Level C reviews are complete, no further changes will be made, and the software version will be declared. After closure, or periodically during a software maintenance period, any further changes will be queued until the next round of modifications. Closely related changes (e.g., in the same subroutine or module) will be grouped to enhance the efficiency of the software modification process. As software modifications progress, the results of each step will be recorded.
- Software modification process: For each category of change order, the following steps of the software modification process are completed:
    1. Verify or reproduce errors or undesired behaviors;
    2. "Trap" errors/behaviors by locating the lines of code that must be modified;
    3. Generate a plan for modifications; and
    4. Implement modifications. The revised software is then passed for Level A QA review.

The overall process for development and operational testing and review is shown in Figure 3.

**Figure 3** Software QA Test and Review Process



#### 6.3.8 Testing

The testing of software follows the procedures outlined in Section 6.3.7.

##### 6.3.8.1 Software Test Plan

Formal software test plans are not developed for CASTNET since the programming for this project is considered to be a Type III system. The DMC staff determines the types of tests necessary to perform on the software before it is deemed usable by non-DMC staff. Testing always includes evaluation runs against the test database.

##### 6.3.8.2 Software Test Description

Section 6.3.7 describes the software test process.

##### 6.3.8.3 Software Test Procedures

The majority of the software test procedures are described in Section 6.3.7 since testing and QA for software prepared for CASTNET are inextricably entwined. See Figure 3 for the overall software test procedure flow.

##### 6.3.8.4 Conducting the Software Test

The DMC staff also tests new, updated, or modified software against a test database that replicates the structure of the production database. The software must perform correctly against the test database prior to release for general use against the production database.

##### 6.3.8.5 Software Test Reports

The DMC staff prepares all software test reports. Because the CASTNET system is a Type III system, software test reports are normally in the form of informal memoranda or e-mails.

### 6.4 Software Development Procedures

#### 6.4.1 Software Standards and Procedures

Software standards are established based on current EPA standards for developing software applications and AMEC IT group standards. In general, software developed for the CASTNET program must conform to normal Microsoft® Windows® programming conventions.

#### 6.4.2 Software Tools

Software tools used to develop computer software code for CASTNET are COTS software that conforms to Microsoft® Windows® standards.

#### 6.4.2.1 Commercial and Reusable Software

Whenever possible, commercial software development products are used to develop software. Components used in software development, as well as individual code snippets, are reusable to the largest extent possible.

#### 6.4.2.2 Data Rights and Documentation

Data rights and documentation are maintained by the DMAIRM or his designee. Data rights are granted to software users and developers on an access requirement basis. Individuals and subcontractors are only granted access rights on an as-needed basis. Documentation of data rights resides with DMAIRM or his designee.

#### 6.4.2.3 Certification

All software certification is maintained by the DMAIRM or his designee or by subcontractors (when preparing software). The only exception to this is software registration and licensing information. Software registration and licensing information is maintained by the AMEC IT group.

#### 6.4.2.4 Software Test Tools

Software test tools are not used by CASTNET for software testing, with the exception of sample data sets. The software testing procedure is outlined in Sections 6.3.7 and 6.3.8.

#### 6.4.2.5 Software Design

Software design for CASTNET is an iterative process that actively involves the users of the CDMSA software. Software design changes to the database structure or to the MLM code are done solely by the DMAIRM or his designee, the only members of the DMC staff with rights to make these modifications.

**Software Design Methodology**

As indicated in the preceding section, the design methodology is an iterative process that involves active user feedback on the ergonomics and function of the software. A preliminary design is developed by the DMAIRM or his designee that indicates the functional performance requirements of the software, along with specific ergonomic requirements (if applicable). A beta version of the software is then prepared using the test data set. The beta version is reviewed by the DMC staff not involved in the software development effort. Once that review is complete and any changes or modifications are made and accepted, the software is then tested by a subset of the users to ensure that the performance and ergonomics are satisfactory. Changes made based on this feedback process are implemented, tested, and then returned to those users for final approval. Once final approval is provided, the software is placed into use.

**Programming Language**

The programming languages used are generally object-oriented, event-driven COTS software packages such as Microsoft® Visual Basic™.

**Interface Methodology**

The interface design is based on standard Microsoft® Windows® conventions coupled with an ergonomic review by a subset of users to make sure that the interface is intuitive and easy to use.

**Network Methodology**

No specific network methodology is required for CASTNET since the network topology for all applications is handled by AMEC's IT group. Prior to implementing any new software, the DOM or his designee confirms that the software operates correctly across AMEC's network.

#### 6.4.2.6 Software Design and Coding Standards

Software design and coding standards are consistent with standard Microsoft® Windows® coding standards and design criteria.

#### 6.4.2.7 Firmware

Program code for firmware is not developed for CASTNET by the DMC staff.

### 6.4.3 Software Configuration Management

AMEC uses a version control system for software configuration management.

#### 6.4.3.1 Configuration Identification

AMEC's DMC staff has implemented a version control system for all programs developed for CASTNET. The system is based on a decimal system. Major changes to programs result in a change to the number to the left of the decimal place (e.g., a major change would be from version 2.1 to 3.0). Changes that result in added capability or functionality, but do not represent a major program change, result in numeric changes to the right of the decimal place. For example, a change in capability to the application could result in a change from 3.0 to 3.1. Changes made to correct bugs or other minor glitches without a resulting functionality change (other than correcting the mistake) result in changes to the right of the decimal place, either as a second decimal (e.g., a change from 3.0.0 to 3.0.1) or at the hundreds decimal place (e.g., version 2.30 to version 2.31).

**Documentation Baselines**

Computer program code documentation is an important part of producing a high quality, replicable product. As a consequence, AMEC develops documentation for computer programmed systems (such as the CDMSA), as well as extensive comments within the program

code itself. Documentation within the program code ensures that future researchers and programmers can understand the code. Extensive documentation of the CDMSA was created during its initial development. Additional program code continues to be documented as it is developed. Documentation of the CDMSA also includes the database tables. The database tables and the data contained in them are also documented within the SQL Server™ database itself. Finally, significant program code changes were made to the MLM during 2000 and 2001. These program code changes were documented both on hard copy and within the code itself (via program code comments).

**Methods and Approach to Standards Implementation**

AMEC utilizes a decimal based version control system as its major configuration management approach. Methods for corroborating versions of the software and the approach to developing software standards implementation are controlled by the DMC staff.

### 6.4.3.2 Configuration Control

Since there is not a concurrent software development process (e.g., multiple programmers working on the same software), configuration control for programming is exercised by providing the most current version of the software to the programmer working on the system. The DMC provides the centralized check-in/check-out point for the most current version. For users, the DMC provides the most current version of the software for access to the database. Only the DMAIRM or his designee runs the MLM or modifies the program code, so check-in/check-out is controlled by the DMAIRM or his designee.

**Configuration Control Flow Diagram**

Not applicable.

**Forms**

No forms are currently used in the configuration management system.

**Storage and Release of Master Copies**

The DMAIRM or his designee stores and releases all master copies of the CDMSA, the databases, and the MLM.

### 6.4.3.3 Configuration Reviews

The DMC staff performs all configuration reviews prior to releasing updated versions of software, programs, or databases to users.

## 7.0 REFERENCES

AMEC E&I, Inc. (AMEC). 2011. *Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan, Revision* 8.0. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

U.S. Environmental Protection Agency (EPA). 1993. *EPA System Design and Development Guidance, Volumes A, B, and C.* EPA Directive 2182. http://www.epa.gov/irmpoli8/sysdsn/.

U.S. Environmental Protection Agency (EPA). 1990. *EPA Operation and Maintenance Manual.* EPA Directive 2181. http://www.epa.gov/irmpoli8/ommanl/.

## 8.0 ATTACHMENTS

This SMP does not contain attachments.

# TITLE: BASIC LOGGERNET OPERATIONS

Effective Date: 11-9-11

Prepared by: Christopher M. Rogers
Data Management, Analysis, Interpretation and Reporting Manager

Reviewed by: Marcus O. Stewart
Project QA Manager

Approved by: Holton K. Howell
Project Manager

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| Annual Review | | | |
|---|---|---|---|
| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Mgr | 10/26/12 | |
| MS | QA Mgr | 10/30/14 | |
| MS | QA Mgr | 10/22/15 | |
| | | | |

# BASIC LOGGERNET OPERATIONS

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide consistent guidance to MACTEC Engineering & Consulting. (MACTEC) Clean Air Status and Trends Network (CASTNET) Data Management Center (DMC) staff for the basic use of Campbell Scientific's LoggerNet polling Software.

## 2.0 SCOPE

These processes are applicable to the operation of LoggerNet, particularly focusing on the activities necessary to conduct basic tasks using the software including polling, adding sites, and simple troubleshooting.

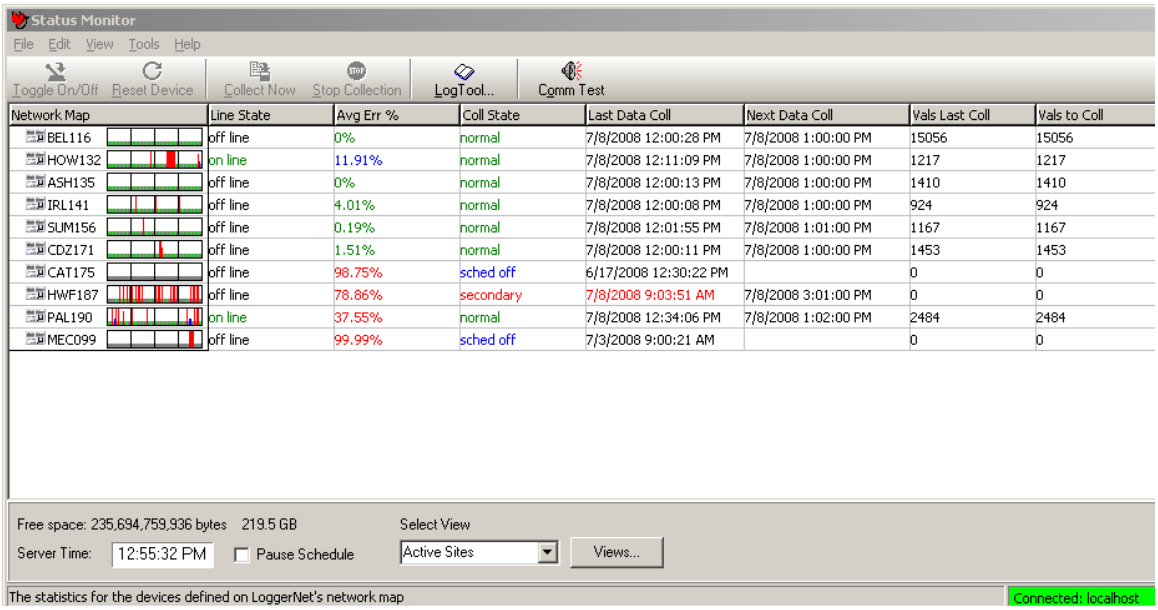
## 3.0 REPOLLING DATA

It will be largely unnecessary to have to repoll data anymore with the Campbell datalogger/Loggernet polling software combination. Currently, loggernet is programmed to poll each Campbell site hourly. If outside of this frequency of polling, repolling is still necessary the following steps can be performed:

- Go to the LoggerNetAdmin toolbar pictured below (Figure 1) and click on Status (third icon from the left).
- This will bring up the second screen pictured below (Figure 2) titled 'Status Monitor'. On this screen, review the information in the 'Coll State' column. A status of "normal" indicates that scheduled polling is occurring as expected. A status of "primary" (not shown on the screen) indicates a first failure in attempting to poll. A status of "secondary" indicates numerous failures in polling at the scheduled time.

**Figure 1**

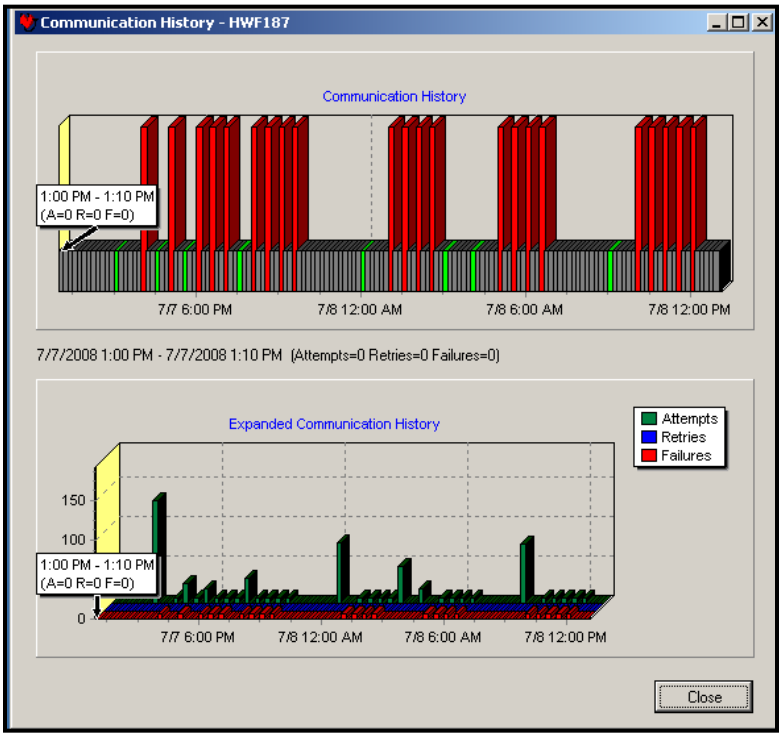
**Figure 2**




| Network Map | Line State | Avg Err % | Coll State | Last Data Coll | Next Data Coll | Vals Last Coll | Vals to Coll |
|---|---|---|---|---|---|---|---|
| BEL116 | off line | 0% | normal | 7/8/2008 12:00:28 PM | 7/8/2008 1:00:00 PM | 15056 | 15056 |
| HOW132 | on line | 11.91% | normal | 7/8/2008 12:11:09 PM | 7/8/2008 1:00:00 PM | 1217 | 1217 |
| ASH135 | off line | 0% | normal | 7/8/2008 12:00:13 PM | 7/8/2008 1:00:00 PM | 1410 | 1410 |
| IRL141 | off line | 4.01% | normal | 7/8/2008 12:00:08 PM | 7/8/2008 1:00:00 PM | 924 | 924 |
| SUM156 | off line | 0.19% | normal | 7/8/2008 12:01:55 PM | 7/8/2008 1:01:00 PM | 1167 | 1167 |
| CDZ171 | off line | 1.51% | normal | 7/8/2008 12:00:11 PM | 7/8/2008 1:00:00 PM | 1453 | 1453 |
| CAT175 | off line | 98.75% | sched off | 6/17/2008 12:30:22 PM | | 0 | 0 |
| HWF187 | off line | 78.86% | secondary | 7/8/2008 9:03:51 AM | 7/8/2008 3:01:00 PM | 0 | 0 |
| PAL190 | on line | 37.55% | normal | 7/8/2008 12:34:06 PM | 7/8/2008 1:02:00 PM | 2484 | 2484 |
| MEC099 | off line | 99.99% | sched off | 7/3/2008 9:00:21 AM | | 0 | 0 |

- When a site in the 'Network Map' column is highlighted by clicking on the site, the first three options (Toggle On/Off, Reset Device, Collect Now) on the menu bar will also be highlighted. Clicking on the 'Toggle On/Off' option will turn the highlighted site on or off from its scheduled polling depending on what the original polling state is at the time. For example, if site CAT175, which is scheduled off (not polling), is highlighted, then clicking the Toggle On/Off option will set site back on for polling again.
- Right clicking on any of the four boxes just to the right of the site ID also provides further information by bringing up a menu of other options. Some of these options are 'communication history' which lists the polling history for the site (see Figure 3). One can also 'collect now' from this feature.
- There are different views in the Status Monitor that can be accessed by clicking on the gray 'Views' button at the bottom right of this screen. The views can be customized for different users and can include different fields from the datalogger's data tables.
- The most straight forward way to repoll a site is to click on the Connect icon (second from the left on the LoggerNet Admin toolbar). The screen below will then come up (Figure 4). Highlight the site to be repolled and click 'connect'. Once connected, go to 'Data Collection' area of this screen and click 'Collect Now'. Figures 5 and 6 show an example of the Connect Screen when a site is connected and the results of repolling data from the site, respectively.

## Figure 3




## Figure 4

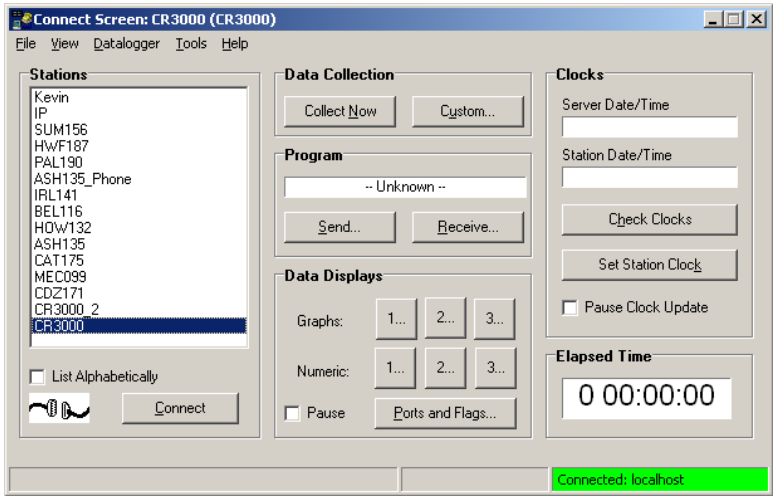


**Figure 5**

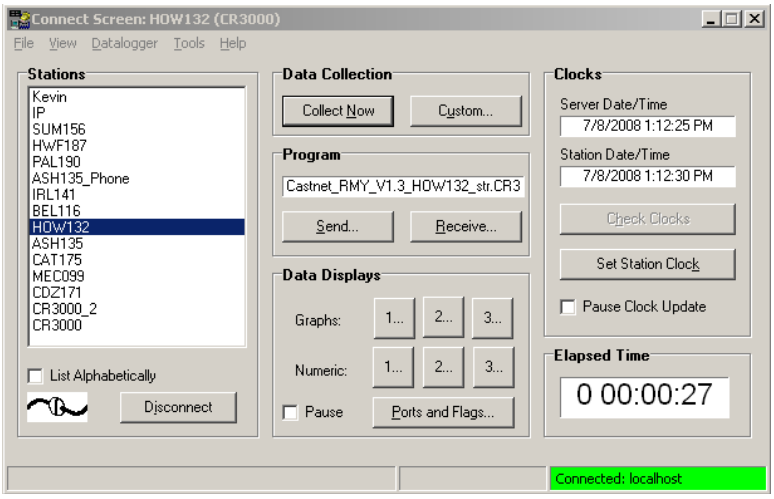
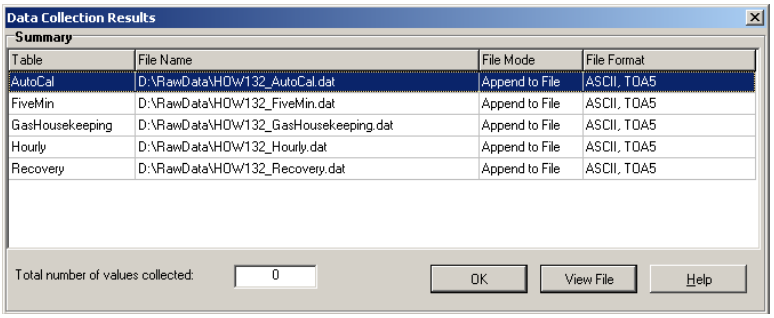


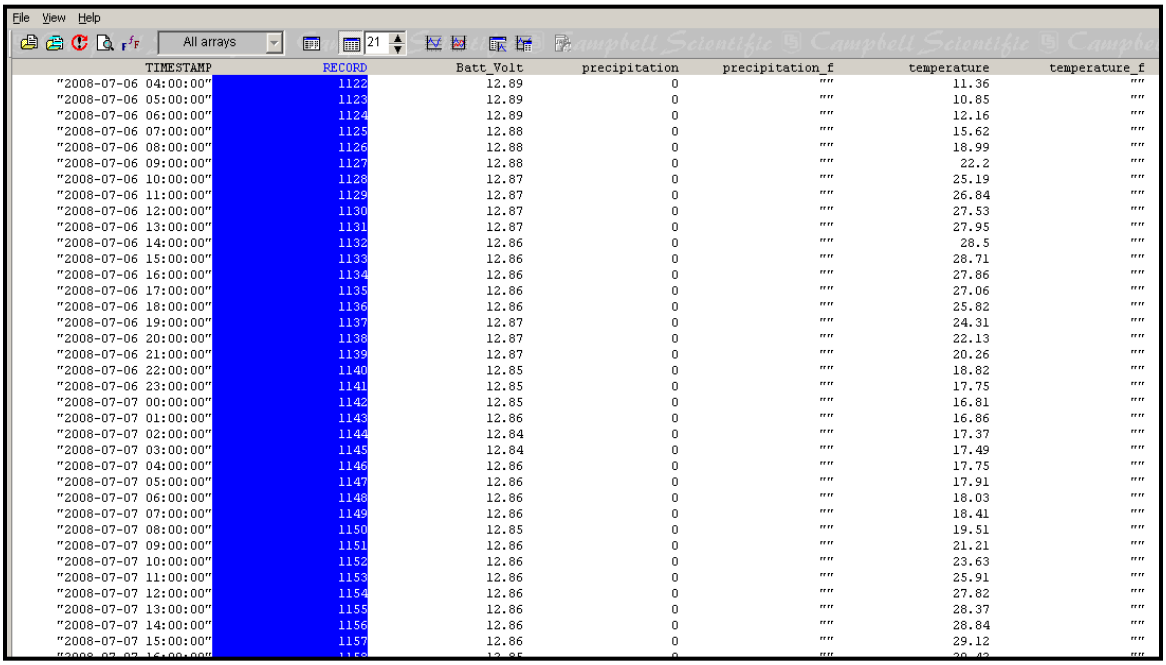

**Figure 6**




## 4.0 VIEWING DATA

- Click on the 'View' icon on the LoggerNet Admin toolbar. This will bring up the the list of sites and the type of data available for viewing.
- Click on the site and type of data to be viewed (hourly, five-minute, etc.). Figure 7 illustrates what an hourly data table looks like.

**Figure 7**


File View Help

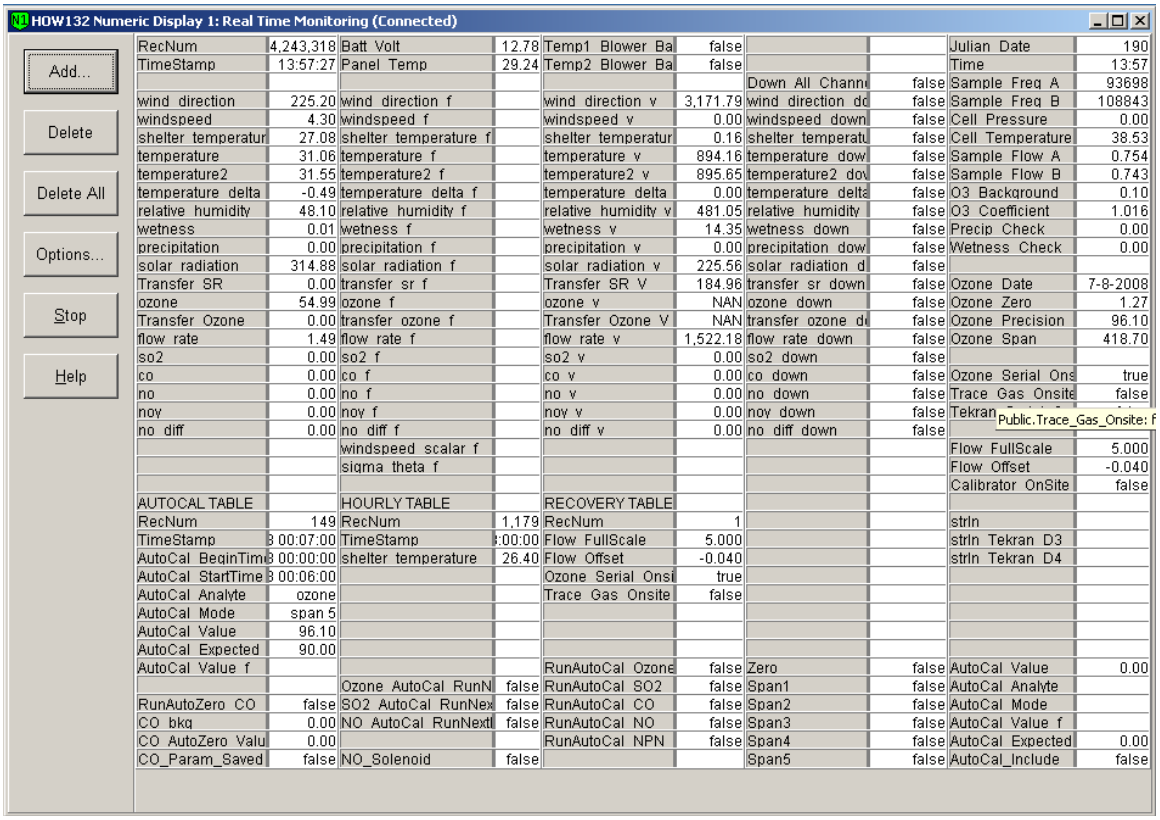
All arrays 21

| TIMESTAMP | RECORD | Batt_Volt | precipitation | precipitation_f | temperature | temperature_f |
|---|---|---|---|---|---|---|
| "2008-07-06 04:00:00" | 1122 | 12.89 | 0 | "" | 11.36 | "" |
| "2008-07-06 05:00:00" | 1123 | 12.89 | 0 | "" | 10.85 | "" |
| "2008-07-06 06:00:00" | 1124 | 12.89 | 0 | "" | 12.16 | "" |
| "2008-07-06 07:00:00" | 1125 | 12.88 | 0 | "" | 15.62 | "" |
| "2008-07-06 08:00:00" | 1126 | 12.88 | 0 | "" | 18.99 | "" |
| "2008-07-06 09:00:00" | 1127 | 12.88 | 0 | "" | 22.2 | "" |
| "2008-07-06 10:00:00" | 1128 | 12.87 | 0 | "" | 25.19 | "" |
| "2008-07-06 11:00:00" | 1129 | 12.87 | 0 | "" | 26.84 | "" |
| "2008-07-06 12:00:00" | 1130 | 12.87 | 0 | "" | 27.53 | "" |
| "2008-07-06 13:00:00" | 1131 | 12.87 | 0 | "" | 27.95 | "" |
| "2008-07-06 14:00:00" | 1132 | 12.86 | 0 | "" | 28.5 | "" |
| "2008-07-06 15:00:00" | 1133 | 12.86 | 0 | "" | 28.71 | "" |
| "2008-07-06 16:00:00" | 1134 | 12.86 | 0 | "" | 27.86 | "" |
| "2008-07-06 17:00:00" | 1135 | 12.86 | 0 | "" | 27.06 | "" |
| "2008-07-06 18:00:00" | 1136 | 12.86 | 0 | "" | 25.82 | "" |
| "2008-07-06 19:00:00" | 1137 | 12.87 | 0 | "" | 24.31 | "" |
| "2008-07-06 20:00:00" | 1138 | 12.87 | 0 | "" | 22.13 | "" |
| "2008-07-06 21:00:00" | 1139 | 12.87 | 0 | "" | 20.26 | "" |
| "2008-07-06 22:00:00" | 1140 | 12.85 | 0 | "" | 18.82 | "" |
| "2008-07-06 23:00:00" | 1141 | 12.85 | 0 | "" | 17.75 | "" |
| "2008-07-07 00:00:00" | 1142 | 12.85 | 0 | "" | 16.81 | "" |
| "2008-07-07 01:00:00" | 1143 | 12.86 | 0 | "" | 16.86 | "" |
| "2008-07-07 02:00:00" | 1144 | 12.84 | 0 | "" | 17.37 | "" |
| "2008-07-07 03:00:00" | 1145 | 12.84 | 0 | "" | 17.49 | "" |
| "2008-07-07 04:00:00" | 1146 | 12.86 | 0 | "" | 17.75 | "" |
| "2008-07-07 05:00:00" | 1147 | 12.86 | 0 | "" | 17.91 | "" |
| "2008-07-07 06:00:00" | 1148 | 12.86 | 0 | "" | 18.03 | "" |
| "2008-07-07 07:00:00" | 1149 | 12.86 | 0 | "" | 18.41 | "" |
| "2008-07-07 08:00:00" | 1150 | 12.85 | 0 | "" | 19.51 | "" |
| "2008-07-07 09:00:00" | 1151 | 12.86 | 0 | "" | 21.21 | "" |
| "2008-07-07 10:00:00" | 1152 | 12.86 | 0 | "" | 23.63 | "" |
| "2008-07-07 11:00:00" | 1153 | 12.86 | 0 | "" | 25.91 | "" |
| "2008-07-07 12:00:00" | 1154 | 12.86 | 0 | "" | 27.82 | "" |
| "2008-07-07 13:00:00" | 1155 | 12.86 | 0 | "" | 28.37 | "" |
| "2008-07-07 14:00:00" | 1156 | 12.86 | 0 | "" | 28.84 | "" |
| "2008-07-07 15:00:00" | 1157 | 12.86 | 0 | "" | 29.12 | "" |

## 5.0 UP CHANNELS THAT ARE DOWN IN ERROR

- Click on the 'Connect' icon on the LoggerNet Admin toolbar. This will bring up the 'Connect screen'.
- On the 'Connect Screen' go to the 'Data displays' area and click on 'Numeric display 1'.
- This will bring up the screen pictured below in Figure 8. The fourth column on this screen shows the status of the channel by listing the parameter and the word 'down'. The white column to the right of this will state either true or false. A false status indicates that the statement 'temperature down' is false. In other words, the temperature channel is not down.
- In order to down a channel go to the white status column and double click so the word true appears. This will then make the statement 'temperature down' a true statement.
- There is also a Down All Channels' option (the first option in this column) where all channels can be downed at once by double-clicking 'false' to 'true'.

**Figure 8**



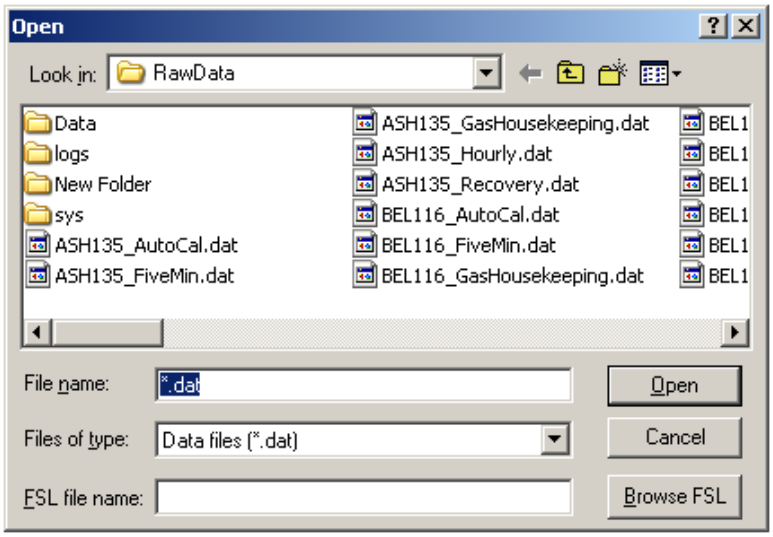

## 6.0 ENTERING NEW FULL SCALE AND ZERO VALUES FOR MFC

- New full scale and zero values for the mass flow controller can also be entered from the same numeric display screen as discussed above (Figure 8).
- On the fifth gray column, about halfway down, can be found a'Calibrator Onsite' entry. Set this statement to true by double-clicking on the white column to the right of this entry to make it read true.
- Highlight the white numeric field to the right of the 'Flow Fullscale' entry (two spaces above the 'calibrator onsite' entry) and type in the new full scale value.
- Highlight the white numeric field to the right of the 'Flow Offset' entry (one space above the 'calibrator onsite' entry) and type in the new zero value. Please note that even though the entry says 'offset', it is the zero value that is really implied.
- When finished updating the full scale and zero values, set the`calibrator onsite' entry back to false. If this is not done, all values will be flagged with a 'C' flag indicating ongoing calibration.

## 7.0 REVIEW 5-MINUTE AND HOURLY DATA VALUES

- On the LoggerNet Admin toolbar click on ‘View’.
- Next, click ‘File’ (upper left) and then ‘open’. This will bring up the screen below.
- Click on the desired data set to be viewed.

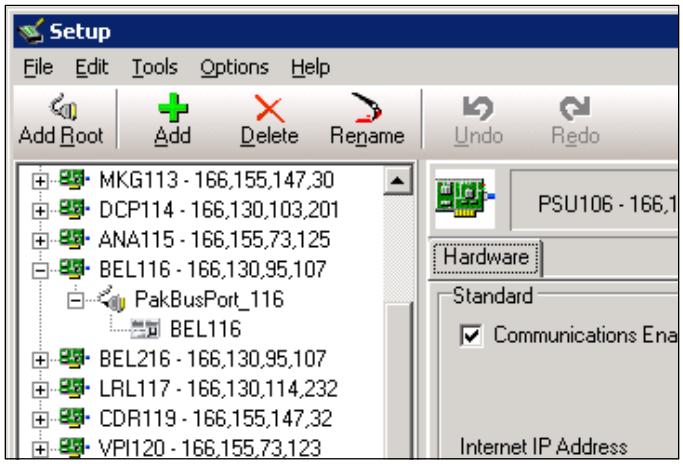
**Figure 9**




## 8.0 SET UP A NEW SITE IN LOGGERNET

- The first step in adding a new site is to launch the SETUP application from the Loggernet Toolbar (Figure 1).
- Shown in the upper left hand corner of Figure 10, click “Add Root” to open the add device Menu.

**Figure 10**



- To add a site using TCP/IP connectivity click “IPPort” (Figure 11). To add a site using a telephone modem connection click “ComPort”. Adding the root node opens the Add Device SubMenu (Figure 12). NOTE: The ComPorts and modems available to the server may already be present in the network tree. In this case, skip to creating a new “Phone Remote”.

**Figure 11**

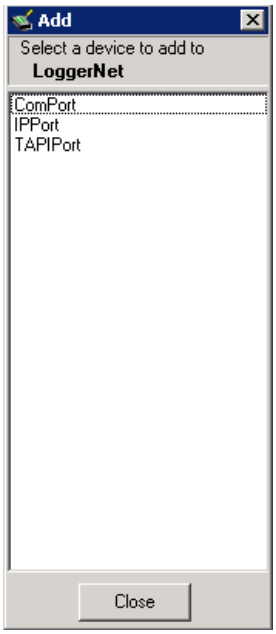
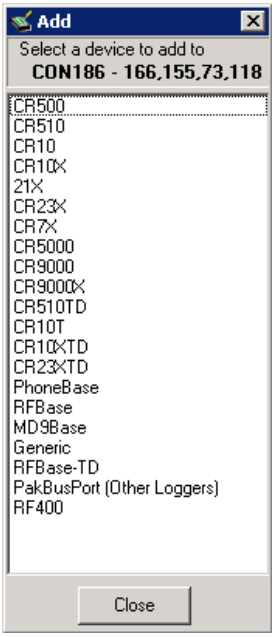



**Figure 12**



- The device selected from the SubMenu will be added below whichever node is selected in the network tree. The following figures show the correct hierarchy and naming schemes for TCP/IP (Figure 13) and modem connected sites (Figure 14).

**Figure 13**

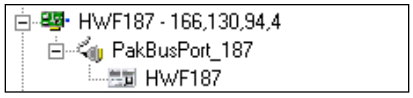
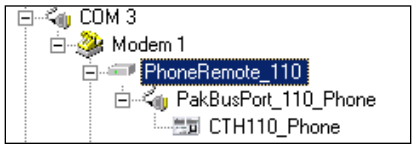
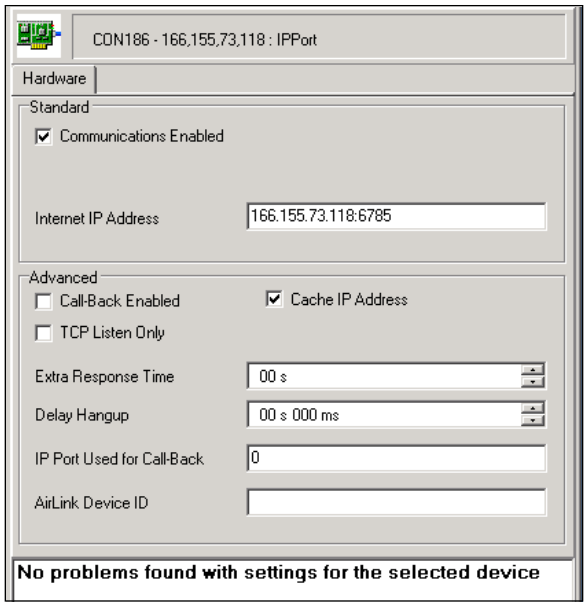



**Figure 14**



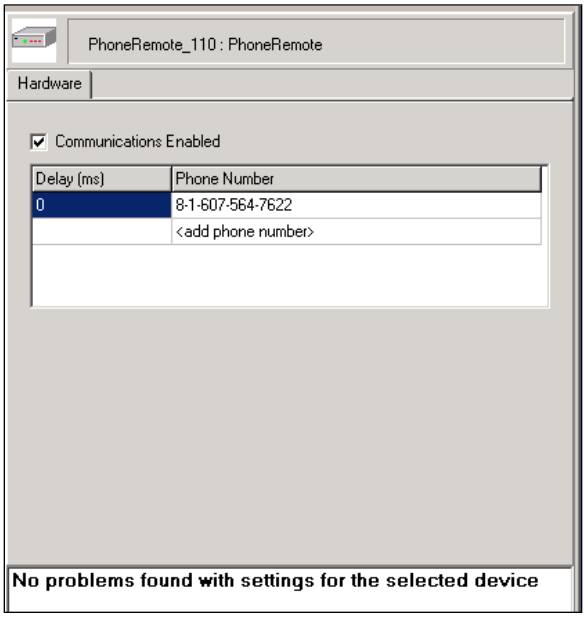

- Selecting the IPPort Root Node will display the configuration options tab show in Figure 15 below. The IP address and port (6785) should be added to the Internet IP Address line.

**Figure 15**



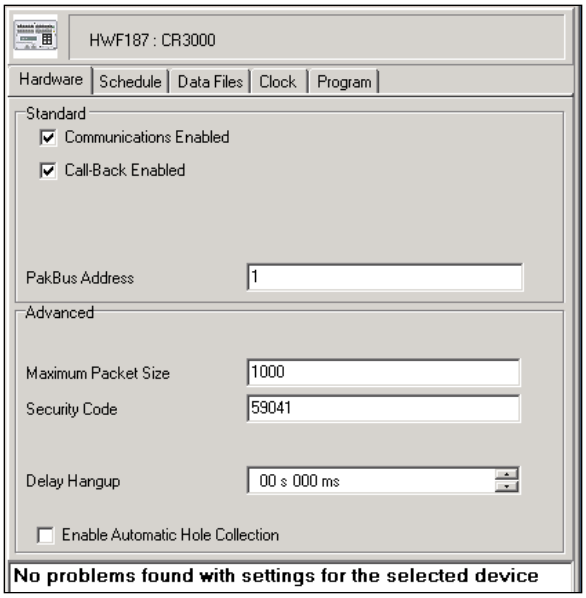

- Selecting the PhoneRemote Node will display the configuration options tab shown in Figure 16. The site phone number including any external dialing codes should be added to the Phone Number list. Some sites may require a delay to allow for remote switching networks.

**Figure 16**




- The PakBus Node does not require configuration changes for standard sites.
- Selecting the Site Datalogger Node displays the following configuration tabs (Figure 17). The Security Code for the site (59041) should be entered in the hardware tab.

**Figure 17**




- The data collection schedules and retry intervals are configured differently for TCP/IP and modem connected sites and are shown in the Figures 18 and 19, respectively.

**Figure 18**

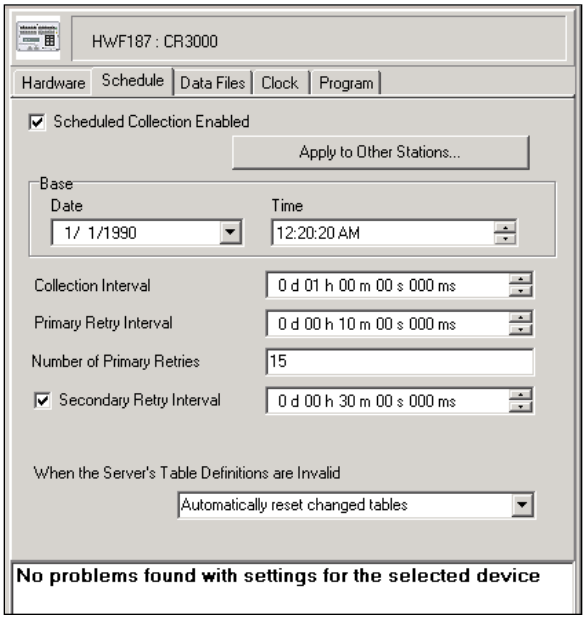
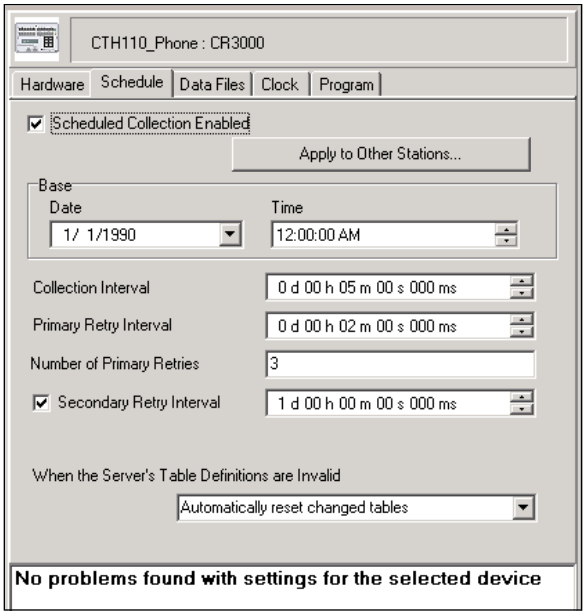
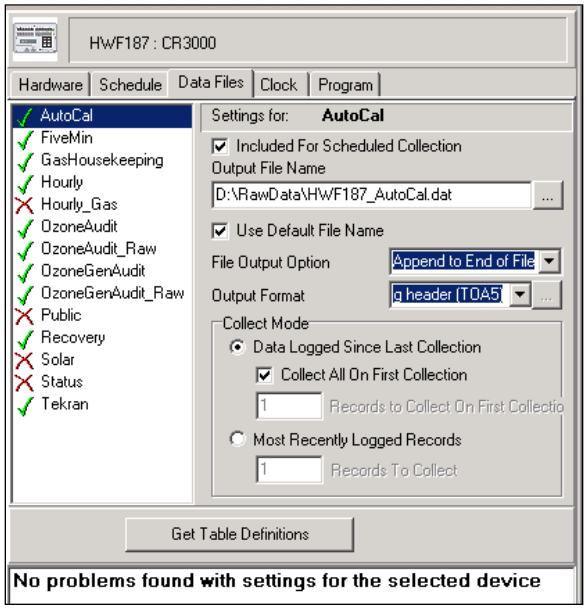



**Figure 19**



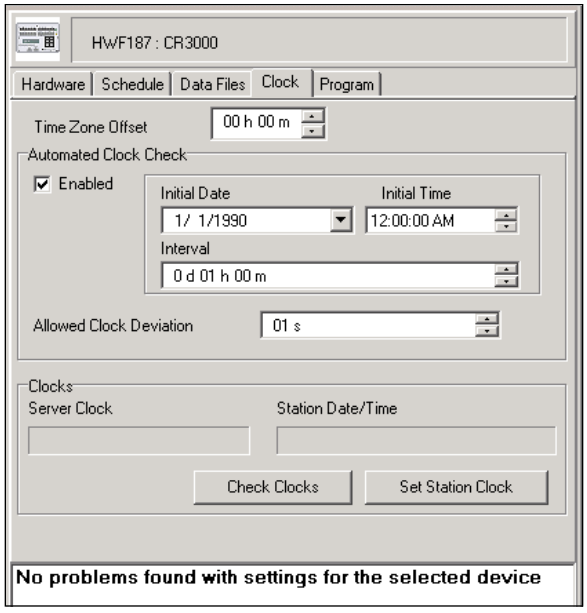

- The data tables collected will vary depending on the equipment operating at each site. An example of the selected tables is shown in the Figure 20. The Public and Status tables should always be disabled.

**Figure 20**




- The automated clock adjustment should be configured as shown in Figure 21 on the Clock tab.

**Figure 21**



# TITLE: DAILY DATA REVIEW

Effective Date: 11-9-11

Prepared by: Anna Karmazyn
Data Analyst

Anna Karmazyn

Selma Isil
Data Analyst

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Reviewed by: Marcus O. Stewart
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Holton K Howell

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|---|---|---|---|
| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Mgr | 10/6/12 | Marcus O. Stewart |
| MS | QA Mgr | 10/20/13 | Marcus O. Stewart |
| MS | QA Mgr | 10/22/14 | Marcus O. Stewart |
| | | | |
| | | | |

# DAILY DATA REVIEW

## 1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide consistent guidance to AMEC E&I, Inc. (AMEC) Clean Air Status and Trends Network (CASTNET) Data Management Center (DMC) personnel for daily review of polled continuous data.

## 2.0 SCOPE

The processes described in this SOP are applicable to the daily review of polled continuous data for purposes of determining possible problems with data collection and/or equipment at remote CASTNET sites.

## 3.0 SUMMARY

Performing daily review of the continuous polled data involves generating daily data reports from the CASTNET Data Management System Application (CDMSA) for all CASTNET sites for the date previous to the current date. Daily reports are generated for each site and then reviewed. Questionable or erroneous data and the time period are marked/noted on the relevant printout. After further review, suspect or erroneous data and the time period are entered into the CDMSA Observations Table for that site and date. Those observations/problems needing immediate attention are ticketed with a problem ticket and assigned to designated field operations personnel. Daily review also involves review of all problem tickets returned to data personnel for closure. The data analyst closes the ticket if data from the site indicate that the problem has been corrected. The data analyst may reassign the ticket to field operations personnel if the problem has not been resolved or may delay action pending further investigation.

## 4.0 MATERIALS

Laptop or personal computer
LoggerNet Software
CDMSA access

## 5.0 SAFETY

The same level of care and caution should be exercised while using the laptop/computer as would be taken when using any electrically powered device. Keep all cords out of walkways. If needed, use appropriately rated extension cords and surge protectors, and do not overload the electrical circuit. Keep liquids and food away from the computer and keyboard.

Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using the computer. Take breaks regularly to allow muscles to relax and to promote blood flow,

including standing up, briefly walking around the room, and stretching to counteract the repetitive motion activities and extended periods of sitting.

## 6.0 PROCEDURE

Daily data reports are generated and printed from the CDMSA. Select Met Data, Daily Review, and Daily Review Grid. Select Level 1 Table, all sites. Generate reports for the day previous to the current date by clicking the Do Report button on the upper right of the daily review grid. Figure 1 shows the daily review grid for site PSU106, PA, and Figure 2 shows a daily report generated for PSU106.

**Figure 1.** Daily Review Grid

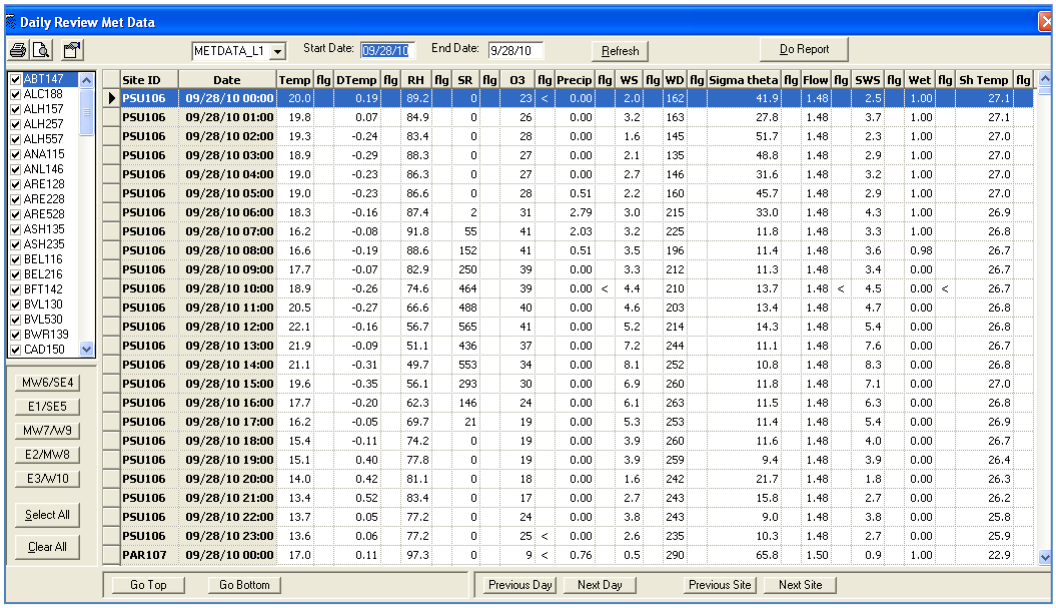
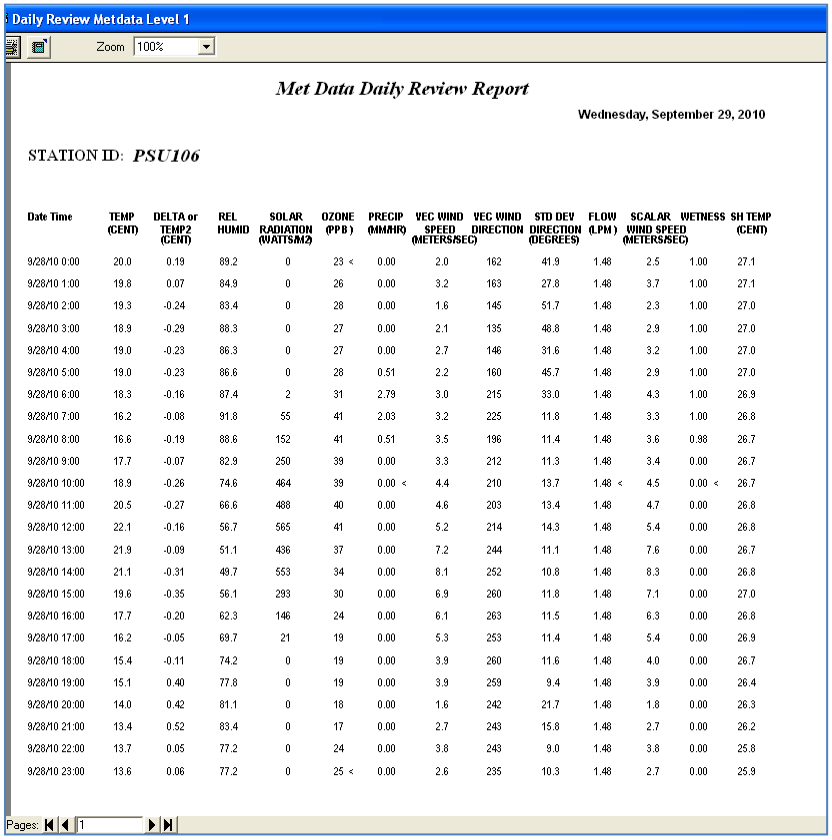


**Figure 2.** Daily Review Report



Daily Review Metdata Level 1

Zoom 100%

*Met Data Daily Review Report*

Wednesday, September 29, 2010

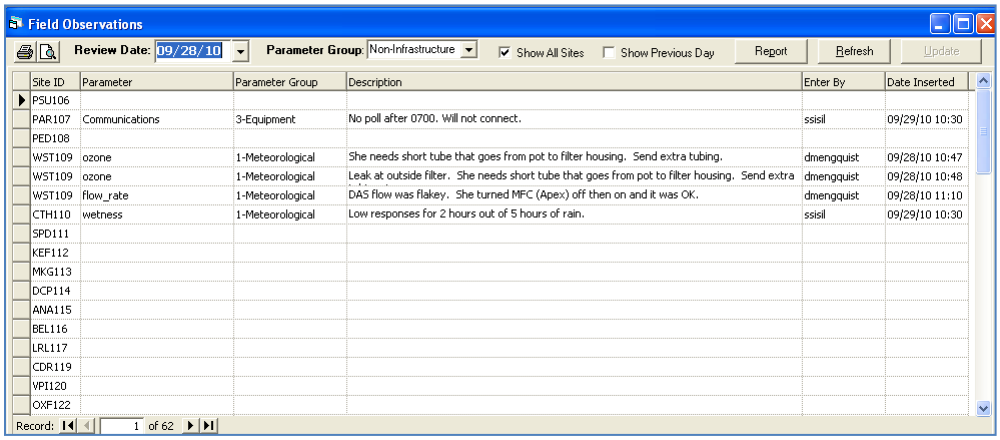
STATION ID: ***PSU106***

| Date Time | TEMP (CENT) | DELTA or TEMP2 (CENT) | REL HUMID | SOLAR RADIATION (WATTS/M2) | OZONE (PPB) | PRECIP (MM/HR) | VEC WIND SPEED (METERS/SEC) | VEC WIND DIRECTION | STD DEV DIRECTION (DEGREES) | FLOW (LPM) | SCALAR WIND SPEED (METERS/SEC) | WETNESS | SH TEMP (CENT) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/28/10 0:00 | 20.0 | 0.19 | 89.2 | 0 | 23 < | 0.00 | 2.0 | 162 | 41.9 | 1.48 | 2.5 | 1.00 | 27.1 |
| 9/28/10 1:00 | 19.8 | 0.07 | 84.9 | 0 | 26 | 0.00 | 3.2 | 163 | 27.8 | 1.48 | 3.7 | 1.00 | 27.1 |
| 9/28/10 2:00 | 19.3 | -0.24 | 83.4 | 0 | 28 | 0.00 | 1.6 | 145 | 51.7 | 1.48 | 2.3 | 1.00 | 27.0 |
| 9/28/10 3:00 | 18.9 | -0.29 | 88.3 | 0 | 27 | 0.00 | 2.1 | 135 | 48.8 | 1.48 | 2.9 | 1.00 | 27.0 |
| 9/28/10 4:00 | 19.0 | -0.23 | 86.3 | 0 | 27 | 0.00 | 2.7 | 146 | 31.6 | 1.48 | 3.2 | 1.00 | 27.0 |
| 9/28/10 5:00 | 19.0 | -0.23 | 86.6 | 0 | 28 | 0.51 | 2.2 | 160 | 45.7 | 1.48 | 2.9 | 1.00 | 27.0 |
| 9/28/10 6:00 | 18.3 | -0.16 | 87.4 | 2 | 31 | 2.79 | 3.0 | 215 | 33.0 | 1.48 | 4.3 | 1.00 | 26.9 |
| 9/28/10 7:00 | 16.2 | -0.08 | 91.8 | 55 | 41 | 2.03 | 3.2 | 225 | 11.8 | 1.48 | 3.3 | 1.00 | 26.8 |
| 9/28/10 8:00 | 16.6 | -0.19 | 88.6 | 152 | 41 | 0.51 | 3.5 | 196 | 11.4 | 1.48 | 3.6 | 0.98 | 26.7 |
| 9/28/10 9:00 | 17.7 | -0.07 | 82.9 | 250 | 39 | 0.00 | 3.3 | 212 | 11.3 | 1.48 | 3.4 | 0.00 | 26.7 |
| 9/28/10 10:00 | 18.9 | -0.26 | 74.6 | 464 | 39 | 0.00 < | 4.4 | 210 | 13.7 | 1.48 < | 4.5 | 0.00 < | 26.7 |
| 9/28/10 11:00 | 20.5 | -0.27 | 66.6 | 488 | 40 | 0.00 | 4.6 | 203 | 13.4 | 1.48 | 4.7 | 0.00 | 26.8 |
| 9/28/10 12:00 | 22.1 | -0.16 | 56.7 | 565 | 41 | 0.00 | 5.2 | 214 | 14.3 | 1.48 | 5.4 | 0.00 | 26.8 |
| 9/28/10 13:00 | 21.9 | -0.09 | 51.1 | 436 | 37 | 0.00 | 7.2 | 244 | 11.1 | 1.48 | 7.6 | 0.00 | 26.7 |
| 9/28/10 14:00 | 21.1 | -0.31 | 49.7 | 553 | 34 | 0.00 | 8.1 | 252 | 10.8 | 1.48 | 8.3 | 0.00 | 26.8 |
| 9/28/10 15:00 | 19.6 | -0.35 | 56.1 | 293 | 30 | 0.00 | 6.9 | 260 | 11.8 | 1.48 | 7.1 | 0.00 | 27.0 |
| 9/28/10 16:00 | 17.7 | -0.20 | 62.3 | 146 | 24 | 0.00 | 6.1 | 263 | 11.5 | 1.48 | 6.3 | 0.00 | 26.8 |
| 9/28/10 17:00 | 16.2 | -0.05 | 69.7 | 21 | 19 | 0.00 | 5.3 | 253 | 11.4 | 1.48 | 5.4 | 0.00 | 26.9 |
| 9/28/10 18:00 | 15.4 | -0.11 | 74.2 | 0 | 19 | 0.00 | 3.9 | 260 | 11.6 | 1.48 | 4.0 | 0.00 | 26.7 |
| 9/28/10 19:00 | 15.1 | 0.40 | 77.8 | 0 | 19 | 0.00 | 3.9 | 259 | 9.4 | 1.48 | 3.9 | 0.00 | 26.4 |
| 9/28/10 20:00 | 14.0 | 0.42 | 81.1 | 0 | 18 | 0.00 | 1.6 | 242 | 21.7 | 1.48 | 1.8 | 0.00 | 26.3 |
| 9/28/10 21:00 | 13.4 | 0.52 | 83.4 | 0 | 17 | 0.00 | 2.7 | 243 | 15.8 | 1.48 | 2.7 | 0.00 | 26.2 |
| 9/28/10 22:00 | 13.7 | 0.05 | 77.2 | 0 | 24 | 0.00 | 3.8 | 243 | 9.0 | 1.48 | 3.8 | 0.00 | 25.8 |
| 9/28/10 23:00 | 13.6 | 0.06 | 77.2 | 0 | 25 < | 0.00 | 2.6 | 235 | 10.3 | 1.48 | 2.7 | 0.00 | 25.9 |

Pages: 1

Review data from each site, and record any data anomalies or problems related to communication and missing data in the Field Observations Table in the CDMSA by selecting Field, Problem Tracking System, Observations, and Enter Observations. This will give you the table depicted in Figure 3.

**Figure 3.** Field Observations Entry Table



Field Observations

Review Date: 09/28/10 Parameter Group: Non-Infrastructure Show All Sites Show Previous Day Report Refresh Update

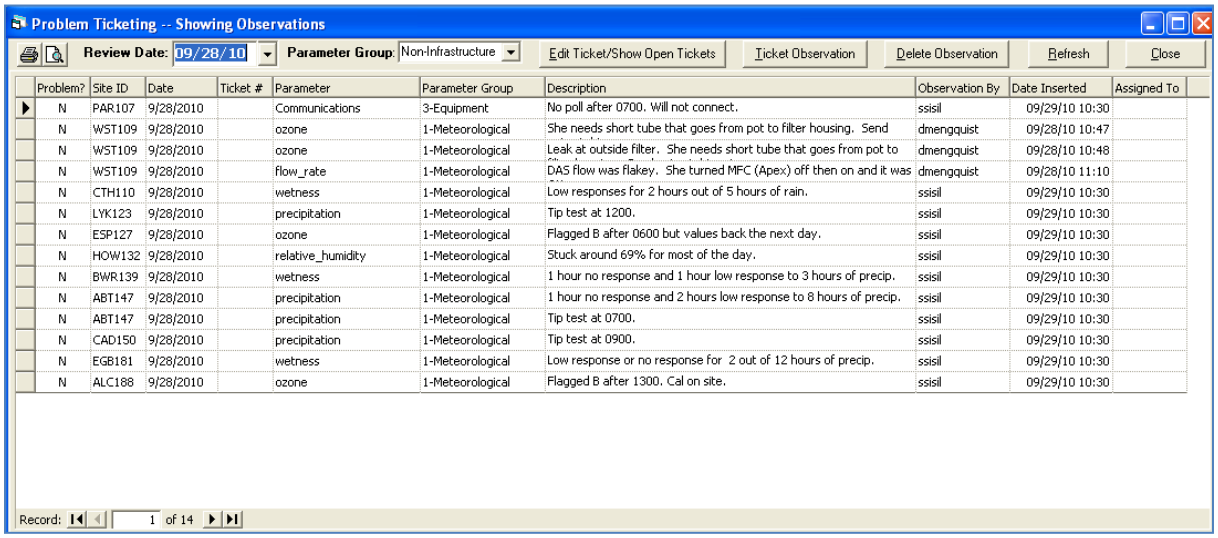
| Site ID | Parameter | Parameter Group | Description | Enter By | Date Inserted |
|---|---|---|---|---|---|
| PSU106 | | | | | |
| PAR107 | Communications | 3-Equipment | No poll after 0700. Will not connect. | ssisil | 09/29/10 10:30 |
| PED108 | | | | | |
| WST109 | ozone | 1-Meteorological | She needs short tube that goes from pot to filter housing. Send extra tubing. | dmengquist | 09/28/10 10:47 |
| WST109 | ozone | 1-Meteorological | Leak at outside filter. She needs short tube that goes from pot to filter housing. Send extra | dmengquist | 09/28/10 10:48 |
| WST109 | flow_rate | 1-Meteorological | DAS flow was flakey. She turned MFC (Apex) off then on and it was OK. | dmengquist | 09/28/10 11:10 |
| CTH110 | wetness | 1-Meteorological | Low responses for 2 hours out of 5 hours of rain. | ssisil | 09/29/10 10:30 |
| SPD111 | | | | | |
| KEF112 | | | | | |
| MKG113 | | | | | |
| DCP114 | | | | | |
| ANA115 | | | | | |
| BEL116 | | | | | |
| LRL117 | | | | | |
| CDR119 | | | | | |
| YPI120 | | | | | |
| OXF122 | | | | | |

Record: 1 of 62

After all observations have been entered, click on the Update button at the upper right corner of the observation table entry screen to save all entries.

To open or submit a problem ticket, show observations by selecting Field, Problem Tracking System, Problem Ticketing. This screen will display all observations entered for a selected day (Figure 4). No sites displayed in Figure 4 currently have problem tickets pending. To create or edit a problem ticket, double-click the gray square to the extreme left of the observation to be ticketed to bring up the Create/Edit Tickets screen (Figure 5). Take care not to open multiple tickets for the same site and observation.

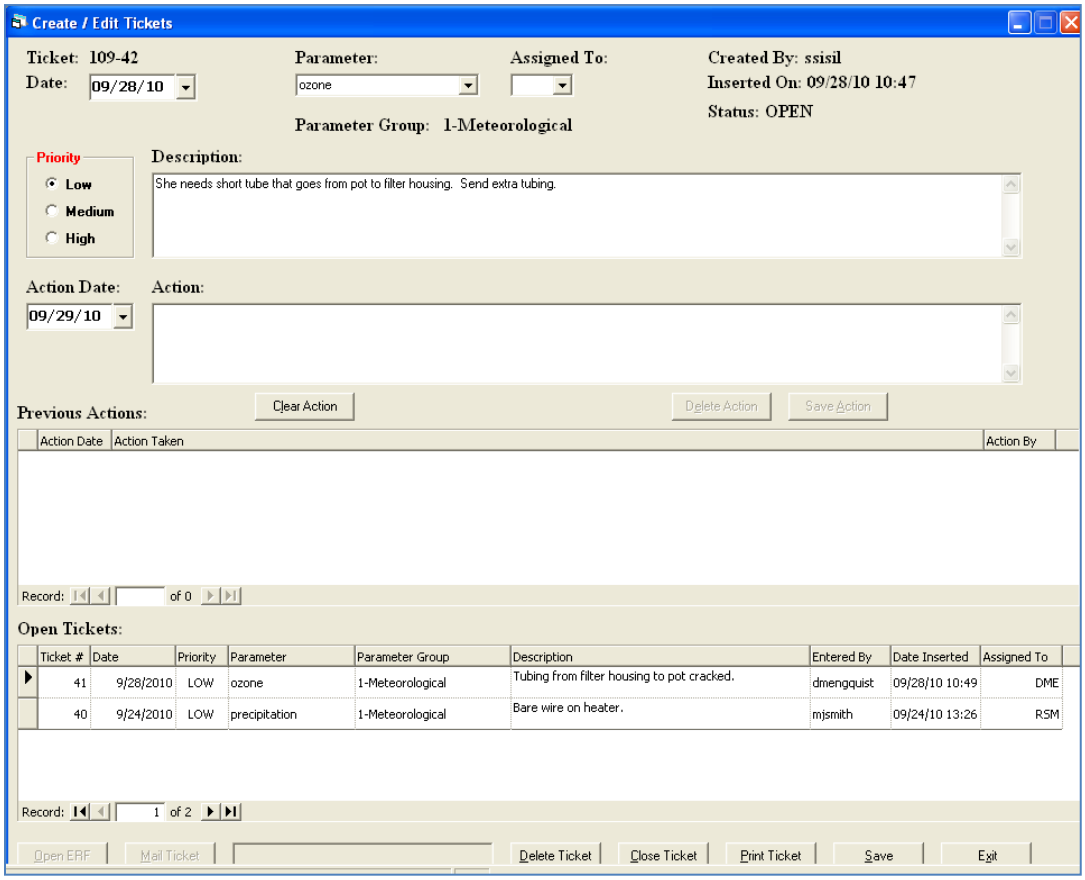
**Figure 4.** Problem Ticketing – Show Observations




| Problem? | Site ID | Date | Ticket # | Parameter | Parameter Group | Description | Observation By | Date Inserted | Assigned To |
|---|---|---|---|---|---|---|---|---|---|
| N | PAR107 | 9/28/2010 | | Communications | 3-Equipment | No poll after 0700. Will not connect. | ssisil | 09/29/10 10:30 | |
| N | WST109 | 9/28/2010 | | ozone | 1-Meteorological | She needs short tube that goes from pot to filter housing. Send | dmengquist | 09/28/10 10:47 | |
| N | WST109 | 9/28/2010 | | ozone | 1-Meteorological | Leak at outside filter. She needs short tube that goes from pot to | dmengquist | 09/28/10 10:48 | |
| N | WST109 | 9/28/2010 | | flow_rate | 1-Meteorological | DAS flow was flakey. She turned MFC (Apex) off then on and it was | dmengquist | 09/28/10 11:10 | |
| N | CTH110 | 9/28/2010 | | wetness | 1-Meteorological | Low responses for 2 hours out of 5 hours of rain. | ssisil | 09/29/10 10:30 | |
| N | LYK123 | 9/28/2010 | | precipitation | 1-Meteorological | Tip test at 1200. | ssisil | 09/29/10 10:30 | |
| N | ESP127 | 9/28/2010 | | ozone | 1-Meteorological | Flagged B after 0600 but values back the next day. | ssisil | 09/29/10 10:30 | |
| N | HOW132 | 9/28/2010 | | relative_humidity | 1-Meteorological | Stuck around 69% for most of the day. | ssisil | 09/29/10 10:30 | |
| N | BWR139 | 9/28/2010 | | wetness | 1-Meteorological | 1 hour no response and 1 hour low response to 3 hours of precip. | ssisil | 09/29/10 10:30 | |
| N | ABT147 | 9/28/2010 | | precipitation | 1-Meteorological | 1 hour no response and 2 hours low response to 8 hours of precip. | ssisil | 09/29/10 10:30 | |
| N | ABT147 | 9/28/2010 | | precipitation | 1-Meteorological | Tip test at 0700. | ssisil | 09/29/10 10:30 | |
| N | CAD150 | 9/28/2010 | | precipitation | 1-Meteorological | Tip test at 0900. | ssisil | 09/29/10 10:30 | |
| N | EGB181 | 9/28/2010 | | wetness | 1-Meteorological | Low response or no response for 2 out of 12 hours of precip. | ssisil | 09/29/10 10:30 | |
| N | ALC188 | 9/28/2010 | | ozone | 1-Meteorological | Flagged B after 1300. Cal on site. | ssisil | 09/29/10 10:30 | |

In Figure 5, the WST109, NH site is assigned a problem ticket of low priority, which is the default priority. The site operator needs extra tubing for the ozone analyzer. The WST109 site number is combined with next sequential problem ticket number to form the unique problem ticket identification number (109-42) that can be tracked in the CDMSA. The ticket depicted in Figure 5 will be assigned to a technician from the field operations group who will address the problem. The data analyst assigning the ticket will verify that all pertinent fields have been completed and will then e-mail the new problem ticket to the field operations staff member assigned to handle the ticket. The Create/Edit Problem ticket screen also displays open tickets in the section at the bottom of the screen.

**Figure 5.** Create/Edit Problem Ticket Screen




## 6.1 Daily Data Review Items by Parameter

### 6.1.1 Temperature

Temperature is collected by probes installed at 9 meters (m) and 2 m. Temperature data typically vary diurnally and are related to solar radiation intensity, and season of the year. Errors in instrument operation can result in an erratic pattern, such as changes of ± 4 or more degrees Celsius (°C) between consecutive hours; values out of range (-50 °C and + 50 °C); or indications of a blower malfunction, which should be identified with a "W" flag.

### 6.1.2 Delta temperature

Delta temperature is recorded as a difference in the temperatures collected by the 9m and 2m temperature probes. Diurnal patterns of warming and cooling should be displayed as positive values at night and negative or relatively smaller positive values at midday. The diurnal pattern is usually related to cloud cover, solar radiation intensity, hours of precipitation, and wind speed. Possible errors could result in an opposite pattern or values exceeding a reasonable range (± 5 °C). The usual range of delta temperature is between +3 °C and -3 °C. Values approaching -3 °C during the midday hours might indicate a lower blower malfunction. Again, a "W" flag should be used to indicate blower malfunction. During hours with precipitation, delta

temperature values should decrease and stay close to 0 °C. High albedo conditions, such as the presence of ground level snow, can also result in an unusual delta temperature pattern – usually as positive values all 24 hours.

### 6.1.3 Relative Humidity

Relative humidity readings show a diurnal pattern influenced by solar radiation, precipitation, and seasonal changes. Readings are usually higher at night and lower at midday. Look for a uniform increase and decrease in hourly values with higher values during precipitation. Extended time periods where values are at full scale and not corresponding to solar radiation or precipitation could indicate sensor oversaturation or other problem. Check for the opposite pattern during time periods with low values when precipitation and wetness are recorded, and solar radiation values are low. Check for values outside of the range of 0 to 100 percent.

### 6.1.4 Solar Radiation

Solar radiation values should be zero, or close to zero, at night and positive during the day. Values outside of ±13 watts per square meter ($W/m^2$) at night should be reported as invalid. In general, values up to 1,100 $W/m^2$ are considered reasonable. Values above 1,100 $W/m^2$ could be recorded at sites located at low latitudes. High values approaching full scale (1,394 $W/m^2$) usually indicate a problem. Solar radiation sensors are often damaged by lightning or can go out of level.

### 6.1.5 Ozone

Ozone data reflect a diurnal pattern and seasonal changes. Check that the daily auto zero, span, and precision results are within acceptance criteria and that hours 00:00 and 23:00 are flagged with "<" to indicate that an auto zero, span, and precision check was conducted during those hours. Check for a sudden increase or decrease of ± 25 parts per billion (ppb) between two consecutive hours, spikes, gradual decrease in values, and steady low levels not related to precipitation or high relative humidity. Check for an erratic pattern with intermittent spikes or very high values. Values ± 75 ppb should be evaluated by the QA Manager.

### 6.1.6 Precipitation

Precipitation should be accompanied by high relative humidity values, low solar radiation values, and a wetness response greater than 0.50 volts direct current (VDC). Precipitation values that show no relationship to these three parameters might indicate malfunction of the tipping bucket. Snow collection and recording of melted snow might be delayed, as snow must be melted by the tipping bucket heater. Winter precipitation recorded during midday with low relative humidity values might indicate a malfunction of the heater. Values of 2 inches or greater should be verified for reasonableness.

### 6.1.7 Vector Wind Direction and Sigma Theta

Check for extended periods with values indicating no movement of the sensor. Usually sigma theta will also be affected and recorded as a very low value or zero. The wind direction sensor could be damaged or restricted in movement by freezing precipitation.

### 6.1.8 Vector Wind Speed and Scalar Wind Speed

Check for hours when scalar wind speed is lower than vector wind speed by 0.2 meters per second (m/s) or more. Check for extensive time periods when wind speed is recorded as the same value, usually low speeds near zero. The wind speed sensor could be damaged or restricted in movement by freezing precipitation. Crosscheck all four wind parameters for reasonable responses; higher wind speeds should result in fewer changes in wind direction and lower sigma theta values. Low wind speeds will generate the opposite pattern. Some exceptions to this might occur at sites that experience very calm conditions at night.

### 6.1.9 Flow

Check for any variations of ± 5 percent of flow rates of 1.50 liters per minute (lpm) and 3.0 lpm. Check for steady fluctuations. These patterns might indicate a restriction in the flow system. The system should be checked for leaks and to ensure that the Balston filter and all tubing are free of restrictions. During winter conditions, ice might be present inside flow tubing. Additionally, flow data are inaccurate if updated full-scale and zero offset values are not properly entered after an on-site calibration. Improper values will be manifested as a sudden change in flow rate after a calibration event.

### 6.1.10 Wetness

Wetness readings should be recorded with a value of 1.0 during precipitation or at night during periods of high relative humidity. As wetness sensor sensitivity is of rather poor quality, there will be instances of the wetness sensor's deteriorating response (e.g., going to zero) during prolonged hours of precipitation. High wind speeds will also affect wetness sensor response as the surface of the sensor dries more quickly. Check for extended periods when the sensor reads full scale during conditions not related to precipitation or reads zero when precipitation and high relative humidity are present. Wetness sensor response at the beginning of the winter season is usually recorded at midday when solar radiation serves as a natural heater to melt away the frost. After the wetness sensor is covered by snow, it will maintain a reading of zero or full scale until the snow melts away.

### 6.1.11 Shelter Temperature

Check for values out of the acceptance range of < 18 °C and > 32 °C. Notify field operations personnel when the shelter temperature values are approaching the low or high range.

### 6.1.12 General

Every Tuesday, site operators perform weekly site condition and instrument checks. Data generated the next day may include a "<" or "B" flag for one hour or more for all or some channels after being returned to operational. Data recorded as null with B status flags require that the data analyst calls the site's data logger and corrects the status since the B flag may indicate that a channel was left down in error by the site operator after the weekly checks were completed.

### 6.1.13 Power failure:

A power failure is not flagged "F" across the channels. It is detected by a combination of ozone values flagged B, temperature and delta temperature flagged W, and flow recorded with zero offset value or any low value and null status. This combination might have some variations as a result of data logger errors.

## 7.0 REFERENCES

AMEC E&I, Inc. (AMEC). 2011. *Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan, Revision* 8.0. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

## 8.0 ATTACHMENTS

Attachment A: Example of E-mail Documentation

From: Rogers, Christopher
Sent: Wednesday, November 04, 2009 2:45 PM
To: Rogers, Christopher; 'Cohen.Michael@epamail.epa.gov'; 'Lear.Gary@epamail.epa.gov'; 'Lee.Brian@epa.gov'; 'Melissa Rury'
Cc: Stewart, Marcus; Howell, Kemp
Subject: October 2009 and Q2 2009 data submittals

Michael,

Today, I loaded the October 2009 and Q2 2009 data submittals into your CASTNETUPDATE and CASTNETSCRATCH schemas. I entered corresponding records into the TABLE_UPDATE tables.

Notes:
1) This submittal includes sites from groups E1 (East 1) and SE5 (Southeast 5).

Thanks,
Chris

Here is a summary of what has been loaded:

Appends:

CALIBRATION_SUMMARY - 60 records
(Q2 2009)

DRYCHEM - 334 records
(Group E1, SE5 data submittal for Feb 2008 - Jul 2009, NPS data submittal for Jun 2009.)

FILTER_PACK - 334 records
(Group E1, SE5 data submittal for Feb 2008 - Jul 2009, NPS data submittal for Jun 2009.)

GAS_CALIBRATION - 5286 records
(Sep 2009)

LABDATA - 13772 records
(Q2 2009)

LABDATA_QC - 5921 records
(Q2 2009)

SAMPLE_REFERENCE - 3373 records
(Q2 2009)

Updates:

METDATA - 53568 records
(Group E1, SE5 data submittal for Feb 2008 - Jul 2009, NPS data submittal for Jun 2009.)

SITE_OPERATOR - 106 records
(current as 11/1/09)

# TITLE: REVIEW OF OZONE DATA USING iCASTNET

Effective Date: 10/30/14

Prepared by: Christopher M. Rogers
Data Management, Analysis, Interpretation, and Reporting Manager

Reviewed by: Marcus O. Stewart
Project QA Manager

Approved by: Holton K. Howell
Project Manager

## TABLE OF CONTENTS

1.0 Purpose
2.0 Scope
3.0 Summary
4.0 Materials
5.0 Safety
6.0 Procedures
7.0 References
8.0 Attachments

| Annual Review | | | |
|---|---|---|---|
| Reviewed by: | Title: | Date: | Signature: |
| MS | QA Mgr | 10/22/15 | |
| | | | |
| | | | |
| | | | |
| | | | |

# REVIEW OF OZONE DATA USING iCASTNET

## 1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide consistent guidance to AMEC Environment & Infrastructure (AMEC) Clean Air Status and Trends Network (CASTNET) Data Management Center (DMC) personnel in the use of the iCASTNET system and related information for review of ozone data.

## 2.0 SCOPE

The processes described in this SOP are applicable to the use of the iCASTNET system and other information for review of continuous data for purposes of determining possible problems with ozone data collection and/or equipment at remote CASTNET sites.

## 3.0 SUMMARY

The iCASTNET system is a web-based information portal that disseminates and displays ozone data. Data analysts receive daily email notifications regarding questionable or erroneous data from the previous day. The email notification contains a detailed report of the data in question. A link is provided in body of the notification to the Ozone Review Dashboard. The dashboard enables team members to review factors related to ozone in real time. Analysts generate custom reports using the reporting tool contained in the iCASTNET system.

## 4.0 MATERIALS

Laptop or personal computer
Microsoft Internet Explorer Version 7 or higher
Microsoft Silverlight 4
iCASTNET access

## 5.0 SAFETY

The same level of care and caution should be exercised while using the laptop/computer as would be taken when using any electrically powered device. Keep all cords out of walkways. If needed, use appropriately rated extension cords and surge protectors, and do not overload the electrical circuit. Keep liquids and food away from the computer and keyboard.

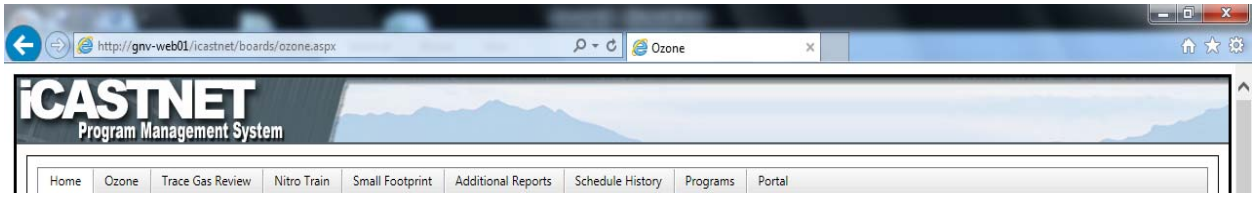
Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using the computer. Take breaks regularly to allow muscles to relax and to promote blood flow, including standing up, briefly walking around the room, and stretching to counteract the repetitive motion activities and extended periods of sitting.

# 6.0 PROCEDURES

## 6.1 Logging In

To access the program, open iCASTNET from your browser http://gnv-web01/icastnet. The iCASTNET Main Menu will be at the top of the page.

**Figure 1.** iCASTNET Main Menu




The screen lists nine tabs that can be clicked to perform various tasks:

- Home
- Ozone
- Trace Gas Review
- Nitro Train
- Small Footprint
- Additional Reports
- Schedule History
- Programs
- Portal

The screen will be updated based on the tab clicked.

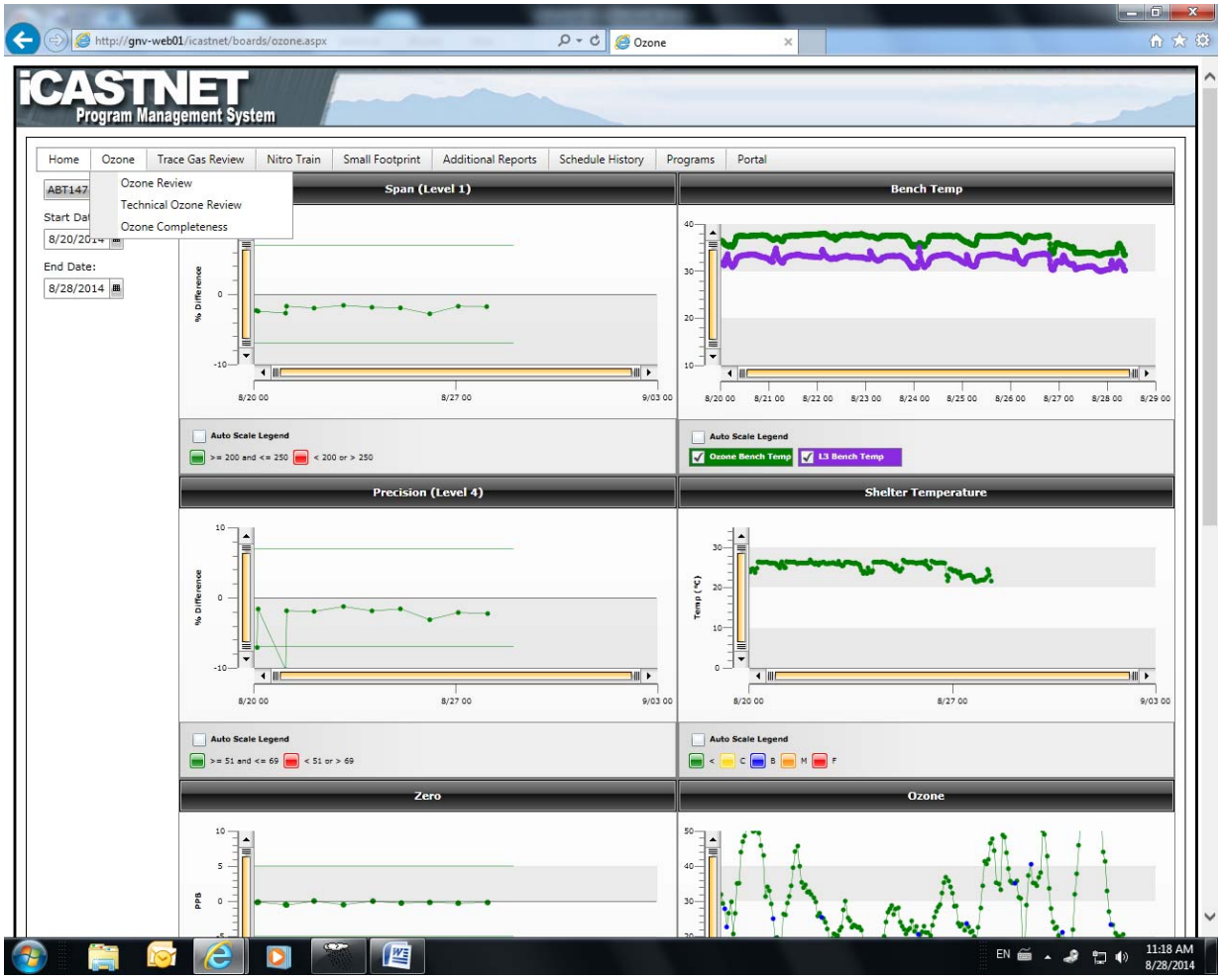
## 6.2 iCASTNET Ozone Review

Open iCASTNET and click the Ozone tab on the iCASTNET Main Menu to display detailed ozone information. Ozone tab has three options:

- Ozone Review
- Technical Ozone Review
- Ozone Completeness

The system enables data analysts to query ozone information by site and date.

**Figure 2.** Ozone Review




The Ozone Review figure shows example times series of percent differences of span, precision and zero levels. Figure 2 also shows time series of bench temperatures for the site and transfer $O_3$ analyzers. The figure shows shelter temperature and actual $O_3$ concentrations. Acceptance limits for span are ± 7% of 225 ppb expected. Acceptance limit for precision are ± 7% of 60 ppb expected. Zero acceptance limits are ± 5 ppb. The acceptance range for bench temperature is 24°C to 40°C; and the acceptance range for shelter temperature is 20°C to 30°C.

**Figure 3**. Technical Ozone Review

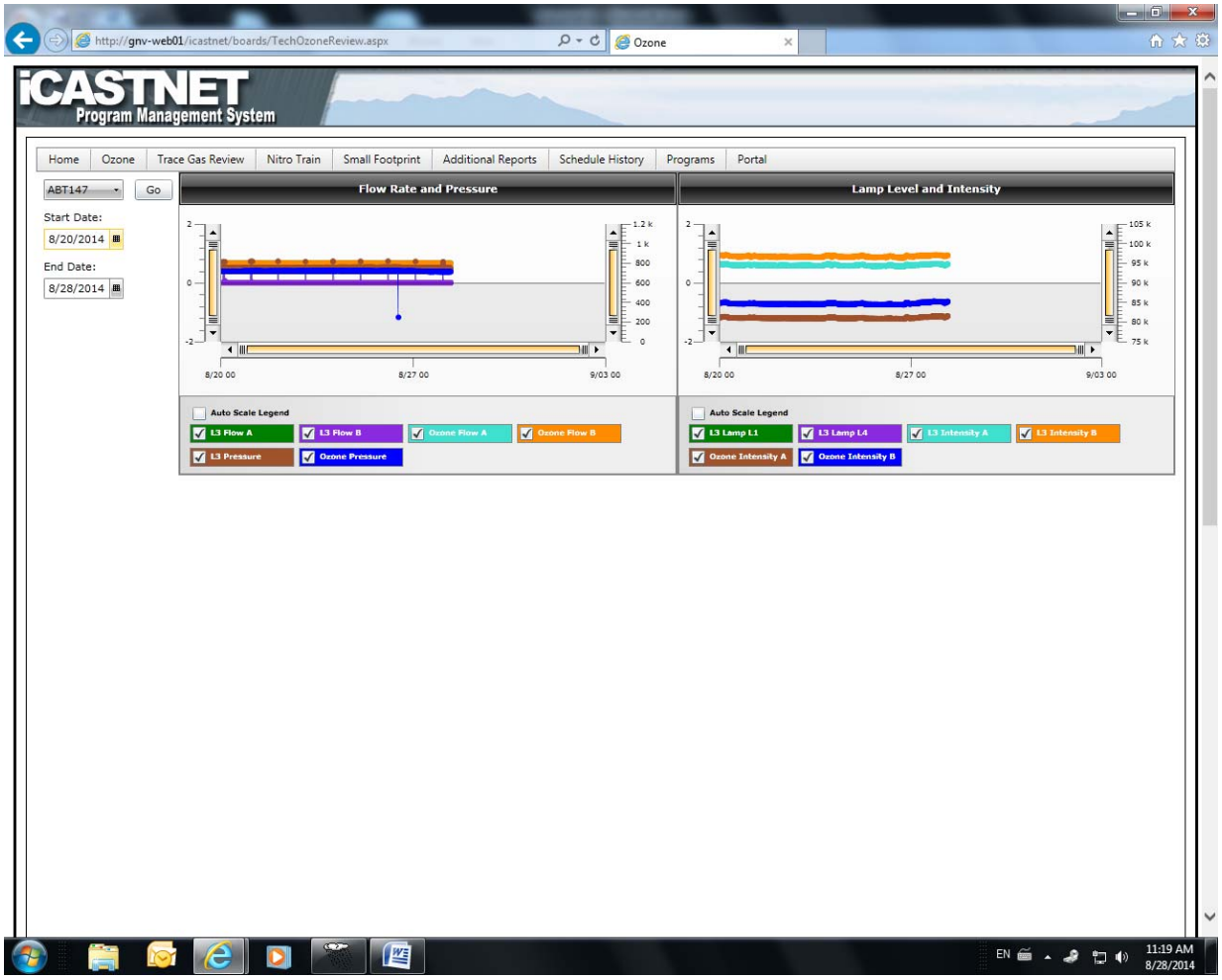
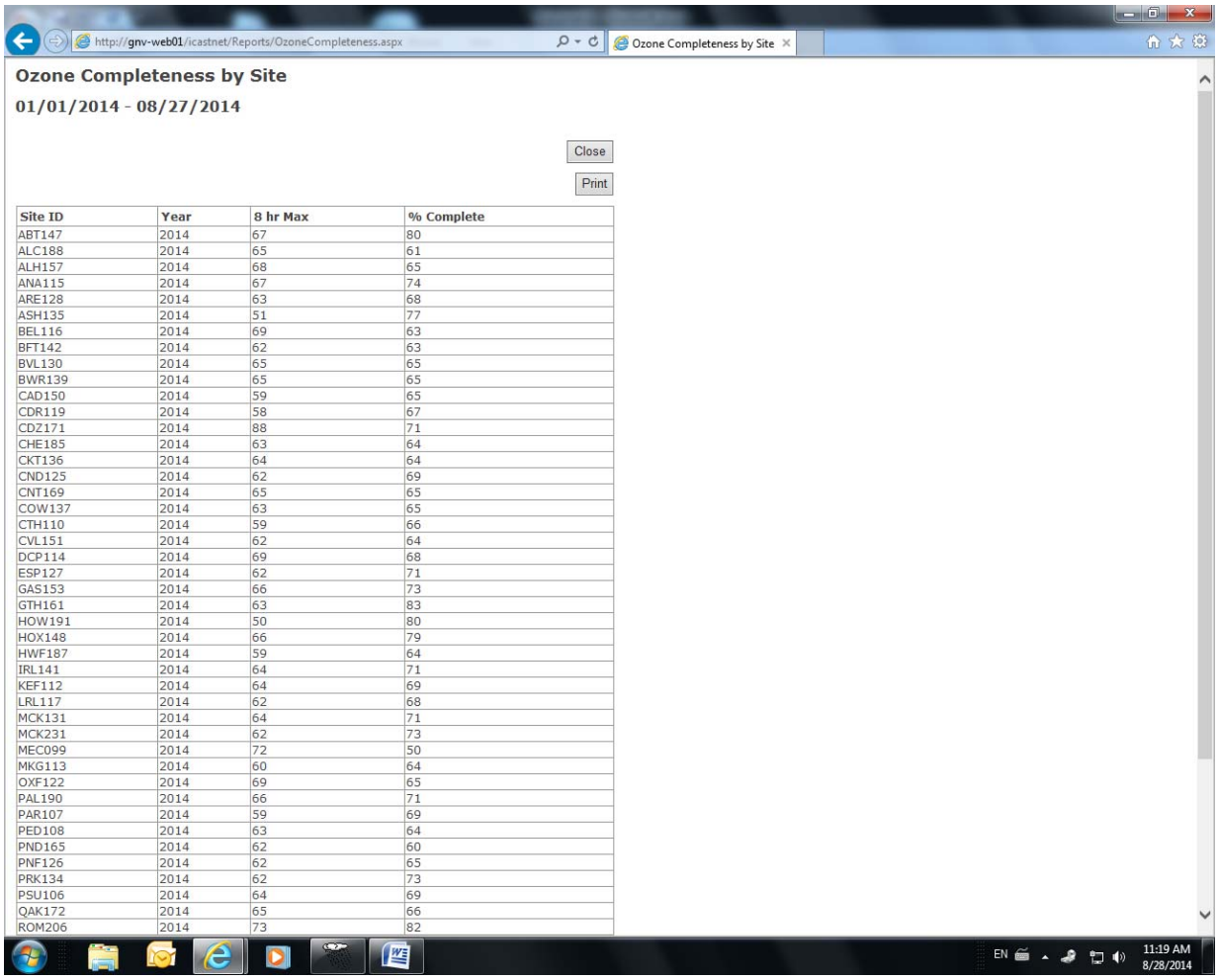



Figure 3 provides time series data on instrument flow rate and temperature for both the primary and transfer analyzers. It also shows lamp level and intensity for both analyzers.

**Figure 4.** Ozone Completeness



Ozone Completeness by Site

01/01/2014 - 08/27/2014

Close

Print

| Site ID | Year | 8 hr Max | % Complete |
|---|---|---|---|
| ABT147 | 2014 | 67 | 80 |
| ALC188 | 2014 | 65 | 61 |
| ALH157 | 2014 | 68 | 65 |
| ANA115 | 2014 | 67 | 74 |
| ARE128 | 2014 | 63 | 68 |
| ASH135 | 2014 | 51 | 77 |
| BEL116 | 2014 | 69 | 63 |
| BFT142 | 2014 | 62 | 63 |
| BVL130 | 2014 | 65 | 65 |
| BWR139 | 2014 | 65 | 65 |
| CAD150 | 2014 | 59 | 65 |
| CDR119 | 2014 | 58 | 67 |
| CDZ171 | 2014 | 88 | 71 |
| CHE185 | 2014 | 63 | 64 |
| CKT136 | 2014 | 64 | 64 |
| CND125 | 2014 | 62 | 69 |
| CNT169 | 2014 | 65 | 65 |
| COW137 | 2014 | 63 | 65 |
| CTH110 | 2014 | 59 | 66 |
| CVL151 | 2014 | 62 | 64 |
| DCP114 | 2014 | 69 | 68 |
| ESP127 | 2014 | 62 | 71 |
| GAS153 | 2014 | 66 | 73 |
| GTH161 | 2014 | 63 | 83 |
| HOW191 | 2014 | 50 | 80 |
| HOX148 | 2014 | 66 | 79 |
| HWF187 | 2014 | 59 | 64 |
| IRL141 | 2014 | 64 | 71 |
| KEF112 | 2014 | 64 | 69 |
| LRL117 | 2014 | 62 | 68 |
| MCK131 | 2014 | 64 | 71 |
| MCK231 | 2014 | 62 | 73 |
| MEC099 | 2014 | 72 | 50 |
| MKG113 | 2014 | 60 | 64 |
| OXF122 | 2014 | 69 | 65 |
| PAL190 | 2014 | 66 | 71 |
| PAR107 | 2014 | 59 | 69 |
| PED108 | 2014 | 63 | 64 |
| PND165 | 2014 | 62 | 60 |
| PNF126 | 2014 | 62 | 65 |
| PRK134 | 2014 | 62 | 73 |
| PSU106 | 2014 | 64 | 69 |
| QAK172 | 2014 | 65 | 66 |
| ROM206 | 2014 | 73 | 82 |

Year-to-date (YTD) ozone completeness by site is provided in Figure 4, which also shows the YTD fourth highest daily maximum 8-hour average $O_3$ concentration.

### 6.2.1 Accessing Site Information

There are three ways to update the selected monitoring site location:

- You can select a site from the dropdown list on the left side of the screen
- You can select the next site in the dropdown list using the on the right side of the screen
- You can select the previous site in the dropdown list using the on the left side of the screen

The screen will be updated with all the available information regarding the selected site.

### 6.2.2 Selecting a Date Range

Click next to the start date and end date to display a calendar. Select a date to update the screen.

### 6.2.3 Using the Graphs

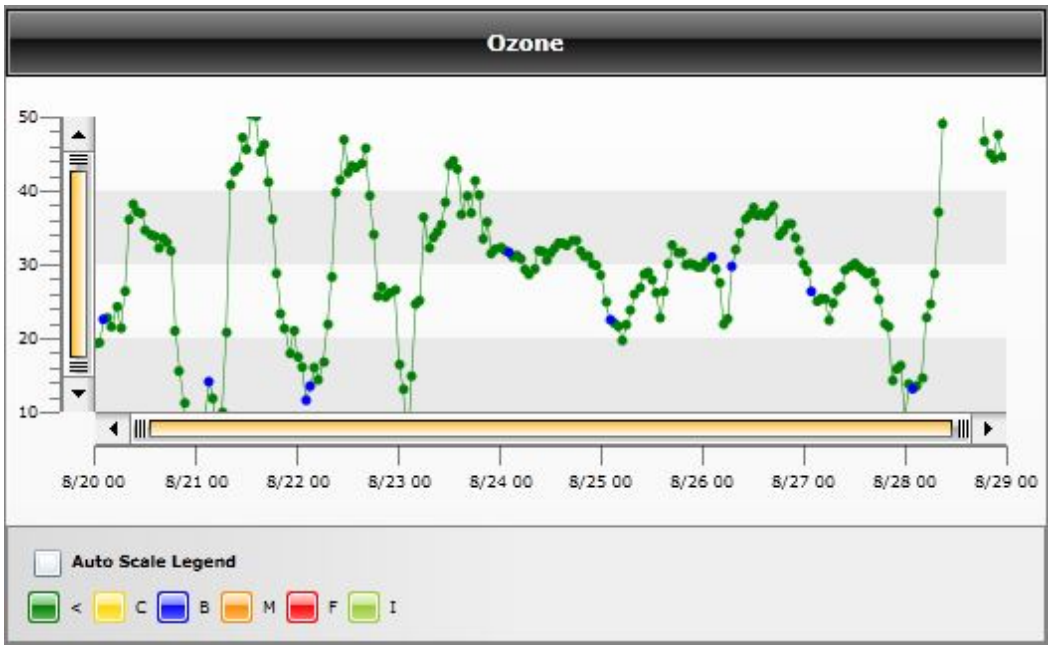
By hovering the mouse over a point on a graph a tooltip will show the date, value, expected value, and flag if there is a flag.

To drill down a graph, drag the mouse on the inside, which will cause the graph to zoom in for a clearer view of the data. To reset the graph back to the original view, click on the x axis.

### 6.2.4 Ozone Graph

Values are color coded based on flagged values.

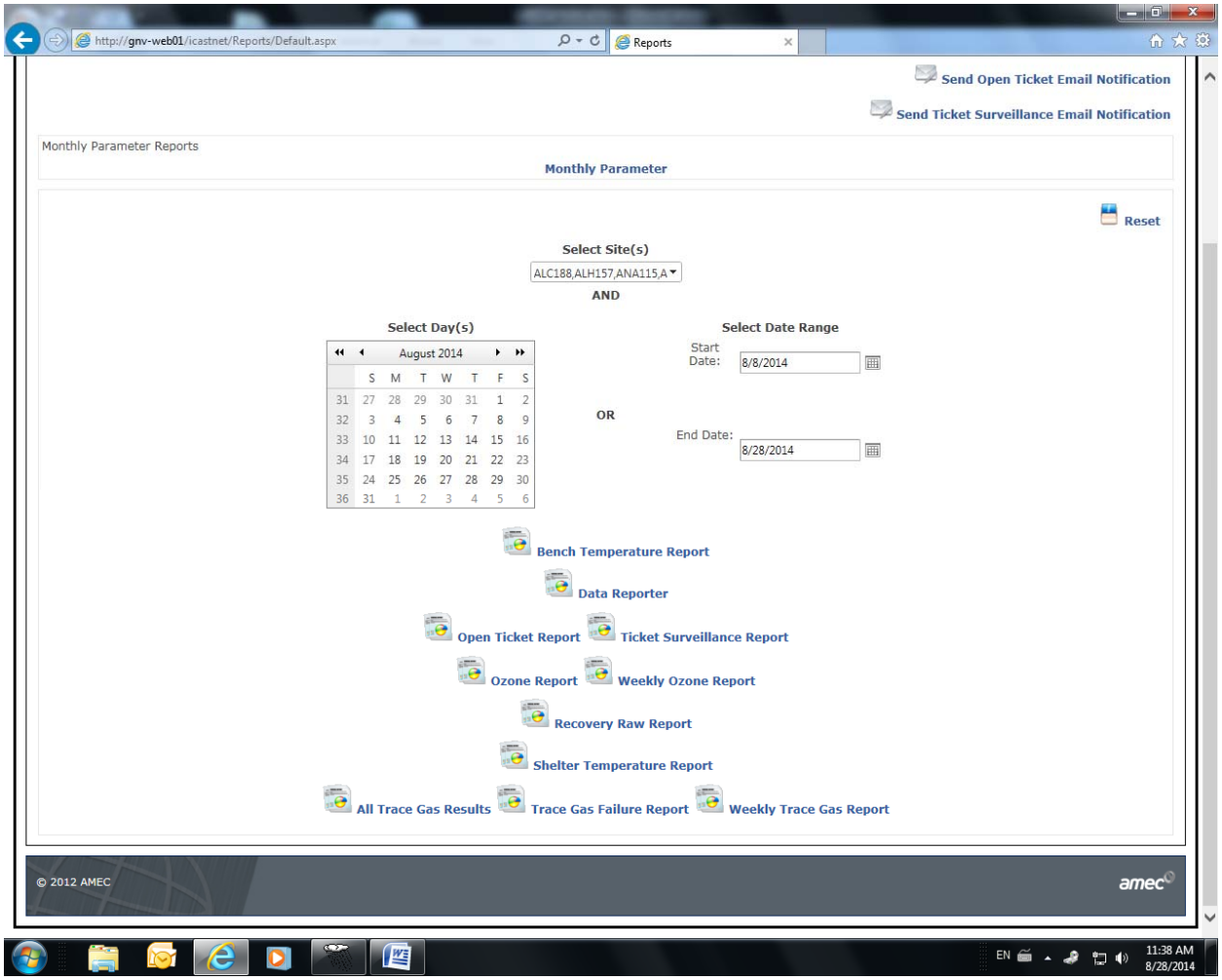
**Figure 5.** Time Series of Ozone Concentrations (ppb)



## 6.3 iCASTNET Additional Reports

Open iCASTNET (http://gnv-web01/iCASTNET). Click the Additional Reports tab on the iCASTNET Main Menu to display database driven reports.

**Figure 6.** Additional Reports



### 6.3.1 Selecting sites for reports

Click to select a monitoring site(s) from the dropdown list. Reports can be generated using all sites or specific sites.

### 6.3.2 Selecting date information

There are two ways to update the dates used in the reports:

- You can select a day or multiple days using the calendar on the middle left side of the screen.
- You can select a date range using the start date and end date on the middle right side of the screen.

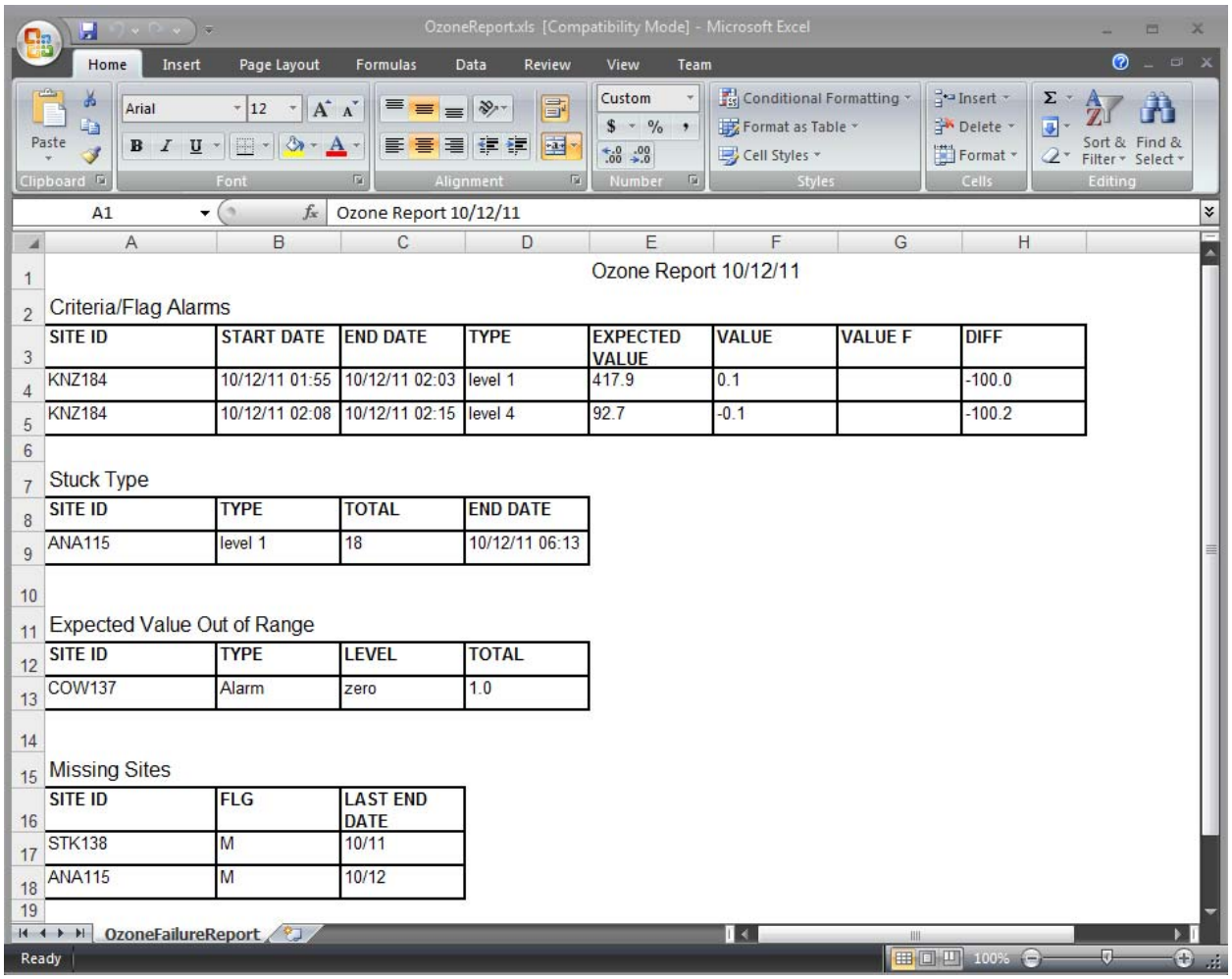
Unless specified, the default date range used for the ozone report is from the previous day until the current date and time.

### 6.3.3 Viewing the Report

Click to view the report in Microsoft Excel.

Ozone Report

**Figure 7.** Ozone Report



OzoneReport.xls [Compatibility Mode] - Microsoft Excel

Ozone Report 10/12/11

Criteria/Flag Alarms

| SITE ID | START DATE | END DATE | TYPE | EXPECTED VALUE | VALUE | VALUE F | DIFF |
|---|---|---|---|---|---|---|---|
| KNZ184 | 10/12/11 01:55 | 10/12/11 02:03 | level 1 | 417.9 | 0.1 | | -100.0 |
| KNZ184 | 10/12/11 02:08 | 10/12/11 02:15 | level 4 | 92.7 | -0.1 | | -100.2 |

Stuck Type

| SITE ID | TYPE | TOTAL | END DATE |
|---|---|---|---|
| ANA115 | level 1 | 18 | 10/12/11 06:13 |

Expected Value Out of Range

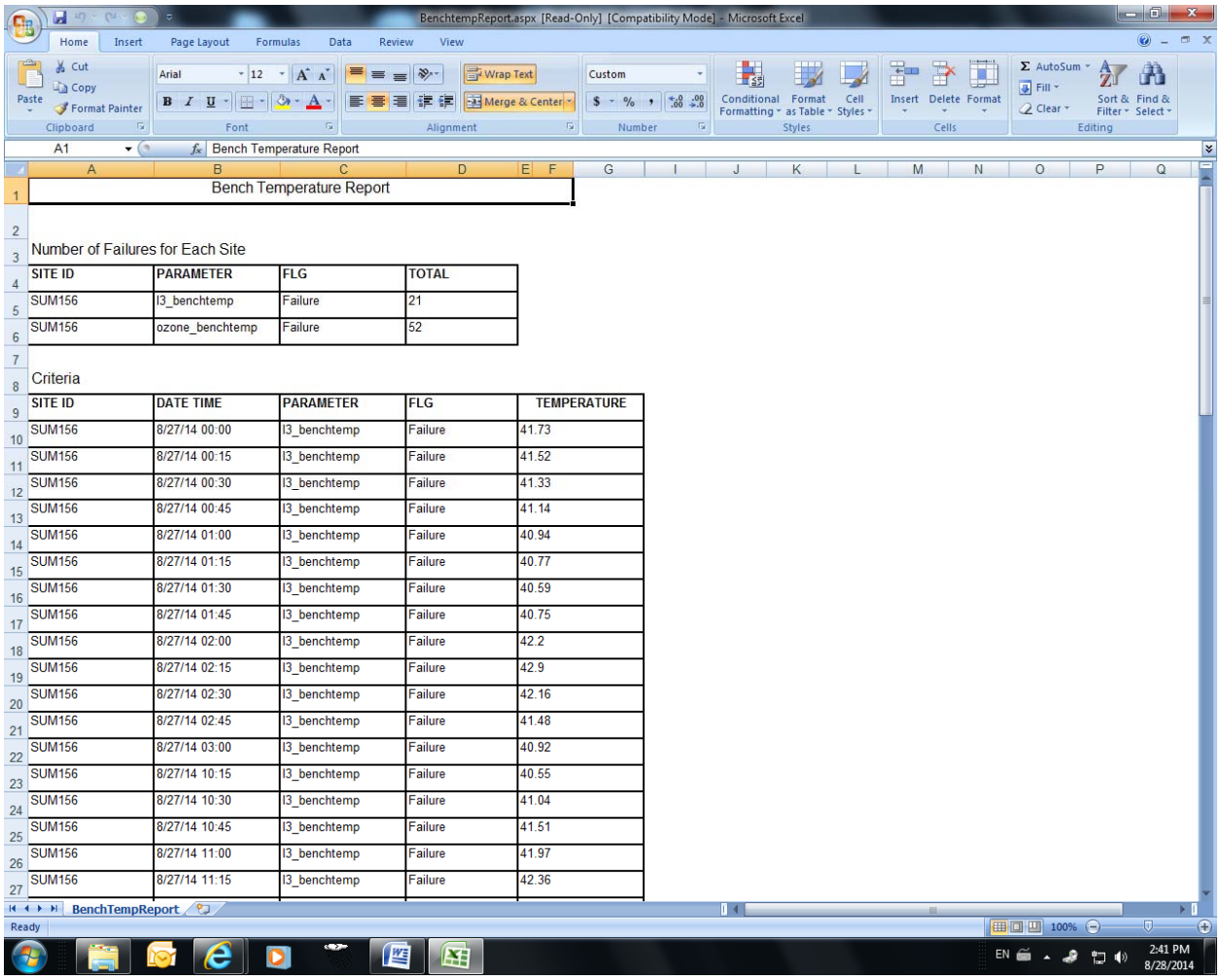
| SITE ID | TYPE | LEVEL | TOTAL |
|---|---|---|---|
| COW137 | Alarm | zero | 1.0 |

Missing Sites

| SITE ID | FLG | LAST END DATE |
|---|---|---|
| STK138 | M | 10/11 |
| ANA115 | M | 10/12 |

### 6.3.4 Other Reports

**Figure 8.** Bench Temperature Report



Bench Temperature Report

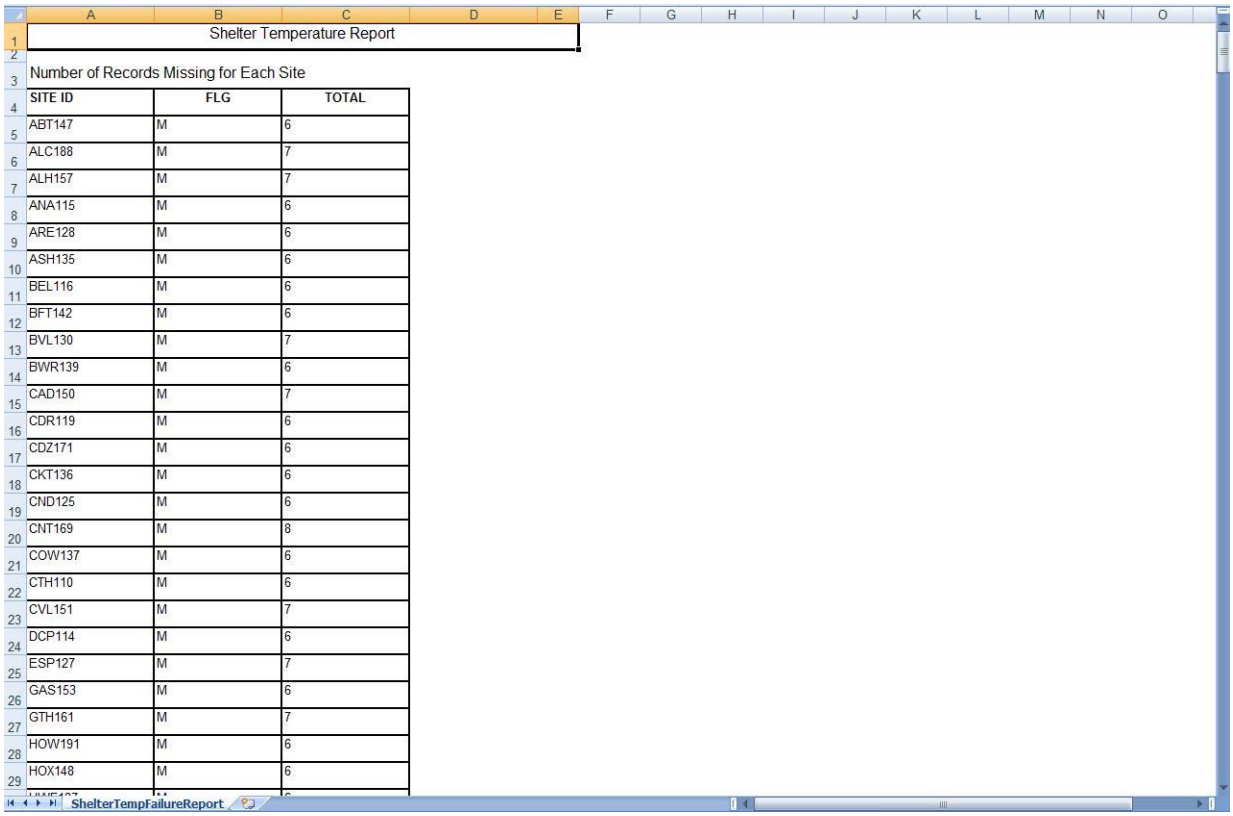
Number of Failures for Each Site

| SITE ID | PARAMETER | FLG | TOTAL |
|---|---|---|---|
| SUM156 | l3_benchtemp | Failure | 21 |
| SUM156 | ozone_benchtemp | Failure | 52 |

Criteria

| SITE ID | DATE TIME | PARAMETER | FLG | TEMPERATURE |
|---|---|---|---|---|
| SUM156 | 8/27/14 00:00 | l3_benchtemp | Failure | 41.73 |
| SUM156 | 8/27/14 00:15 | l3_benchtemp | Failure | 41.52 |
| SUM156 | 8/27/14 00:30 | l3_benchtemp | Failure | 41.33 |
| SUM156 | 8/27/14 00:45 | l3_benchtemp | Failure | 41.14 |
| SUM156 | 8/27/14 01:00 | l3_benchtemp | Failure | 40.94 |
| SUM156 | 8/27/14 01:15 | l3_benchtemp | Failure | 40.77 |
| SUM156 | 8/27/14 01:30 | l3_benchtemp | Failure | 40.59 |
| SUM156 | 8/27/14 01:45 | l3_benchtemp | Failure | 40.75 |
| SUM156 | 8/27/14 02:00 | l3_benchtemp | Failure | 42.2 |
| SUM156 | 8/27/14 02:15 | l3_benchtemp | Failure | 42.9 |
| SUM156 | 8/27/14 02:30 | l3_benchtemp | Failure | 42.16 |
| SUM156 | 8/27/14 02:45 | l3_benchtemp | Failure | 41.48 |
| SUM156 | 8/27/14 03:00 | l3_benchtemp | Failure | 40.92 |
| SUM156 | 8/27/14 10:15 | l3_benchtemp | Failure | 40.55 |
| SUM156 | 8/27/14 10:30 | l3_benchtemp | Failure | 41.04 |
| SUM156 | 8/27/14 10:45 | l3_benchtemp | Failure | 41.51 |
| SUM156 | 8/27/14 11:00 | l3_benchtemp | Failure | 41.97 |
| SUM156 | 8/27/14 11:15 | l3_benchtemp | Failure | 42.36 |

**Figure 9.** Shelter Temperature Report



Shelter Temperature Report

Number of Records Missing for Each Site

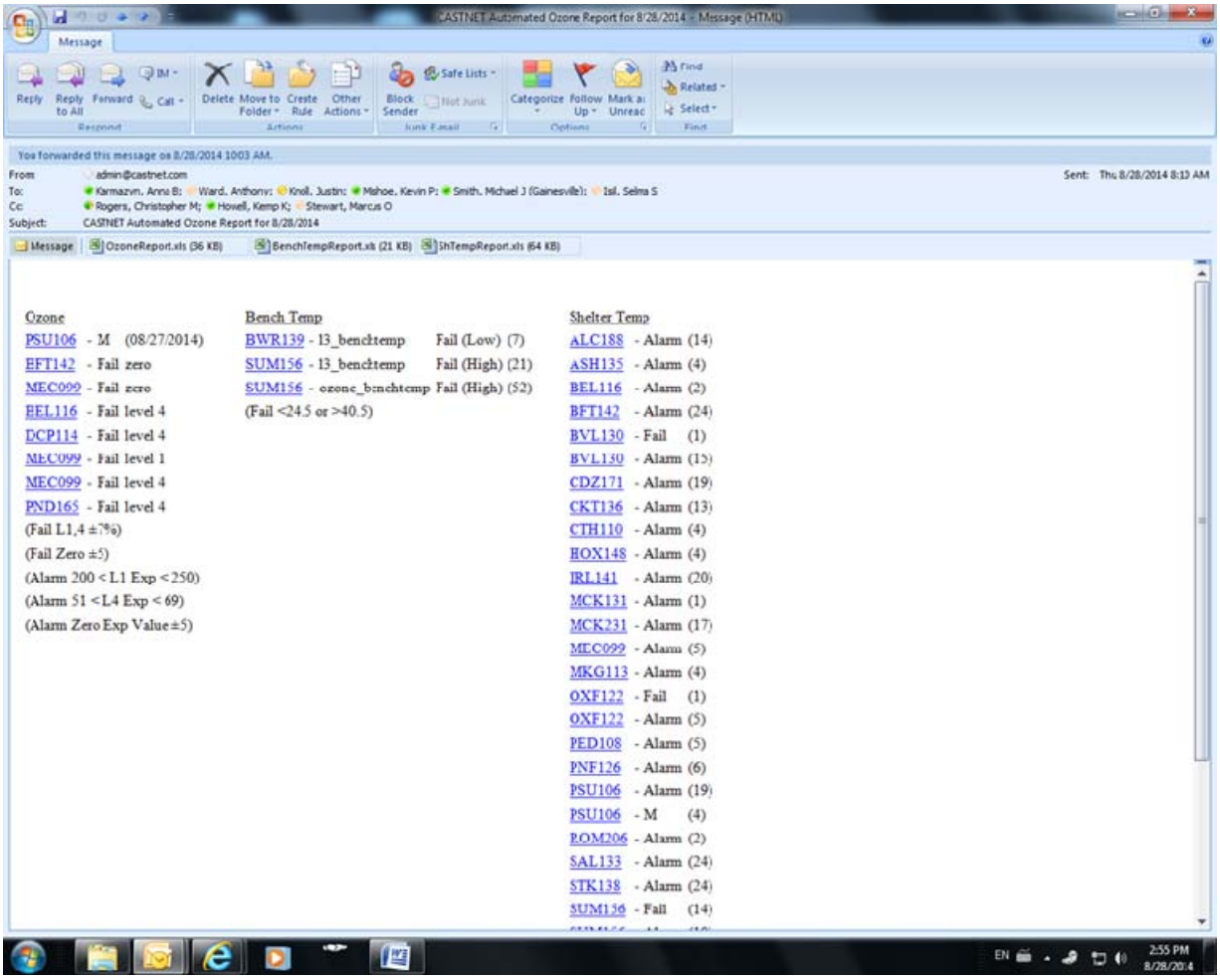
| SITE ID | FLG | TOTAL |
|---|---|---|
| ABT147 | M | 6 |
| ALC188 | M | 7 |
| ALH157 | M | 7 |
| ANA115 | M | 6 |
| ARE128 | M | 6 |
| ASH135 | M | 6 |
| BEL116 | M | 6 |
| BFT142 | M | 6 |
| BVL130 | M | 7 |
| BWR139 | M | 6 |
| CAD150 | M | 7 |
| CDR119 | M | 6 |
| CDZ171 | M | 6 |
| CKT136 | M | 6 |
| CND125 | M | 6 |
| CNT169 | M | 8 |
| COW137 | M | 6 |
| CTH110 | M | 6 |
| CVL151 | M | 7 |
| DCP114 | M | 6 |
| ESP127 | M | 7 |
| GAS153 | M | 6 |
| GTH161 | M | 7 |
| HOW191 | M | 6 |
| HOX148 | M | 6 |

ShelterTempFailureReport

## 6.4 iCASTNET Automated Ozone Report

Each morning an email notification is sent to data analysts with a summary of questionable or erroneous data from the previous day until the current date and time. Click on the site hyperlink to open the Ozone Review Dashboard to the selected site.

**Figure 10.** Automated Ozone Report




## 6.5 $O_3$ Data Validation

The following steps will assist in the review, evaluation, and validation of ambient $O_3$ measurements.

1. Gather documentation, including the information discussed in Subsections 6.1 through 6.4.,
   - QC failure report
   - Bench temperature failure report
   - Shelter temperature
   - Problem tickets
   - Observation report.

2. Open iCASTNET for all sections related to data validation.

3. Open selected site and selected time period in iCASTNET under Ozone Tab.

4. In iCASTNET sort shelter temperature column and record the monthly minimum and maximum values (shelter temperature is used only when analyzer bench temperatures were not collected).

   The criterion for range is 20–30°C. The additional criterion of ±2°C previously allowed for this range if no longer accepted.

   Sort Ozone column and look for outliers at the minimum and maximum ends of the range of values.

   Use Sort feature to check highlighted areas or values needing review.
   Sort feature will highlight:
   - Hourly concentrations increased or decreased more than 20 ppb from one hour to the next.
   - Flat line concentrations (the same value over 3 hours).
   - Lack of data status flag when the numerical field is null.

5. Invalidate all hourly ozone concentrations with analyzer bench temperature outside range of 24 to 40°C.

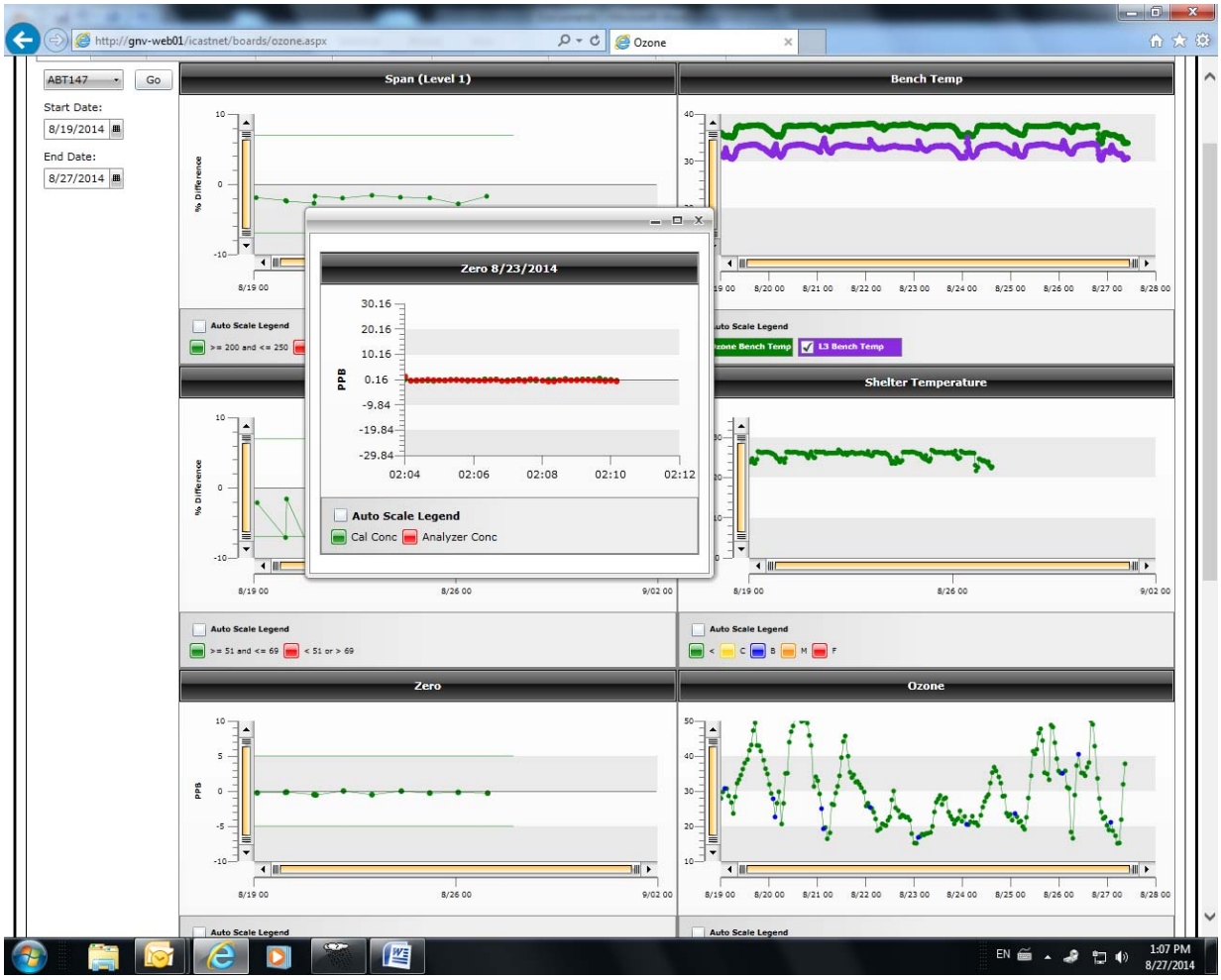
6. Invalidate all auto ZPS values if they had run when site ozone transfer, analyzer or bench temperature were outside of range.

7. Review all QC failures, e.g., zero $< \pm$ 5 ppb, span or single point QC check $\leq \pm$ 7% between expected and response, listed on failure report and problem tickets associated with those QC failures.

   Problem tickets provide recommendations based on technical information affecting QC. Some tickets will recommend disregarding QC checks and some will describe how data validity is related to a QC failure. Make appropriate decision.

8. Use iCASTNET to check stability of responses for zero, precision or span by clicking on a particular point representing a phase (Figure 11). 1-minute data are used to generate the graph. Last 6 minutes are averaged for a reading.

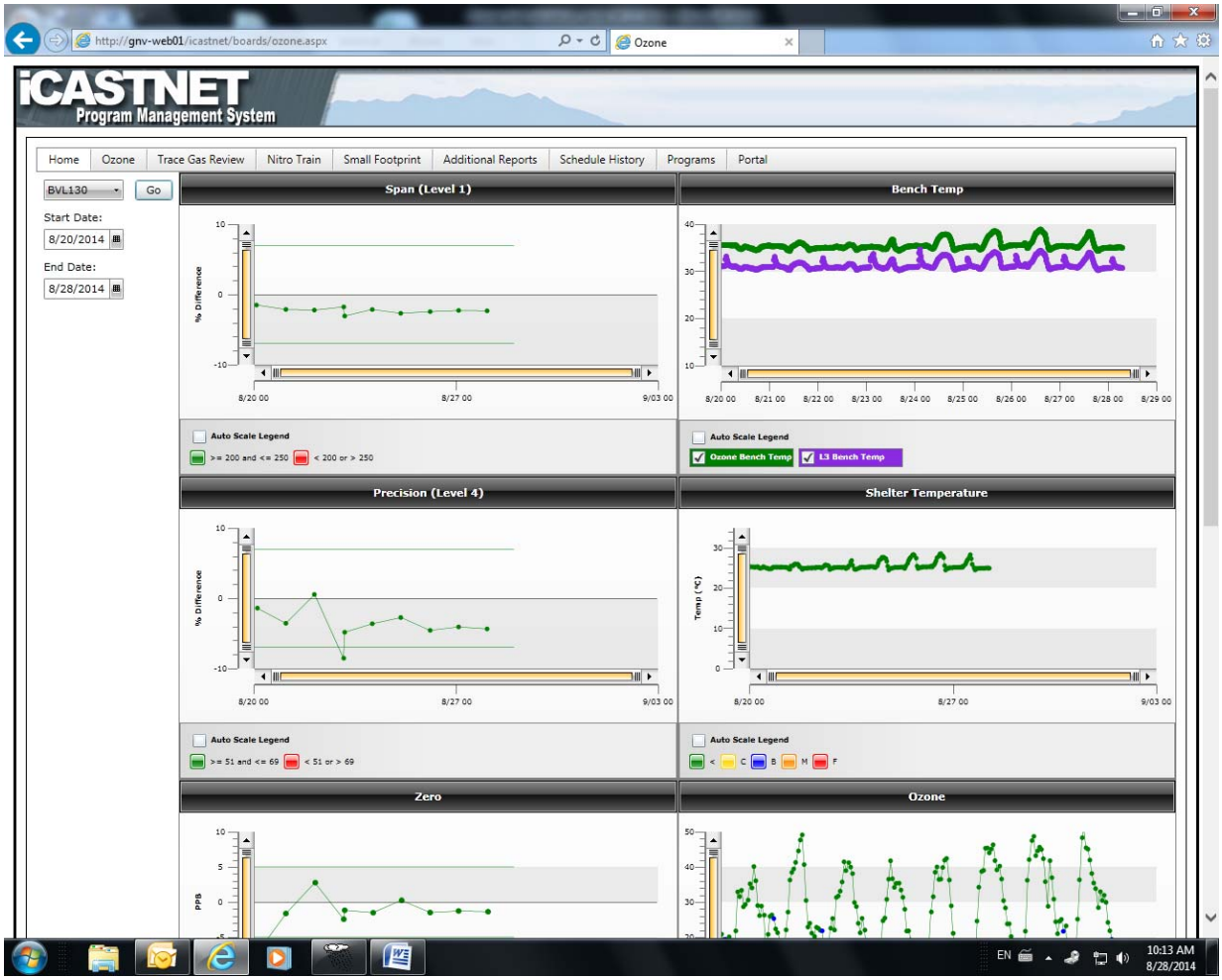
**Figure 11.** $O_3$ and Related Data Displays




9. All data invalidated due to a QC failure have to be bracketed by passing QC checks. Review the graph for additional needed checks and review the results. Some additional checks will run automatically after a failing QC check. They are initialized within iCASTNET. Some additional QC checks will need to be initialized manually. If the data passed the manual check but failed the automated checks, then the measured data will have to be invalidated accordingly from when the automated checks failed up to when the manual check was performed.

   The checks are presented as two green dots almost next to each other in the span, precision, and zero plots in Figure 12. Closeness depends on a time between two ZPS runs. ZPS initiated by program starts immediately at the end of failing one. Manual will take additional time.

**Figure 12.** Displays of Span, Precision and Temperature Data




10. Review all problem tickets and take appropriate corrective actions or invalidate the data if problems with analyzer operation affected measurement of ambient data.

11. For extended periods of QC failure, QC issues produced by bench temperature failures or data completeness affected by measurement problems, the time limit for not passing QC is 14 days. After 14 days, data have to be invalidated up to the previous time when QC was acceptable.

12. Review the graph of hourly data and search for suspect rapid increases followed by immediate declines, which create "spike" like appearances. Use display of 1-minute data (Figure 13) to verify spikes. Review other suspicious looking time periods, e.g., tooth and saw patterns, which might indicate presence of moisture in the system. Again, 1-minute data provide better resolution in problem identification.

**Figure 13.** One-Minute $O_3$ Measurements for 8/7/14

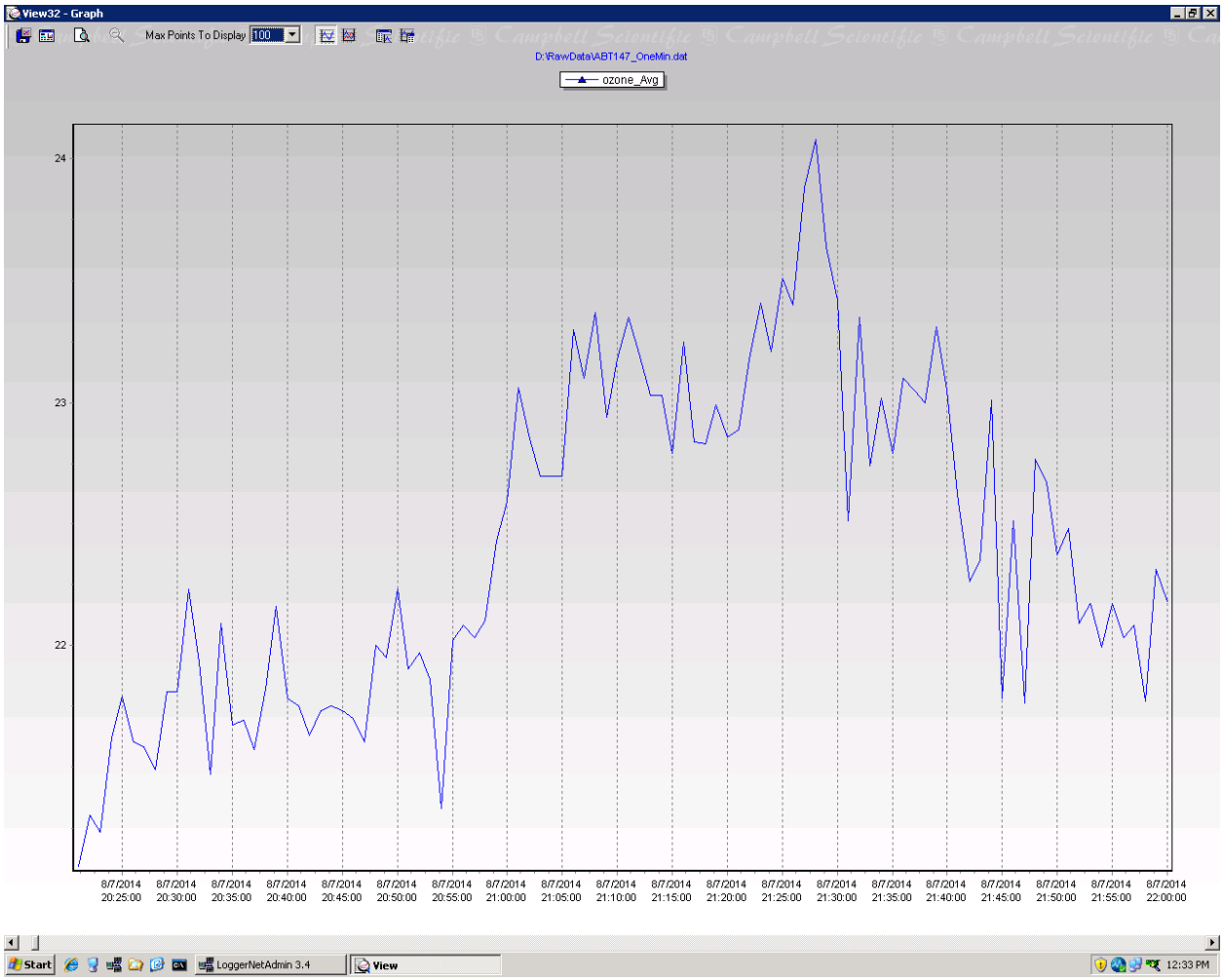
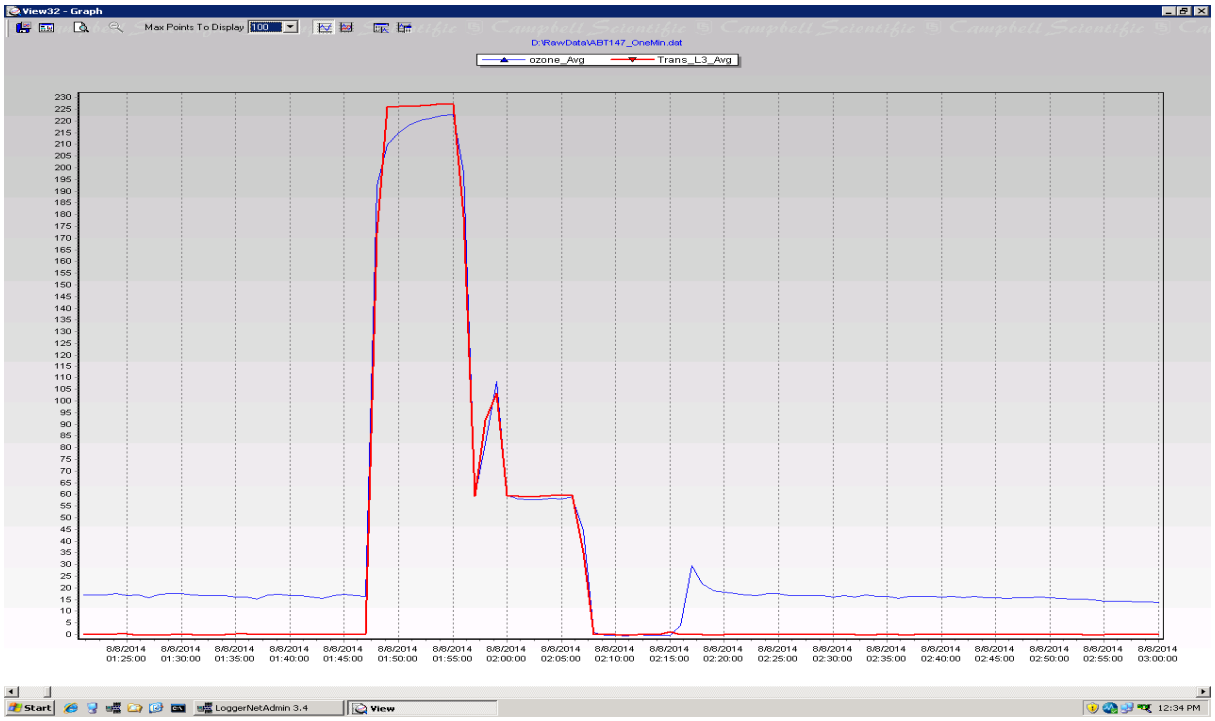


**Figure 14.** Five-Minute $O_3$ Measurements for 8/7/14




13. In Microsoft Access Database apply "I" flags to all QC checks marked for elimination.

14. Apply "I" flags to all hourly $O_3$ concentrations selected for elimination. Data are invalidated for verified QC failures, analyzer malfunctions, analyzer bench temperatures outside of criteria of 24 to 40°C, outliers, negative or spike like positive concentrations, data affected by human error, or analyzer issues, e.g., analyzer left in noise check mode.

15. Document on appropriate forms all manual modifications to data.

16. After Project QA Manager reviews the data, additional corrections might be necessary based on the QA findings.

## 7.0 REFERENCES

AMEC E&I, Inc. (AMEC). 2012. *Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan, Revision* 8.0. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

## 8.0 ATTACHMENTS

This SOP does not contain attachments.