



CASTNET

Quality Assurance Project Plan

Appendix 6: CASTNET Data Operations Standard Operating Procedures

Clean Air Status and Trends Network

Quality Assurance Project Plan

Revision 10.1

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CASTNET Data Operations Standard Operating Procedures

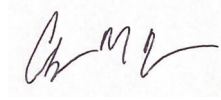
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TITLE: DATA ANALYSIS AND REPORTS

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Prepared by: Christopher M. Rogers
Project Manager



Digitally signed by Rogers,
Christopher (USCR718689)
Date: 2023.10.09 16:05:14 -04'00'

Reviewed and
Approved by: Marcus O. Stewart
QA Manager



Digitally signed by Stewart,
Marcus (USMS719399)
Date: 2023.10.06 16:50:39 -04'00'

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Annual Review			
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DATA ANALYSIS AND REPORTS

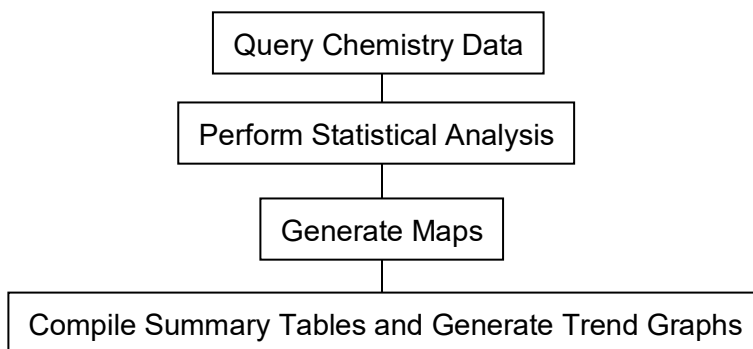
1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide guidance to WSP USA Environment & Infrastructure Inc. (WSP) 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 (SO₂) – current quarter, current year [i.e., Q2 2001];
2. Particulate sulfate (SO₄²⁻) – current quarter, current year;
3. Nitric acid (HNO₃) – current quarter, current year;
4. Particulate ammonium (NH₄⁺) – current quarter, current year;
5. Particulate nitrate (NO₃⁻) – current quarter, current year;
6. Total NO₃⁻ – current quarter, current year;
7. Particulate calcium (Ca²⁺) – current quarter, current year;
8. Particulate potassium (K⁺) – current quarter, current year;
9. Particulate magnesium (Mg²⁺) – 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 = $(0.667 * \text{nso4}) + \text{wso2}$,

SO_4^{2-} = tso4 ,

HNO_3 = nhno3 ,

NH_4^+ = tnh4 ,

NO_3^- = tno3 , and

Total NO_3^- = $\text{tno3} + (0.9841 * \text{nhno3})$.

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™ 2022 syntax and are set up as SQL Pass Through Queries to directly access the SQL Server™ 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., SO₂) must be changed to the current analyte of interest. For example, SO₂ 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, Ca²⁺, K⁺, Mg²⁺, 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.

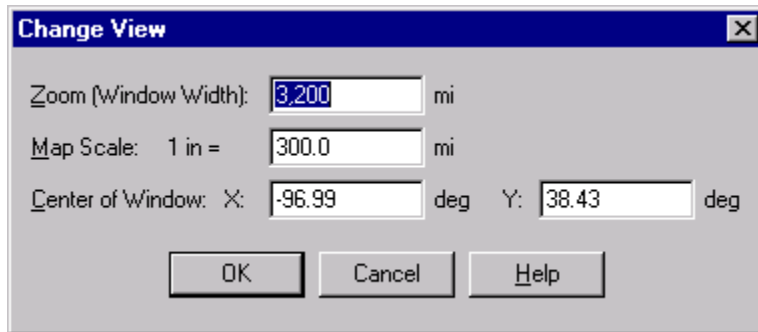
After these summary tables are created, the percent difference between each value for each site for the current quarter and the corresponding value for the same quarter of the previous year is calculated by joining the two tables on site_id, latitude, and longitude. The percent difference is calculated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

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

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 SO₂ (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 SO₂ 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

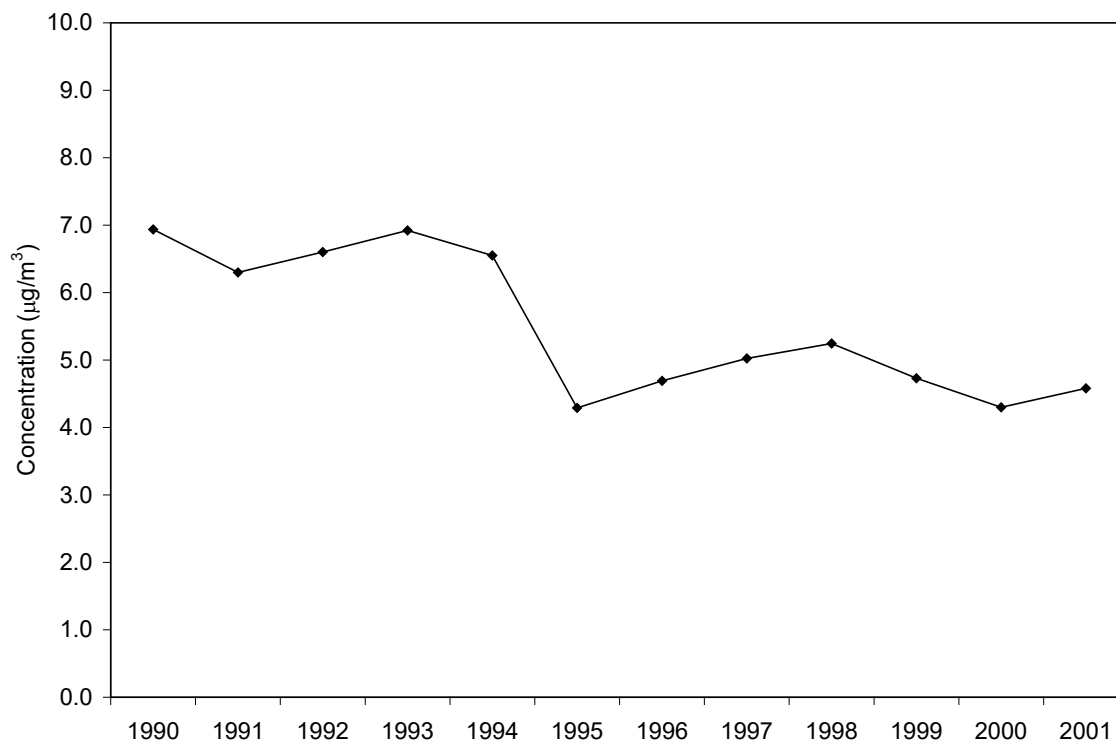
The results of the query are copied and pasted into Microsoft® Excel™ and sorted by site_id, quarter, and year. Missing values are identified and replaced by either interpolation (if values for surrounding years are valid) or extrapolation (if the missing quarterly mean is at the beginning or end of 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 (µg/m³)”] 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 SO₂.

Figure 3. Example of a Trend Graph for SO₂ (Q2 2001)



6.2 Quarterly Reports: Ozone

The second, third, and fourth quarter reports include two maps created from analysis of the ozone (O₃) 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 O₃ concentration for each site (Figure 4). These values are calculated using a SQL script. The details of the calculation are given in *National 8-Hour Primary and Secondary Ambient Air Quality Standards* (EPA, 2023).

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 O₃ Concentrations (Q2 2001)

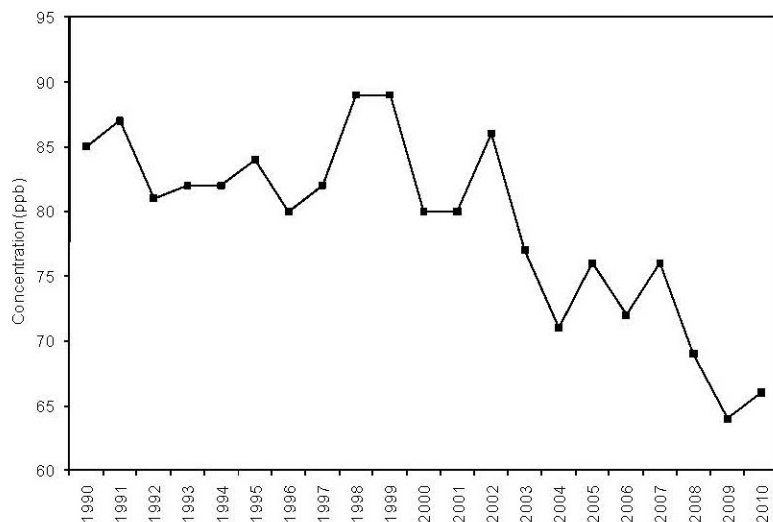


6.2.3 Trends in Fourth Highest Daily Maximum Concentrations

Trends in fourth highest daily maximum 8-hour O₃ 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. Details of the calculation are

given in *National 8-Hour Primary and Secondary Ambient Air Quality Standards* (EPA, 2023). 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 O₃ 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® SO₄²⁻ (tso4)
- Teflon® NO₃⁻ (tno3)
- Teflon® NH₄⁺ (tnh4)
- Teflon® Cations Ca²⁺, K⁺, Mg²⁺, Na⁺ (ca, k, mg, na)
- Nylon HNO₃ (nhno3)
- Nylon SO₄²⁻ (nso4)
- Whatman cellulose SO₂ (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 SO₂ derived from the Whatman filters for Q2 2001. The Whatman SO₂ is indicated by wso2 (shown **wso2**). The quarter is selected by the collection criteria, in this case, Q2 2001 (i.e., 2001q2, which is shown 2001q2):

```
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:

- SO₄²⁻ = tso4
- NO₃⁻ = tno3
- NH₄⁺ = tnh4
- Ca²⁺ = ca
- Mg²⁺ = mg
- Na⁺ = na
- K⁺ = k
- HNO₃ = nhno3
- SO₂ = (0.667*nso4)+wso2
- Total NO₃⁻ = 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 ⁻
\bar{X}	5.98	1.21	2.24	0.36	0.07	0.16	0.09	2.59	4.85	3.76
\bar{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:

$$MAD = Average(|X - Y|)$$

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 (WSP, 2002).

6.4.1 Concentrations of Sulfur and Nitrogen Species and Cations

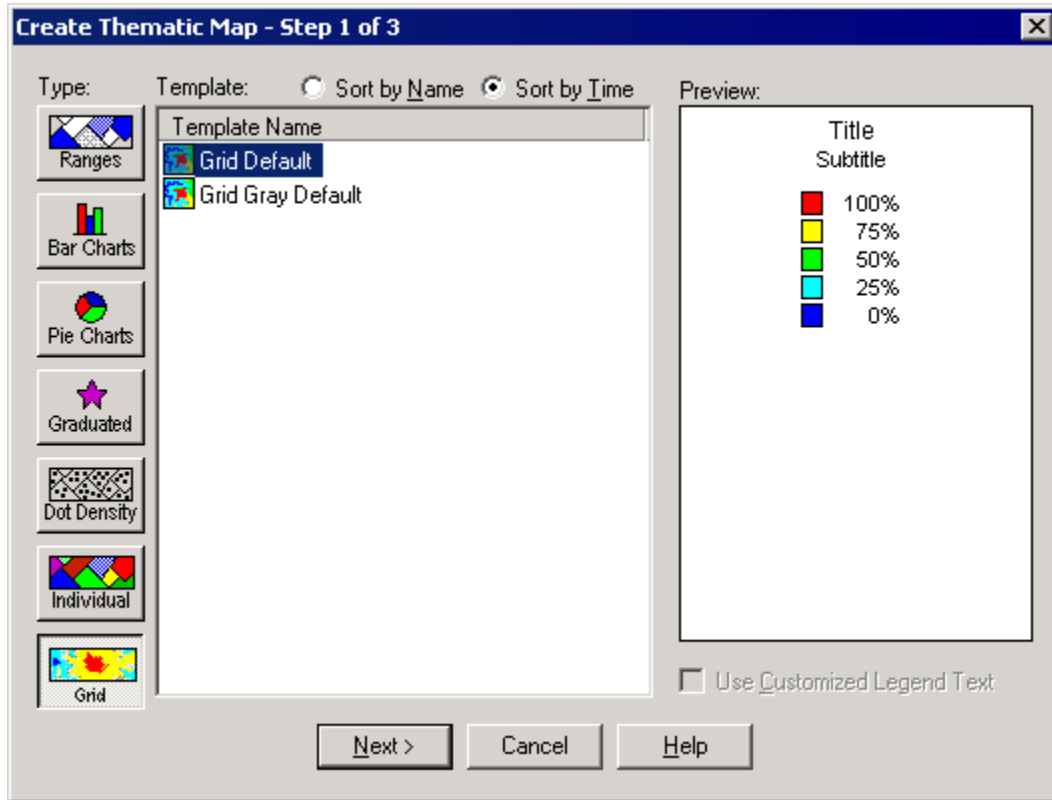
6.4.1.1 Concentration Maps

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^+

All map and label settings are identical to the settings discussed in Section 6.1.2. Beginning with the CASTNET 2000 Annual Report (WSP, 2002), an interpolated grid was constructed using an inverse distance-weighting function as a means of providing pseudo-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

Create Thematic Map - Step 2 of 3

Select a Table and a Field:

Table: concentration_maps_2000

Field: so2_conc

Ignore Zeroes or Blanks

Grid Options

Select a Table of Boundaries to Clip Against:

Table: WholeUSA

Grid File Name:

G:\DATA_AND_REPORTS\2000\2000_ANNU

Browse...

< Back Next > Cancel Help

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

IDW Interpolator Settings

Cell Size: 6.21 mi

Grid Dimensions: 951 X 636

Exponent: 3

Search Radius: 310.5 mi

Grid Border: 0 mi

Aggregate Coincident Points by

Avg Count Sum Min Max

OK Cancel Help

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 (WSP, 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 (WSP, 2002) for examples of the grid and remote site maps.

6.4.1.2 Concentration Box Plots

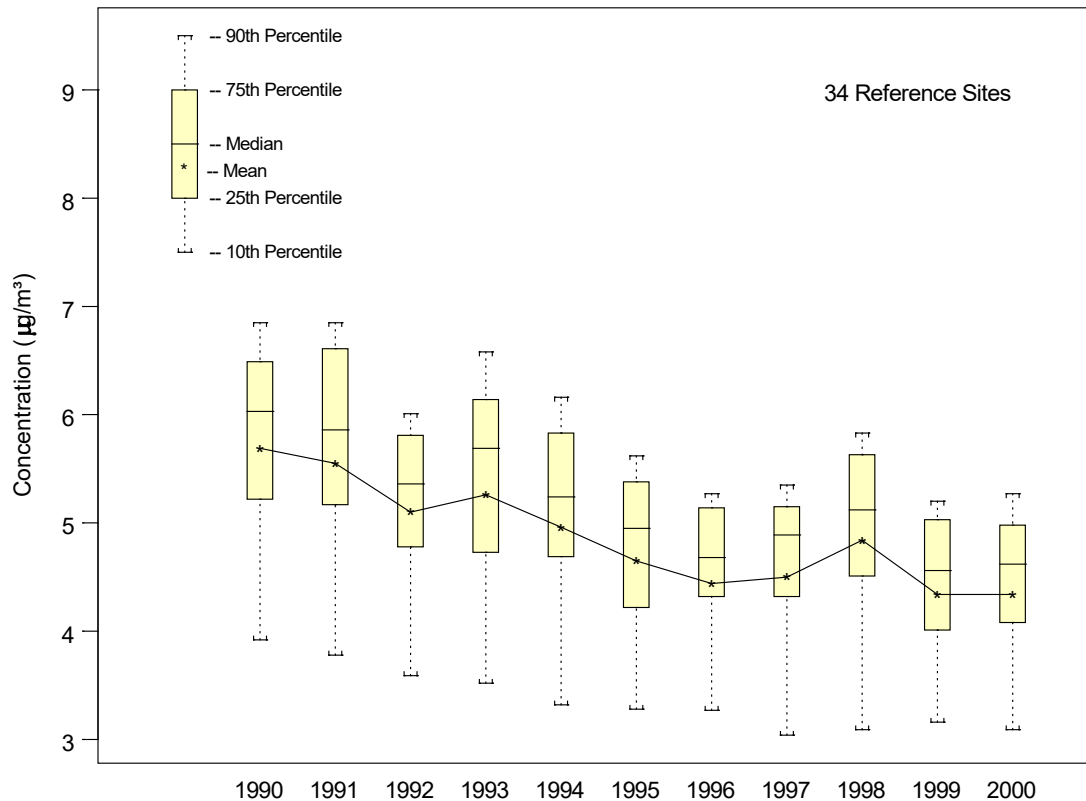
Box plots are also included in the Concentrations Chapter to show long-term trends in concentrations. They are prepared using Excel. Previously, S-Plus®, a statistical and graphics package was used. Box plots present 10th, 25th, 75th, and 90th percentile, mean, and median values (Figure 9). Box plots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

- SO₂
- SO₄²⁻
- Total NO₃⁻
- NH₄⁺

Data for the box plots are 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 are included in the aggregations.

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

CASTNET now uses the National Atmospheric Deposition Program's (NADP) Total Deposition (TDEP) measurement model fusion (MMF) technique to report dry and total deposition fluxes (Schwede and Lear, 2014). Maps in the annual report are generated by EPA and provided for inclusion in the CASTNET annual report.

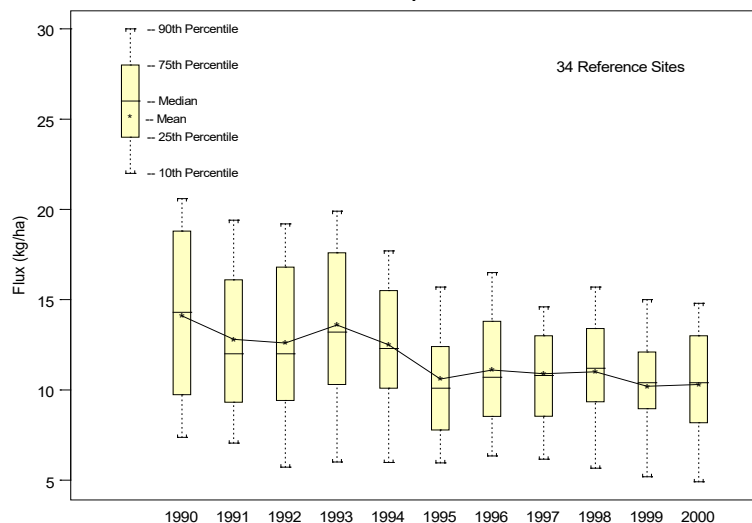
6.4.2.2 Deposition Box Plots

Box plots are also included in the Deposition Chapter to show long-term trends in deposition. They are prepared using Excel. Box plots present 10th, 25th, 75th, and 90th 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 extracted from TDEP model grids provided by EPA, which contain 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 are included in the aggregations.

The data analyst must verify that a value is provided for each year for all components.

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

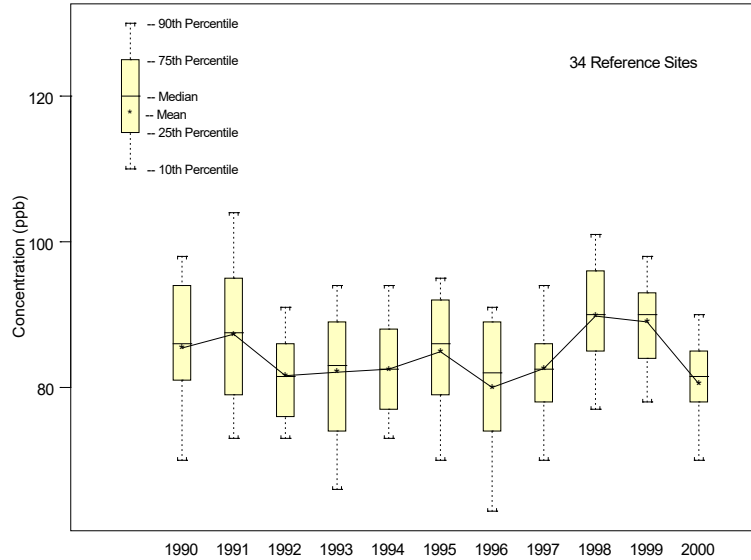
Analyses presented in the chapter titled, “Ozone Concentrations” (Ozone Concentrations Chapter) are very similar to those contained in the second, third, and fourth quarter reports. Please see Section 6.2.2 for a detailed description of the preparation of ozone maps for the quarterly reports. The following 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 O₃ 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 O₃ 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 O₃ Concentrations – Eastern United States.

Data and figures are prepared using Excel[®]. Box plots present 10th, 25th, 75th, and 90th 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 O₃ 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

WSP formerly known as Amec Foster Wheeler Environment & Infrastructure, Inc. 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.

WSP formerly known as Wood Environment & Infrastructure Solutions, Inc. (Wood)*. 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.

WSP formerly known as Wood Environment & Infrastructure Solutions, Inc. (Wood)*. 2010. *Clean Air Status and Trends Network (CASTNET) Second Quarter 2010 Data Report*. Prepared for U.S. Environmental Protection Agency (EPA), Washington, DC. Contract No. EP-W-09-028. Gainesville, FL.

U.S. Environmental Protection Agency (EPA). 2023. *National 8-Hour Primary and Secondary Ambient Air Quality Standards for Ozone*. 40 CFR 50, Appendix I.

Schwede, D.B. and Lear, G.G. 2014. A Novel Hybrid Approach for Estimating Total Deposition in the United States. *Atmos. Environ.*, 92:207-220. DOI: 10.1016/j.atmosenv.2014.04.008

* Formerly known as Amec Foster Wheeler Environment & Infrastructure, Inc.

8.0 ATTACHMENTS

Attachment A – Script Used to Create DRYCHEM_DAYS Tables

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
```

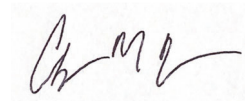
```
        THEN SUM(convert(float(8),dateoff-dateon)) ELSE 0.0
    END
INTO
    castnet_temp.dbo.Na_temp
FROM
    castnet_working.dbo.drychem_report RIGHT JOIN castnet_working.dbo.drychem_days ON
    castnet_working.dbo.drychem_report.site_id = castnet_working.dbo.drychem_days.site_id AND
    datepart(qq, (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!'
```

TITLE: DATA DELIVERABLES

Effective

Date: 10-11-2023

Prepared by: Christopher M. Rogers
Project Manager



Digitally signed by Rogers,
Christopher (USCR718689)
Date: 2023.10.09 16:05:44 -04'00'

Reviewed and Approved by: Marcus O. Stewart
QA Manager



Digitally signed by Stewart,
Marcus (USMS719399)
Date: 2023.10.06 16:52:44 -04'00'

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Annual Review			
Reviewed by:	Title:	Date:	Signature:

DATA DELIVERABLES

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide consistent guidance to WSP USA Environment & Infrastructure, Inc. (WSP) 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).

2.0 SCOPE

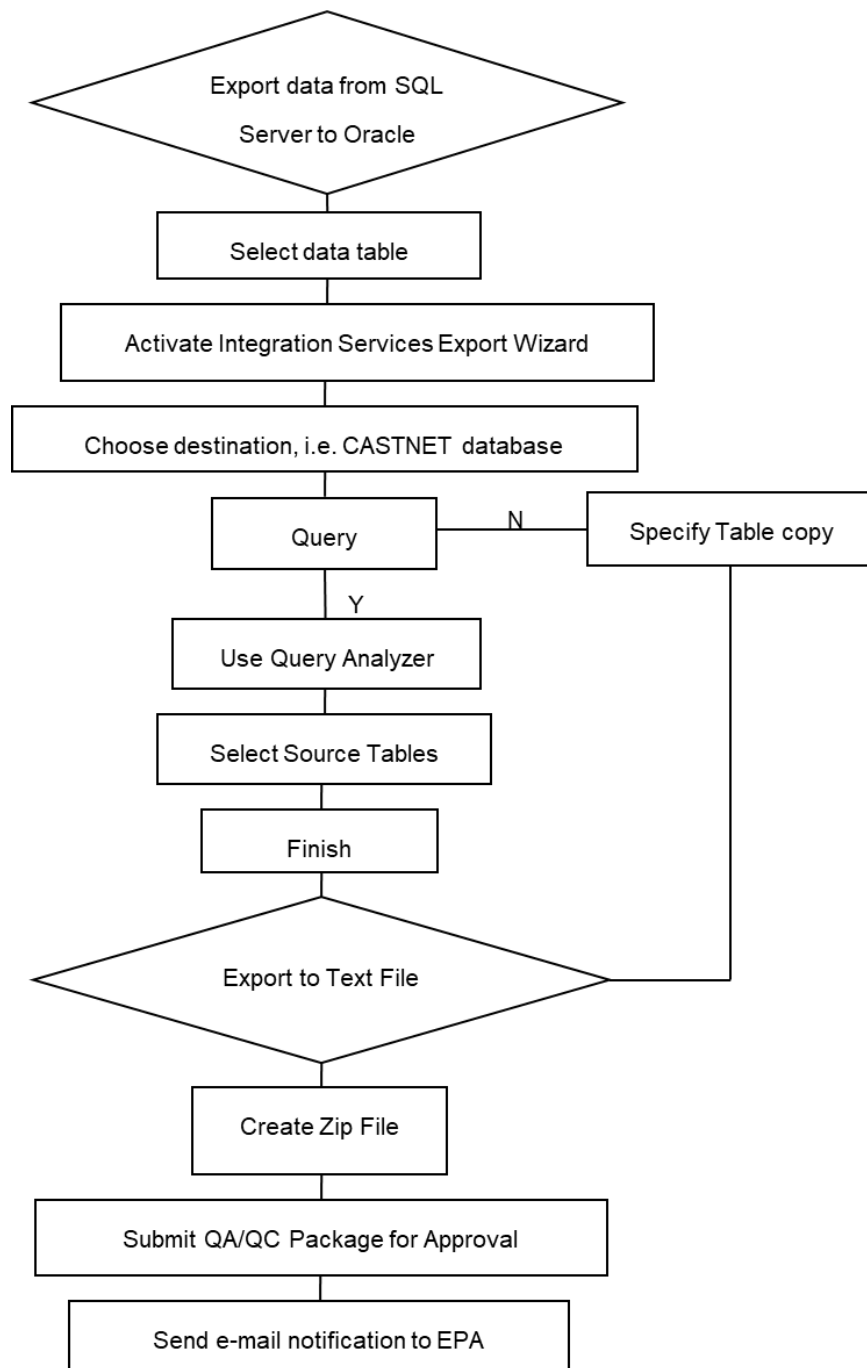
The processes described in this SOP are applicable to the production of contractual CASTNET data deliverables, which are prepared by WSP for submittal to EPA. This SOP assumes that the user possesses a basic understanding of the SQL Server Enterprise Manager.

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 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.

Figure 1. Data Deliverable Submittal Overview



3.1 Delivery Schedule

3.1.1 Text File 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	✓			
NETWORK_CHANGE	✓			
SITE_PHOTO	✓			
WOOD_INVOICE	✓			
CALIBRATION_SUMMARY		✓		
LABDATA		✓		
LABDATA_QC		✓		
SAMPLE_REFERENCE		✓		
SITE_OPERATORS		✓		
EQUIPMENT_INVENTORY			✓	
ASSUMED_FLOW				✓
CALIBRATION_CRITERA				✓
LEAF_ANGLE				✓
MODEL_OUTPUT				✓
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 WSP’s Field Operations Manager. Approximately 12 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 (6 Sites)	SND152, AL GAS153, GA	CND125, NC COW137, NC	BFT142, NC SPD111, TN	January July	July – December January – June	March September
MW-6 (6 Sites)	CDZ171, KY CKT136, KY	MCK131, KY ESP127, TN	MCK231, KY PNF126, NC	January July	July – December January – June	March September
E-1 (8 Sites)	BEL116, MD BWR139, MD WSP144, NJ	CTH110, NY ARE 128, PA PSU106, PA	PED108, VA VPI120, VA	February August	August – January February – July	April October
SE-5 (5 Sites)	CAD150, AR CVL151, MS	IRL141, FL SUM156, FL	DUK008, NC	February August	August – January February – July	April October
MW-7 (8 Sites)	RED004, MN BVL130, IL STK138, IL	VIN140, IN DCP114, OH OXF122, OH	QAK172, OH PRK134, WI	March September	September – February March – August	May November
W-9 (5 Sites)	KNZ184, KS CHE185, OK	SAN189, NE ALC188, TX	KIC003, KS	March September	September – February March – August	May November
E-2 (9 Sites)	ABT147, CT ASH135, ME NIC001, NY	CAT175, NY HWF187, NY WFM105, NY	EGB181, ON WST109, NH UND002, VT	April October	October – March April – September	June December
MW-8 (4 Sites)	SAL133, IN ANA115, MI	UVL124, MI HOX148, MI		April October	October – March April – September	June December
E-3 (5 Sites)	KEF112, PA MKG113, PA	CDR119, WV PAR107, WV	LRL117, PA	May November	November – April May – October	July January
W-10 (8 Sites)	ROM206, CO GTH161, CO PAL190, TX	CNT169, WY PND165, WY UMA009, WA	LPO010, CA NPT006, ID	May November	November – April May – October	July 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.

WOOD_INVOICE submittals are made monthly to provide documentation supporting financial reporting to EPA. Records for a monthly invoice are delivered within 30 days following the end of the financial reporting period.

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)

The EQUIPMENT_INVENTORY table is submitted annually with the property report 30 days after the end of EPA’s fiscal year (i.e., by 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 Secure File Transfer Protocol (sFTP). The Data Archiver process creates comma-separated variable (CSV) files containing these data. The Data Archiver runs daily at 1400 local time and creates the CSV files for the previous day’s data.

Four 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,
- gas_calibration_yyyymmdd.csv – quality control (QC) check 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 1500 and put these files on the sFTP site. The login for the sFTP site must be changed every 90 days and is maintained by the DMAIRM or designee.

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 sFTP 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 WSP.

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 60 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.

Each quarter, 1-point QC check data are submitted for the previous three months. For example, data for January through March are submitted the following May. Only 1-point QC check data associated with valid hourly ambient concentrations are submitted. QC checks invalidated during data validation are excluded, and a valid daily maximum 8-hour average concentration is required for that day's QC check to be included in the submittal.

4.0 MATERIALS

Laptop or personal computer
Microsoft SQL Server

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 email. SQL queries are written for each table and then exported to pipe-delimited txt files using SQL Server Integration Services. The files are zipped and then emailed to EPA. Prior to sending the email, a review package is sent to the QA Manager for approval. The package includes all the queries, the resulting submittal files, an Excel spreadsheet listing the tables and record counts, and an Excel file that has all the DRYCHEM records (Table 1) being submitted. Table 5 shows a blank submittal checklist that is completed and provided to the QA Manager. Data sent to EPA are archived in EPA's Oracle 12c database.

Table 5. Data Submittal Checklist

CASTNET Monthly Submittal QC Checklist

Monthly Submittal: _____

EPA Sites: Group ID: _____

Start Date: _____ End Date: _____

BLM/NPS Sites: Start Date: _____ End Date: _____

Table Name	Records	Query	Count	EPA Count Verification
DRYCHEM (prelim = _____)	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FILTER_PACK	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NETWORK_CHANGE (month = _____)	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SITE_PHOTO (month = _____)	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRYCHEM (update)	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GAS_CALIBRATION (month = _____)	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HOURLY_GAS (update; AQS = _____)	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
METDATA (update; AQS = _____)	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
METDATA L3 records moved to METDATA from METDATA_L2 and deleted from METDATA_L2?				<input type="checkbox"/>

ON CHANGE (accompanies Monthly):

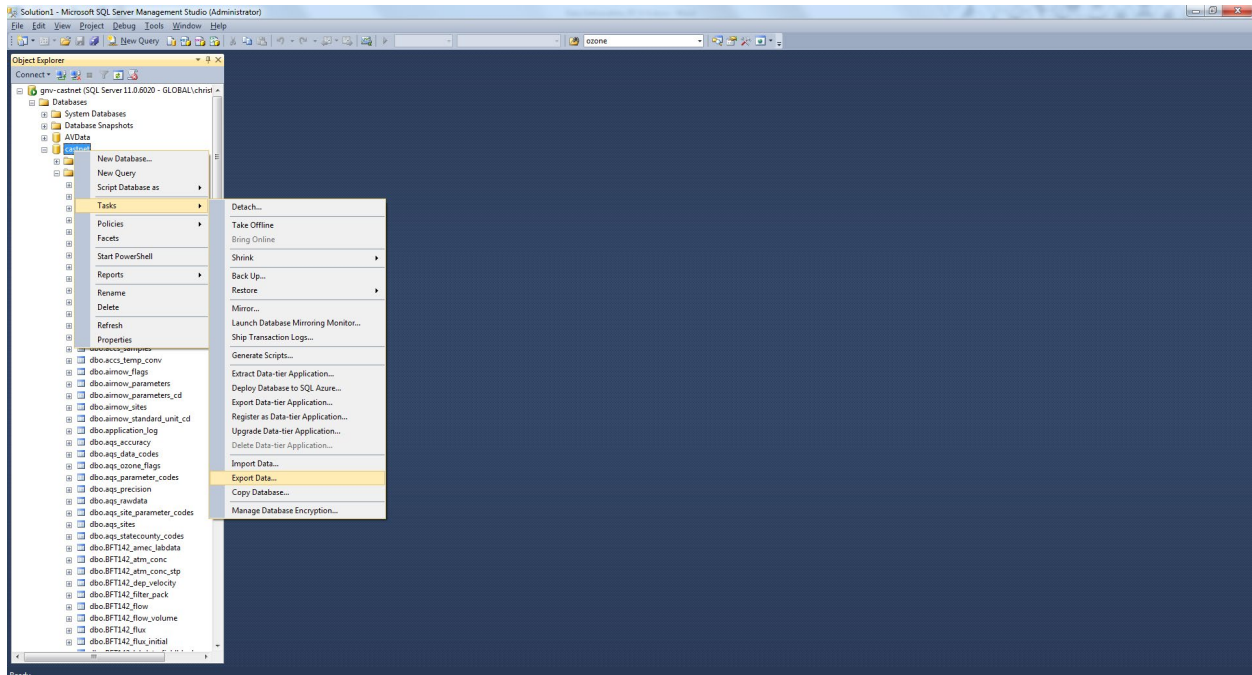
Table Name	Records	Query	Count	EPA Count Verification
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Signature of Wood Data representative:

Signature of Wood QA representative:

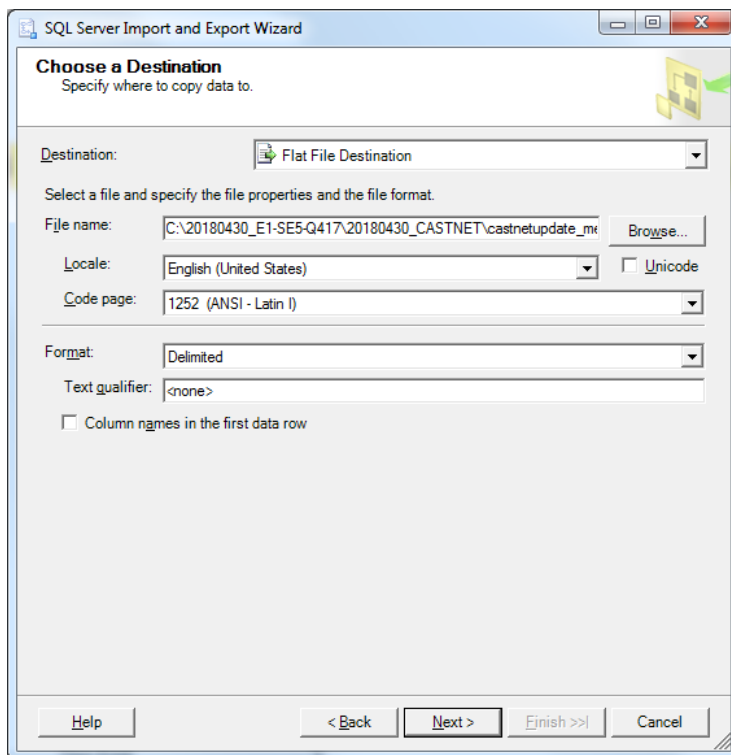
Signature of Wood Project Manager:

Figure 2. Accessing Integration Services Functions



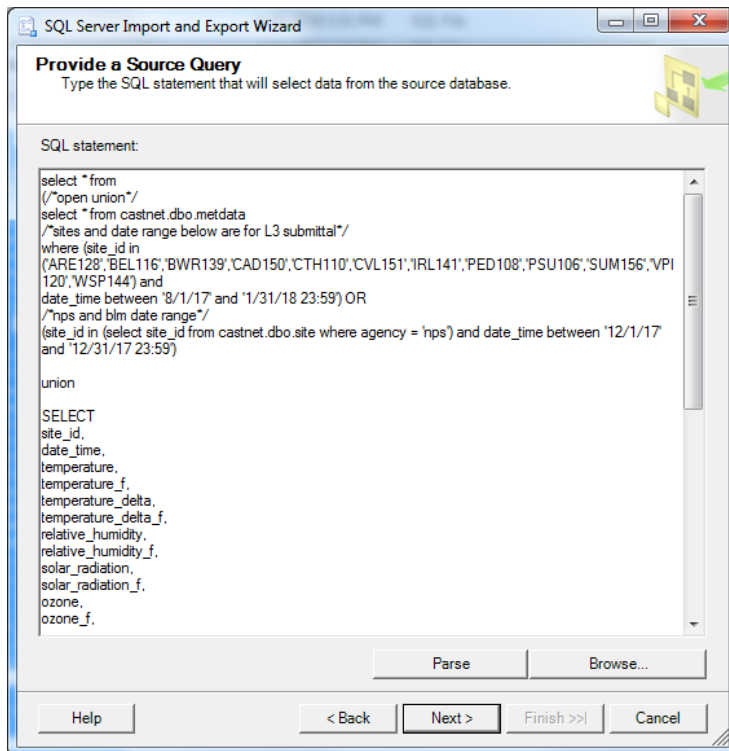
The data source is defined in the first step of the Integration Services Export Wizard, which is labeled, “Choose a Data Source.” For this process, the CASTNET database will always be the source. The next step is to “Choose a Destination” (Figure 3). Select “Microsoft OLE DB Provider for Oracle” from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

Figure 3. Integration Services 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 screenshot shows the 'SQL Server Import and Export Wizard' window, specifically the 'Provide a Source Query' step. The window title is 'SQL Server Import and Export Wizard'. The main heading is 'Provide a Source Query' with the instruction 'Type the SQL statement that will select data from the source database.' Below this is a text area labeled 'SQL statement:' containing the following SQL code:

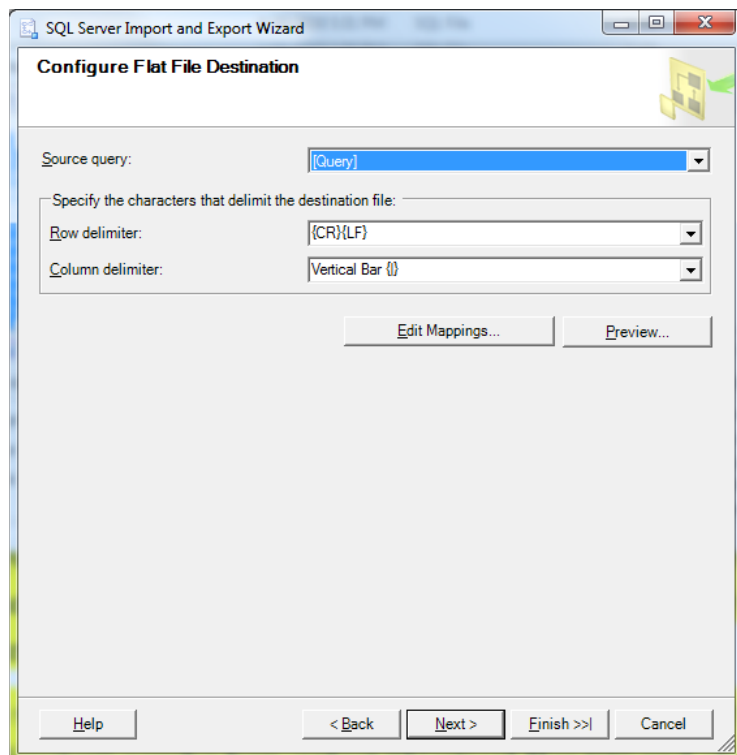
```
select * from
/*open union*/
select * from castnet.dbo.metdata
/*sites and date range below are for L3 submittal*/
where (site_id in
(ARE128,'BEL116','BWR139','CAD150','CTH110','CVL151','IRL141','PED108','PSU106','SUM156','VPI
120','WSP144') and
date_time between '8/1/17' and '1/31/18 23:59') OR
/*hps and blm date range*/
(site_id in (select site_id from castnet.dbo.site where agency = 'hps') and date_time between '12/1/17'
and '12/31/17 23:59'))
union
SELECT
site_id,
date_time,
temperature,
temperature_f,
temperature_delta,
temperature_delta_f,
relative_humidity,
relative_humidity_f,
solar_radiation,
solar_radiation_f,
ozone,
ozone_f.
```

At the bottom of the text area are 'Parse' and 'Browse...' buttons. Below the text area are navigation buttons: 'Help', '< Back', 'Next >', 'Finish >>', and 'Cancel'.

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 “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 “Configure Flat File Destination.” From the “Column delimiter” combo box, select “Vertical Bar (|)” and click “Next.” Finally, verify that the “Run Immediately” box is checked and click “Finish” to begin the records transfer. Once the transfer is complete, note the number of records transferred.

Figure 5. Configuring the Flat File



There are two destination schemas in EPA’s Oracle database: CASTNETSCRATCH (for appends) and CASTNETUPDATE (for updates). Flat file names incorporate the name of the schema name and the database table (e.g., castnetupdate_metdata.txt).

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 QC findings, resubmittals from ARS, or general table cleanup. Updates are delivered via pipe-delimited txt files in an identical manner as the other submittals. All updates are processed through 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. 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 WSP 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: Sep 2019

EPA Sites: Group ID: MW6, SE4
Start Date: 1/1/19 End Date: 6/30/19

BLM/NPS Sites: Start Date: 5/1/19 End Date: 5/31/19

Table Name	Records	Query	Count	EPA Count Verification
✓ DRYCHEM (prelim = <u>Jul 19</u>)	<u>460</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
✓ FILTER_PACK	<u>403</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
NETWORK_CHANGE (month = <u>Aug 19</u>)	<u>0</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
✓ SITE_PHOTO (month = <u>Jul 19</u>)	<u>336</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
✓ DRYCHEM (update)	<u>552</u> ⁵⁵³	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
✓ GAS_CALIBRATION (month = <u>Jul 19</u>)	<u>6758</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
✓ HOURLY_GAS (update; AQS = <u>Jul 19</u>)	<u>29016</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
✓ METDATA (update; AQS = <u>Jul 19</u>)	<u>122184</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

METDATA L3 records moved to METDATA from METDATA_L2 and deleted from METDATA_L2?

ON-CHANGE (accompanies Monthly):

Table Name	Records	Query	Count	EPA Count Verification
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Signature of Wood Data representative: _____ Date: 9/30/19

Signature of Wood QA representative: _____ Date: 10/2/19

Signature of Wood Project Manager: _____ Date: 10/2/19

The name of the submittal is written on the line (e.g., September 2019).

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) Zipped archive file containing text pipe-delimited text files
- 2) Table-specific queries used to extract data from SQL Server
- 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

Placeholder

8.0 ATTACHMENTS

Attachment A – Example of E-mail Documentation

ATTACHMENT A

Example of E-mail Documentation

To: Puchalski, Melissa
Cc: Stewart, Marcus O; Howell, Kemp K; Wanta, Carol A; Gregory Beachley
(Beachley.Gregory@epamail.epa.gov); Rogers, Christopher M
Subject: Sep 2019 data submittal
Attachments: 20190930_CASTNET.xxx

Hi Melissa,

Attached are the pipe-delimited text files that comprise the Jul 2019 data submittal.

Notes:

1) This submittal includes sites from groups MW6 (Midwest 6) and SE4 (Southeast 4).

2) This submittal includes photos from the Jul 2019 calibration trips. I placed photos matching the SITE_PHOTO records on your newftp sFTP site. The file is named 20190930_JUL19_photos.zip.

Thanks,
Chris

Here is a summary of what has been loaded:

Appends:

TABLE_NAME	COUNT	COMMENT
DRYCHEM	460	All sites, preliminary data for Jul 2019.
FILTER_PACK	403	Group MW6, SE4 data submittal for Jan 2019 - Jun 2019, BLM/NPS data submittal for May 2019.
SITE_PHOTO	336	Photos from site calibrations during Jul 2019.

Updates:

TABLE_NAME	COUNT	COMMENT
DRYCHEM	553	Group MW6, SE4 data submittal for Jan 2019 - Jun 2019, BLM/NPS data submittal for April-May 2019, NPT006 sample 1851004-04.
GAS_CALIBRATION	6758	All Level 3 records for Jul 2019.
HOURLY_GAS	29016	AQS submittal and Level 3 records for all sites for Jul 2019.
METDATA	122184	Group MW6, SE4 data submittal for Jan 2019 - Jun 2019, BLM/NPS data submittal for May 2019, AQS submittal for Jul 2019.

9.0 APPENDIX

EPA AQS Ozone Data File Generator SOP

APPENDIX A

WSP 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 for gaseous parameters (e.g. ozone, sulfur dioxide and other gases). These files will be used to upload data in batch format to the EPA Air Quality Subsystem (AQS) application. The data is retrieved from WSP’s GNVCASTNET Microsoft SQL Server database, to which this application is linked.

This application utilizes a tab control, which has three tabs 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/aqs>) as per the instruction listed in the AQS User Guide (<https://www.epa.gov/aqs/aqs-user-guide>).

2.0 RAW DATA

Figure 2-1. Raw Data Form

The screenshot shows the 'Raw Data' form in the CASTNET Air Quality System (AQS). The form has three tabs: 'Raw Data', 'Accuracy data', and 'Precision Data'. The 'Raw Data' tab is active. It features a 'Start Date' field set to 10/1/2014 and an 'End Date' field set to 10/31/2014. There is an 'Action' dropdown menu with options 'Insert', 'Update', and 'Delete'. A 'Parameters' list contains 'OZONE', 'CO', 'SO2', 'NO', 'NOY', and 'NOY - NO'. A checkbox labeled 'Union Metadata L1 & L2' is checked. There are buttons for 'Output Data', 'Get Data', and 'Display Output File'. Below these controls is a table of sites with columns: Site ID, Site Name, County, State, AQS Code, and AQS Date. The table lists 10 sites, including ABT147, ALC188, ALH157, ANA115, ARE128, ASH135, BEL116, BFT142, and BVL130. Below the site table is a larger table of data records with columns: Code, Action, State, County, Site Code, Site ID, Parameter, POC, Duration, Unit, Method, Day, Hour, Value, Text, Data Code, and Coll. The records show data for site ABT147 at various times of day, with parameters like 44201 and values ranging from 12.56 to 13.49.

Site ID	Site Name	County	State	AQS Code	AQS Date
ABT147	Abington	Windham	CT	090159991	04/08/2011
ALC188	Alabama-Coushatta	Polk	TX	483739991	03/30/2011
ALH157	Alhambra	Madison	IL	171199991	03/23/2011
ANA115	Ann Arbor	Washtenaw	MI	261619991	04/26/2011
ARE128	Arendtsville	Adams	PA	420019991	07/27/2010
ASH135	Ashland	Aroostook	ME	230039991	05/19/2011
BEL116	Beltsville	Prince George's	MD	240339991	02/25/2011
BFT142	Beaufort	Carteret	NC	370319991	07/23/2010
BVL130	Bondville	Champaign	IL	170191001	03/22/2011

Code	Action	State	County	Site Code	Site ID	Parameter	POC	Duration	Unit	Method	Day	Hour	Value	Text	Data Code	Coll
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	00:00	12.56	12		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	01:00	12.51	12		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	02:00	13.3	AN		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	03:00	14.11	14		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	04:00	13.66	13		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	05:00	13.49	13		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	06:00	12.7	12		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	07:00	12.22	12		

2.1 Raw Data Form

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

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. Check the *Union Metadata L1 & L2* box for historical data. Select the desired gas(es) in the *Parameters* box. It is not necessary to use the control key for multiple selections.

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

CASTNET Air Quality System (AQS)

Raw Data Accuracy data Precision Data

Start Date: 10/1/2014

End Date: October, 2014

Parameters: OZONE, CO, SO2, NO, NOY, NOY - NO

Union Metadata L1 & L2

Get Data

Site ID	County	State	AQS Code	A
ABT147	Windham	CT	090159991	0
ALC188	Alabama-Coushatta	Polk	483739991	0
ALH157	Alhambra	Madison	171199991	0
ANA115	Ann Arbor	Washtenaw	261619991	0

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 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. Raw Data Form – Upper Right Section

NOY - NO

Select All Sites

Site ID	Site Name	County	State	AQS Code	AQS Date	Include
ABT147	Abington	Windham	CT	090159991	04/08/2011	<input type="checkbox"/>
ALC188	Alabama-Coushatta	Polk	TX	483739991	03/30/2011	<input type="checkbox"/>
ALH157	Alhambra	Madison	IL	171199991	03/23/2011	<input type="checkbox"/>
ANA115	Ann Arbor	Washtenaw	MI	261619991	04/26/2011	<input type="checkbox"/>
ARE128	Arendtsville	Adams	PA	420019991	07/27/2010	<input type="checkbox"/>
ASH135	Ashland	Aroostook	ME	230039991	05/19/2011	<input type="checkbox"/>
BEL116	Beltsville	Prince George's	MD	240339991	02/25/2011	<input checked="" type="checkbox"/>
BFT142	Beaufort	Carteret	NC	370319991	07/23/2010	<input type="checkbox"/>
BVL130	Bondville	Champaign	IL	170191001	03/22/2011	<input checked="" type="checkbox"/>

Code Action State County Site Code Site ID Parameter POC Duration Unit Method Day Hour Value Text Data Code Coll

Figure 2-4. Raw Data Form – Lower Section

Code	Action	State	County	Site Code	Site ID	Parameter	POC	Duration	Unit	Method	Day	Hour	Value	Text	Data Code	Coll
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	00:00	12.56	12		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	01:00	12.51	12		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	02:00	13.3		AN	
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	03:00	14.11	14		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	04:00	13.66	13		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	05:00	13.49	13		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	06:00	12.7	12		
RD	I	09	015	9991	ABT147	44201	1	1	008	047	20141001	07:00	12.22	12		

2.5 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. Raw Data Output Text File

```

RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 00:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 01:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 02:00 | 12 | AN
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 03:00 | 14 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 04:00 | 13 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 05:00 | 13 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 06:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 07:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 08:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 09:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 10:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 11:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 12:00 | 10 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 13:00 | 10 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 14:00 | 11 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 15:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 16:00 | 12 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 17:00 | 12 |
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RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 19:00 | 15 |
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RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 21:00 | 19 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 22:00 | 19 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141001 | 23:00 | 18 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141002 | 00:00 | 17 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141002 | 01:00 | 17 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141002 | 02:00 | 12 | AN
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141002 | 03:00 | 16 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141002 | 04:00 | 16 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141002 | 05:00 | 16 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141002 | 06:00 | 17 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141002 | 07:00 | 16 |
RD | I | 09 | 015 | 9991 | 44201 | 1 | 1 | 008 | 047 | 20141002 | 08:00 | 17 |

```

3.0 DATA ACCURACY

3.1 Data Accuracy Form

The AQS 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. Data Accuracy Form

The screenshot shows the 'CASTNET Air Quality System (AQS)' application window. At the top, there are three tabs: 'Raw Data', 'Accuracy data', and 'Precision Data'. The 'Accuracy data' tab is active. The form contains several input fields and buttons:

- Date:** A date picker set to 7/13/2013.
- Action:** A dropdown menu with options: Insert, Update, Delete.
- Parameters:** A list box containing: OZONE, CO, SO2, NO, NOY, NOY - NO.
- Site ID:** A dropdown menu set to PRK134.
- Buttons:** 'Get Data', 'Add Records', 'Output Data', and 'Display Output File'.

Below the input fields is a table with the following data:

Code	Action	State	County	Site Code	Site ID	Parameter Code	Parameter	POC	Audit ID	Duration	Unit	Method	Day	Level 1 Value
RA	I	55	119	9991	PRK134	44201	OZONE	1	1	1	008	047	20130713	

At the bottom of the form, there are two buttons: 'Get Existing Data' and 'Update Existing Data'. Below these buttons is another table with the following columns:

Code	Action	State	County	Site Code	Site ID	Parameter	POC	Level	Audit ID	Duration	Unit	Method	Day	Value	Expected
------	--------	-------	--------	-----------	---------	-----------	-----	-------	----------	----------	------	--------	-----	-------	----------

3.2 Date and Record Action Selection

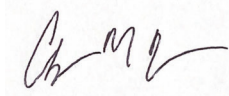
The desired data range is selected first, as seen in Figure 2-2. Next the record Action Indicator is selected; the action may be an Insert, Update, or Delete operation. The source of the AQS accuracy data is the castnet_loggernet.cal_raw table.

TITLE: MULTI-LAYER MODEL OPERATION

Effective

Date: 10-11-2023

Prepared by: Christopher M. Rogers
Project Manager



Digitally signed by Rogers,
Christopher (USCR718689)
Date: 2023.10.09 16:08:20 -04'00'

Reviewed and Approved by: Marcus O. Stewart
QA Manager



Digitally signed by Stewart,
Marcus (USMS719399)
Date: 2023.10.06 17:00:27 -04'00'

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- 1.0 Purpose
- 2.0 Scope
- 3.0 Operating the Pre-/Post-Processor Interface
- 4.0 Model Output Post Processing: Tables, Aggregation Schemes, and Requirements
- 5.0 Adding the lab_key to VELHR
- 6.0 References
- 7.0 Attachments

Annual Review			
Reviewed by:	Title:	Date:	Signature:

MULTI-LAYER MODEL OPERATION

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide consistent guidance to WSP USA Environment & Infrastructure, Inc. (WSP) 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).

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 4.2.1.3, Modeling Software, of the CASTNET QAPP.

3.1 Required Directory and File Set Up

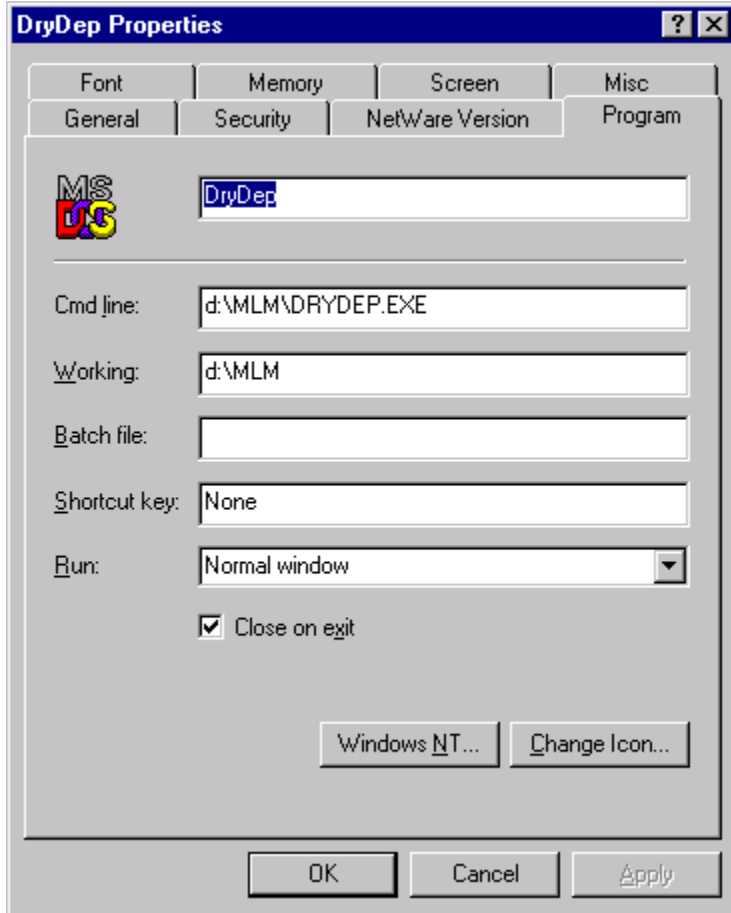
Operation of the MLM requires the existence of five files, all of which must be in the same local directory on the user's computer. These files are listed below:

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. 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

Dry Deposition Batch Model

File Run View

▶ || ■ ADD Import

Select Sites

Sites Available: ABT147, ACA416, ALH157, ALH257, ALH557, ANA115, ANL146

Sites Selected: GAS153

Select Dates

First Day: 01/01/87

Last Day: 12/31/01

All Periods

Model Processing Options

- Create Meteorology Input Files
- Create Chemistry Input Files
- Run Dry Dep Model (Hourly Averages)
- Create Weekly Averages
- Create Monthly Averages
- Create Seasonal Averages
- Create Quarterly Averages
- Create Annual Averages - Seasonal
- Create Annual Averages - Quarterly

Dry Deposition Model Options

- Create Vd Files
- Create Resistance File
- Create Plant Vd File
- Create Plant Flux Files
- Calculate Missing Wetness Data
- Substitute for Missing Met Data
- Keep Chemistry Data
- Force Calculated Wetness
- Force Constant Soil Moisture

Data Output Options

- Update Database
- Add Only

Before creating inputs

- Delete input files
- Delete output files

After database update

- Delete input files
- Delete output files

Select sites, dates and options for DryDep model and/or averages.

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 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 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

The screenshot shows a dialog box titled "Dry Deposition Model Program Log". It features a title bar with a close button. The main area contains two input fields: "Operator initials:" with the text "CMR" and "Model Version No." with the text "2.3". Below these is a large text area labeled "Comments:". At the bottom of the dialog are "Continue" and "Cancel" buttons. A status bar at the very bottom shows "Model", "ADO Import", and "Dry Dep Model".

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 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 Padprof2.20 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.
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 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 aggregations, see Section 4.4.4, Aggregations, of the CASTNET QAPP.

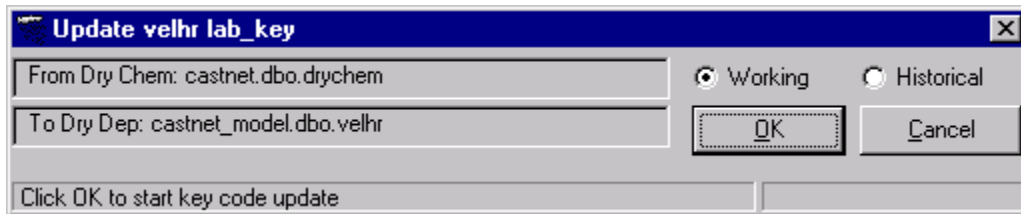
Table 5

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. 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 *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

Placeholder

7.0 ATTACHMENTS

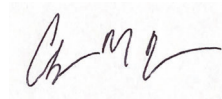
This SOP does not contain attachments.

TITLE: DATABASE BACKUPS

Effective

Date: 10-11-2023

Prepared by: Christopher M. Rogers
Project Manager



Digitally signed by Rogers,
Christopher (USCR718689)
Date: 2023.10.09 16:06:13 -04'00'

Reviewed and Approved by: Marcus O. Stewart
QA Manager



Digitally signed by Stewart,
Marcus (USMS719399)
Date: 2023.10.06 16:54:14 -04'00'

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- 7.0 References
- 8.0 Attachments

Annual Review			
Reviewed by:	Title:	Date:	Signature:

DATABASE BACKUPS

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide consistent guidance to WSP USA Environment & Infrastructure, Inc. (WSP) 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 version 2022 databases as specified in the CASTNET Quality Assurance Project Plan (QAPP) (WSP, 2023).

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 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.

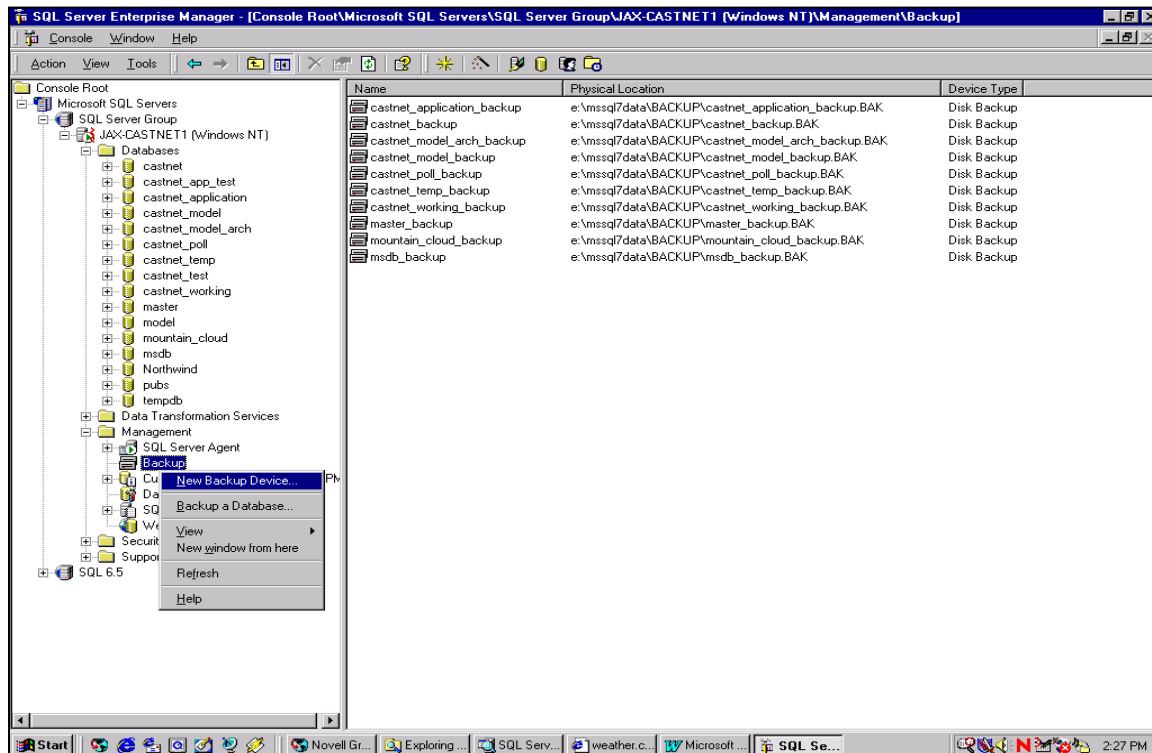
Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using the computer. Take breaks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

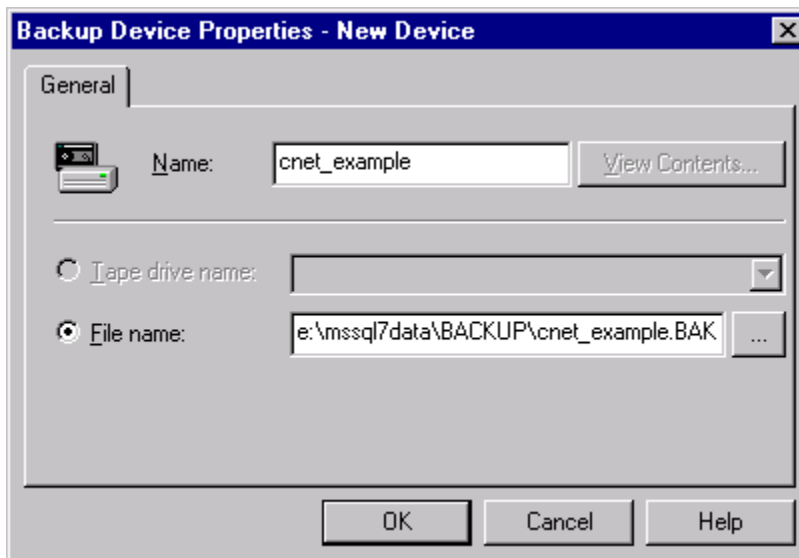
The CASTNET data set, which consists of seven permanent databases managed using Microsoft SQL Server, must be backed up weekly to ensure protection against catastrophic server failure, theft, and other forms of data loss. The process for routine backups of SQL Server managed databases begins with the 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:

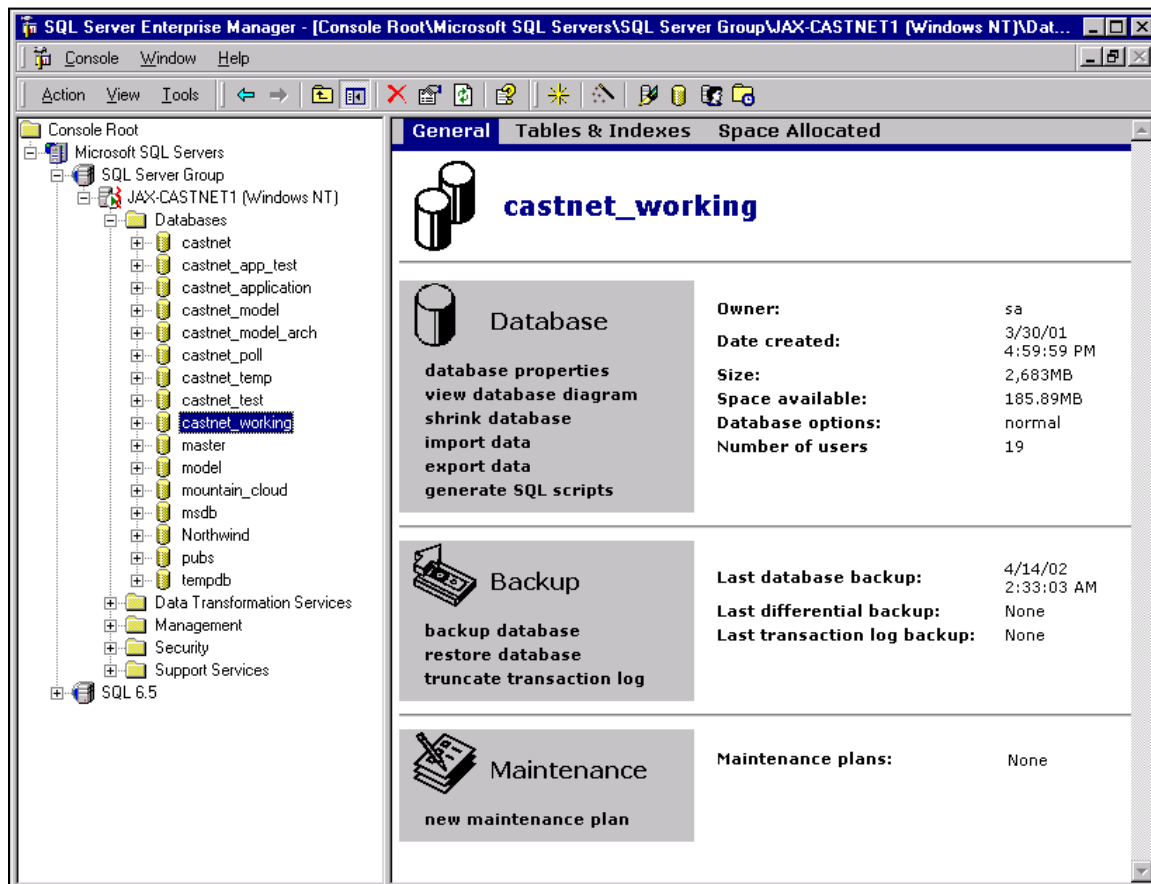
Figure 2



6.2 Manual Database Backups Using Sql Server

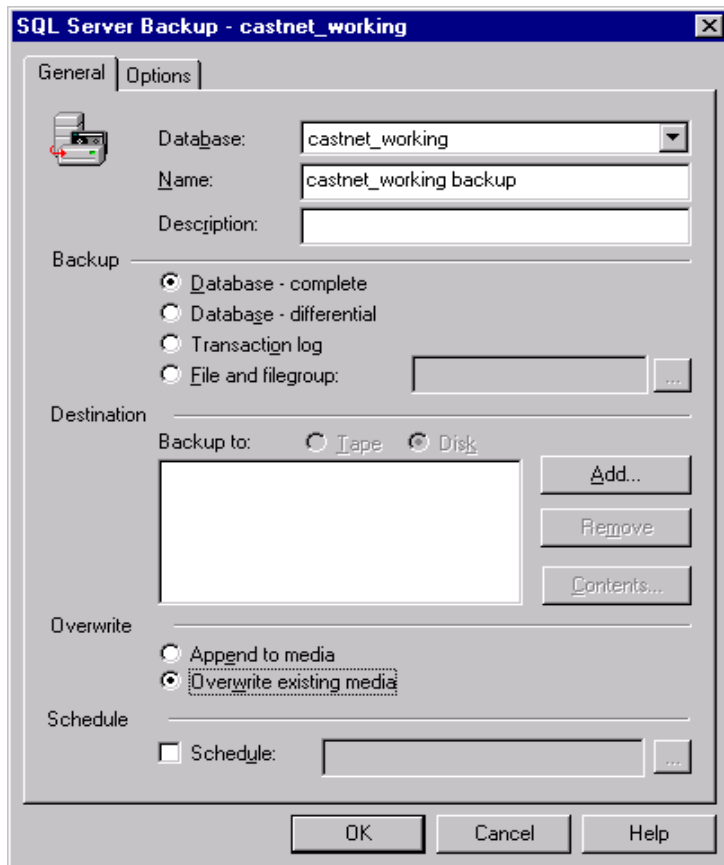
Databases can be backed up without a backup device. However, for a database that is routinely backed up, it is simpler to first create a backup device that can then be used repeatedly. Once the database backup device is established, a database can be manually backed up. To begin, under the “Databases”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

Figure 3



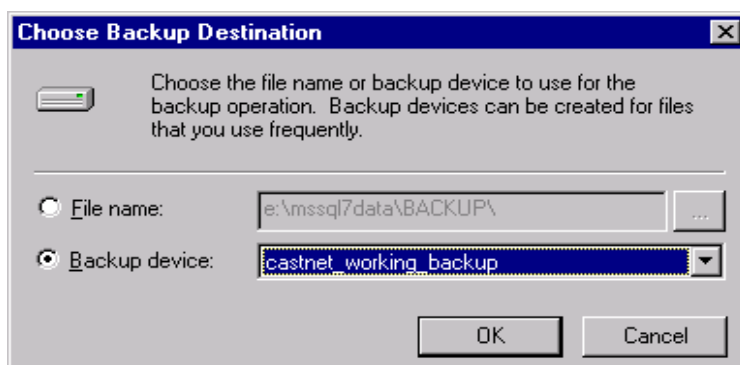
Multiple options are shown in the right window. Under the “Backup” options, select “backup database.” The following form (Figure 4) is displayed:

Figure 4



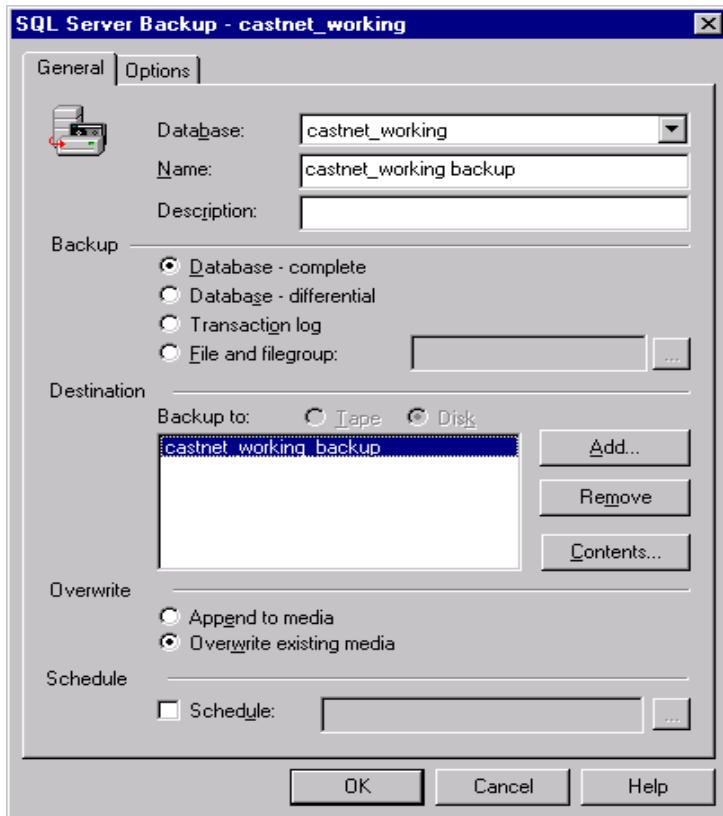
Only complete backups of the CASTNET databases are performed. This is the default setting and is indicated by the selected radio button next to “Database – complete.” As an additional step, when a new backup is created, existing backups are overwritten. This option is not a default and must be selected 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



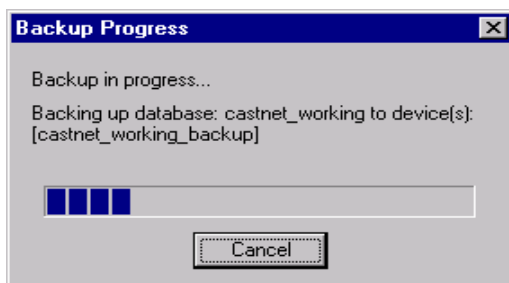
Backups can either be sent to a file or to a backup device which points to the file to be used. Open the combo box next to “Backup device” and select the backup device to be used. In this example, the castnet_working database is being backed up and therefore the “castnet_working_backup” backup device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

Figure 6



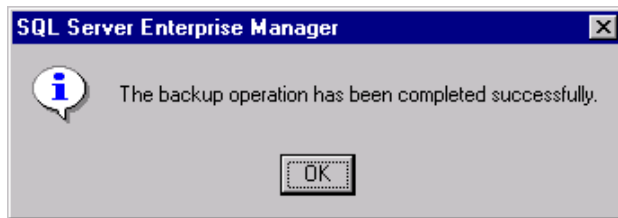
To start the manual backup, click “OK.” The progress bar (Figure 7) indicates the percent of completion for the backup process:

Figure 7



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

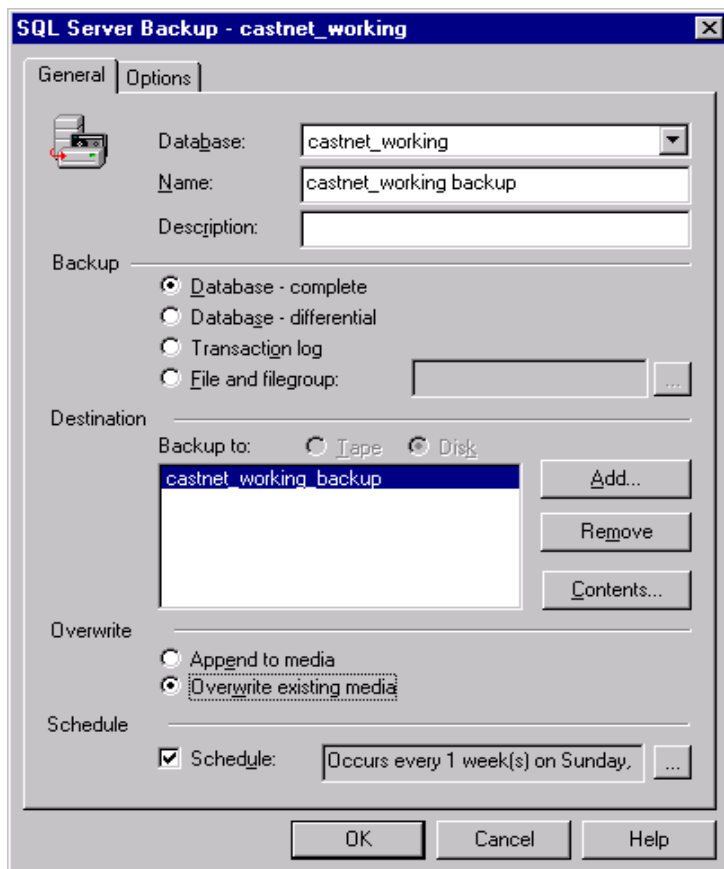
Figure 8



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

The screenshot shows the 'Edit Schedule' dialog box. The 'Name' field is filled with 'castnet_working backup job' and the 'Enabled' checkbox is checked. Under the 'Schedule type' section, the 'Recurring' radio button is selected. The recurring schedule is set to 'Occurs every 1 week(s) on Sunday, at 12:00:00 AM.' There are 'Change...', 'OK', 'Cancel', and 'Help' buttons at the bottom.

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

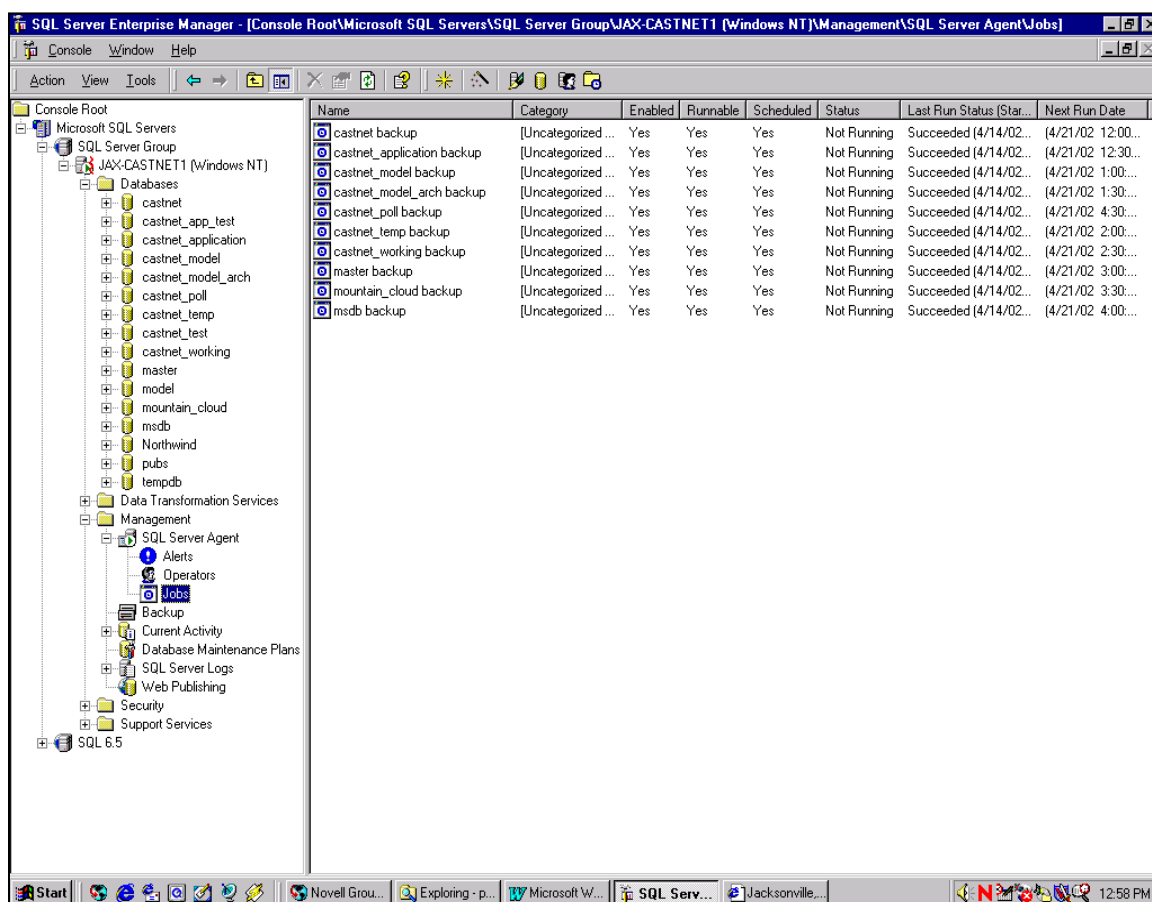
The screenshot shows the 'Edit Recurring Job Schedule' dialog box. The 'Job name' is '(New Job)'. Under the 'Occurs' section, the 'Weekly' radio button is selected. The frequency is set to 'Every 1 week(s) on: Sun'. Under the 'Daily frequency' section, 'Occurs once at: 12:00 AM' is selected. Under the 'Duration' section, 'Start date: Fri 4/19/2002' and 'End date: Fri 4/19/2002' are selected. There are 'OK', 'Cancel', and 'Help' buttons at the bottom.

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 labelment 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 external hard drive by an automated script.

6.5 CREATING BACKUPS IN ORACLE 19c

The Oracle 19c CASTNET database is also backed up weekly to external hard drive. To backup the Oracle 19c 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 19c 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

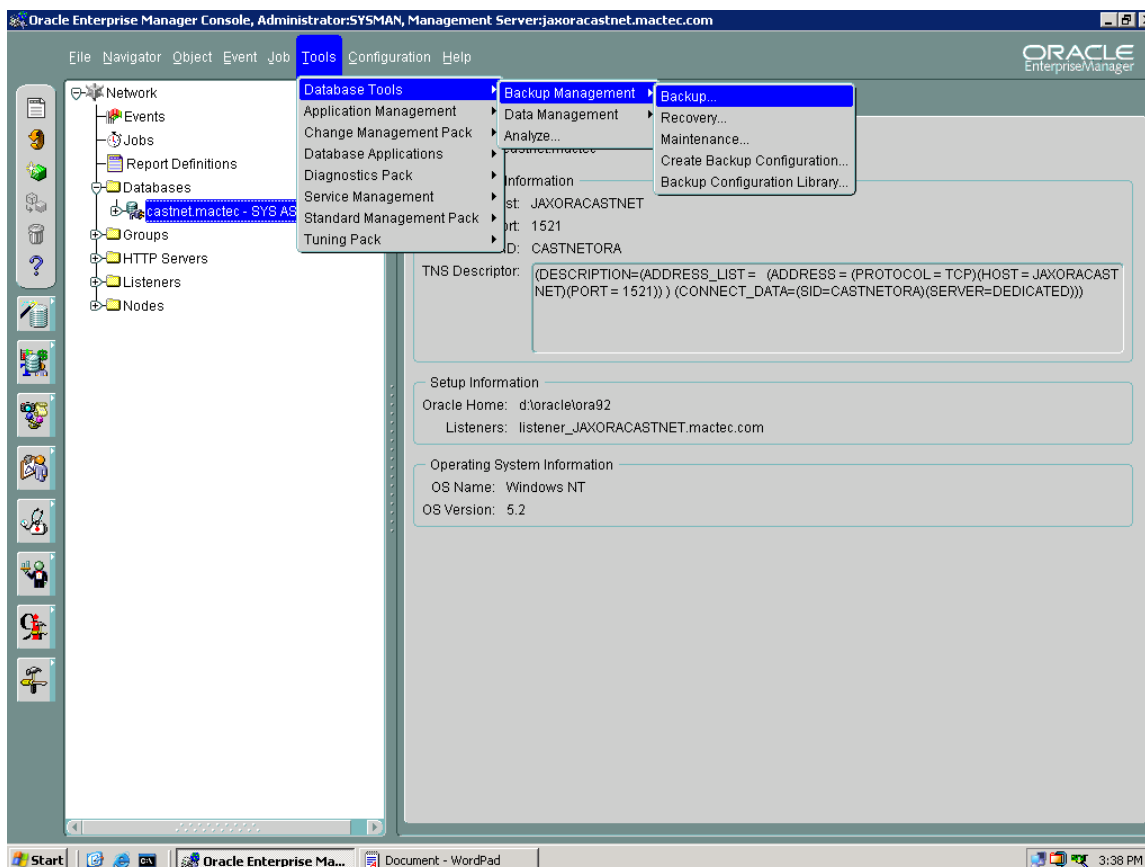


Figure 14

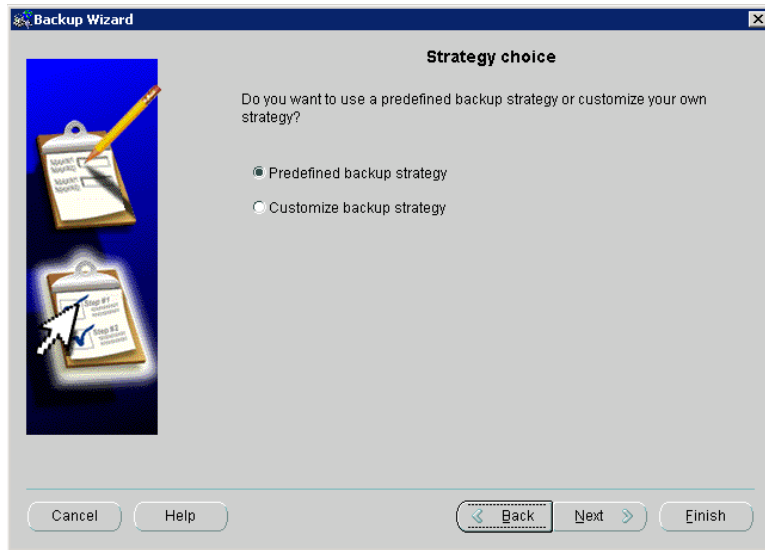


Figure 15

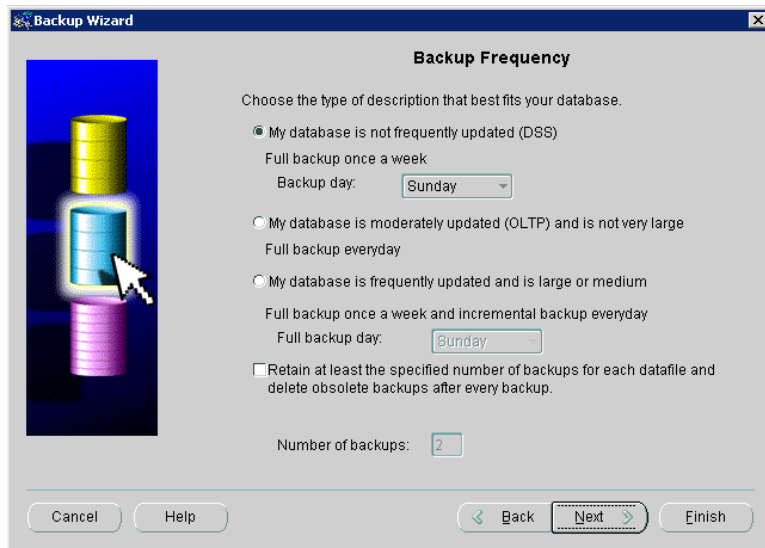


Figure 16

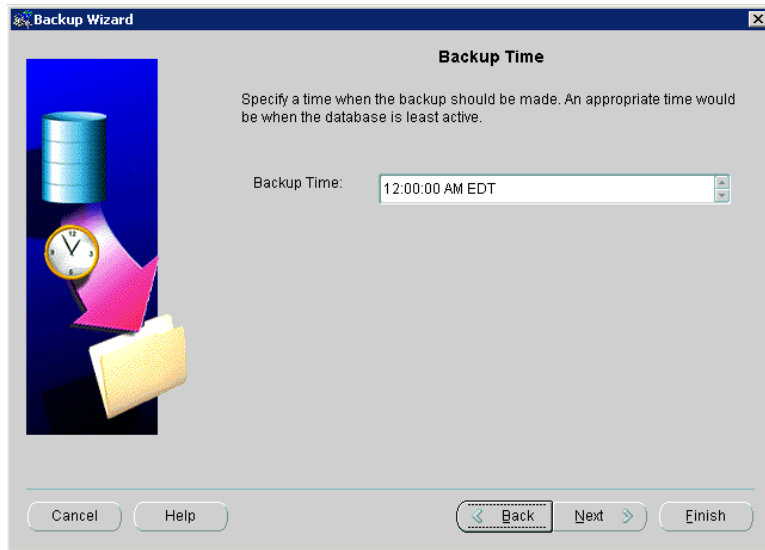


Figure 17

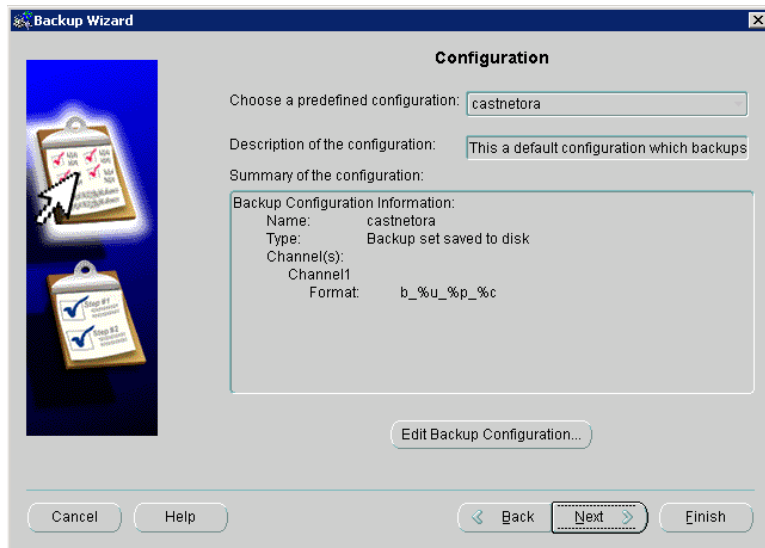


Figure 18

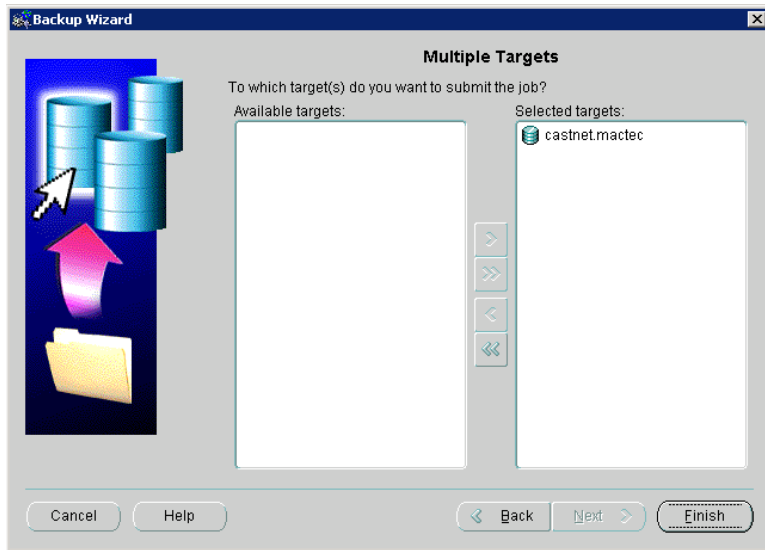
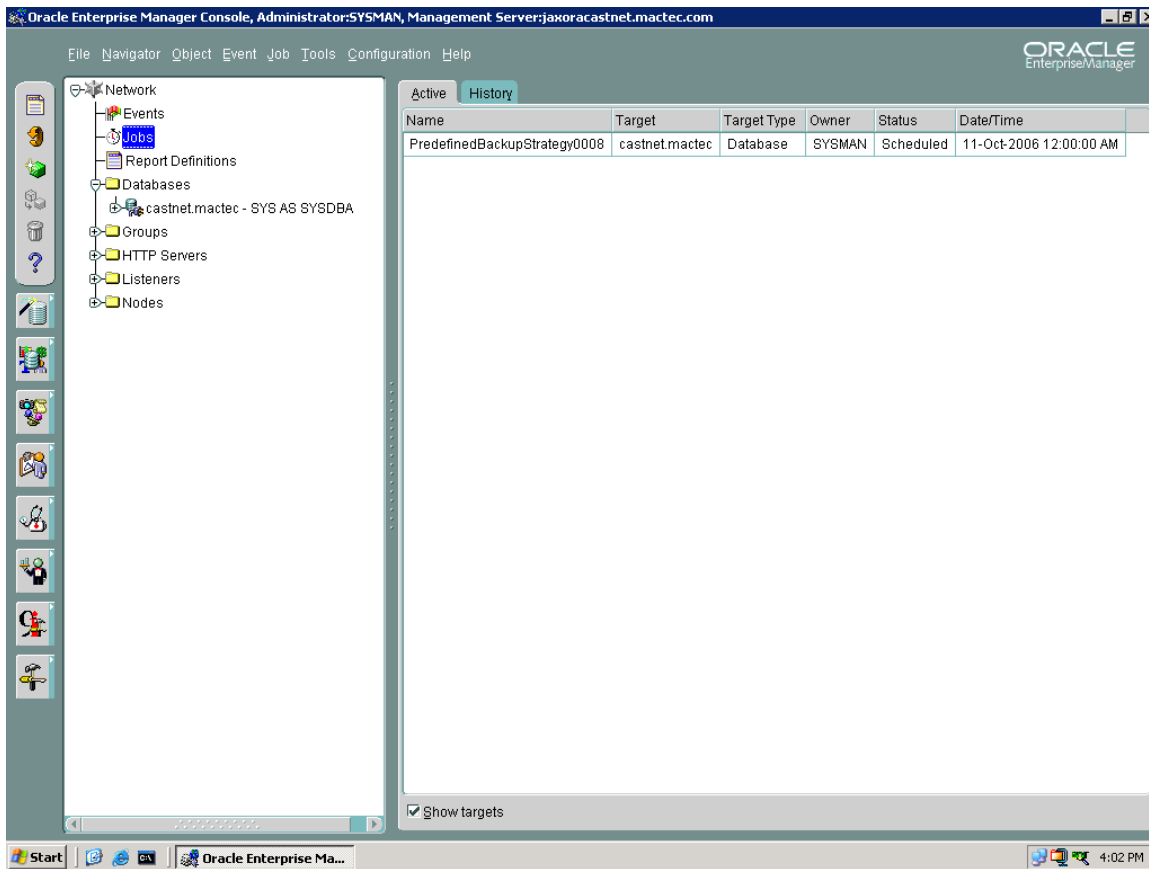


Figure 19



7.0 REFERENCES

Placeholder

8.0 ATTACHMENTS

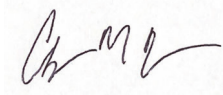
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TITLE: HARDWARE MAINTENANCE PLAN

Effective

Date: 10-11-2023

Prepared by: Christopher M. Rogers
Project Manager



Digitally signed by Rogers,
Christopher (USCR718689)
Date: 2023.10.09 16:07:47 -04'00'

Reviewed and
Approved by: Marcus O. Stewart
QA Manager



Digitally signed by Stewart,
Marcus (USMS719399)
Date: 2023.10.06 16:57:21 -04'00'

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Annual Review			
Reviewed by:	Title:	Date:	Signature:

HARDWARE MAINTENANCE PLAN

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide consistent guidance to WSP USA Environment & Infrastructure Inc.(WSP) 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 WSP corporate servers.

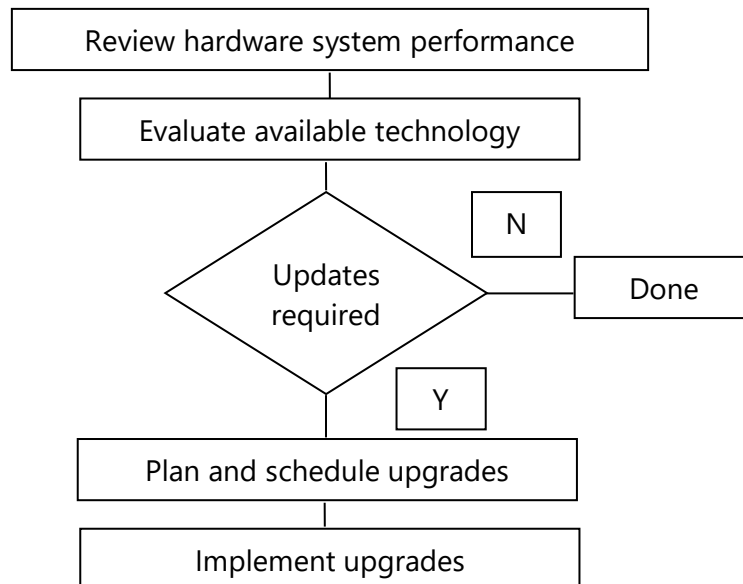
2.0 SCOPE

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 WSP 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 2022 server: Lenovo ThinkSystem SR650

SQL Server 2022-related software

Oracle 19c database server: Lenovo ThinkSystem SR650

Oracle 19c database-related software

LoggerNet polling software server: Lenovo ThinkSystem SR650

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

A Lenovo ThinkSystem SR650 server hosts 4 virtual machines for MS SQL Server data, Oracle data, web applications and Campbell'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

WSP's Information Technology (IT) staff recommends defragmenting all hard drives on servers with Microsoft® operating systems on a monthly basis.

6.1.3 Use of Virus Scanning Software on the CASTNET Server

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

6.1.4 Incident Response

If a data breach is suspected, WSP will immediately initiate investigation and implement response action as appropriate. WSP will alert EPA within 3 to 5 days of a suspected data breach.

6.2 Maintenance of User Workstations

6.2.1 Routine Hardware Evaluation

User workstation hardware configurations are evaluated annually by WSP IT staff based on minimum workstation specifications established for the company. Workstations are replaced after approximately three years of use to ensure usability and compatibility with current systems and software.

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

6.2.2 User Workstation Antivirus Software

WSP IT manages the deployment of antivirus signature files and the antivirus scan schedule for all WSP workstations.

6.3 Maintenance of WSP Servers on the WSP WAN

Office servers on the WSP WAN are maintained and managed solely by WSP IT staff, which continually evaluates the hardware configuration of the office servers. Office servers are routinely backed up to a central WSP data center. Scheduled virus scans of hard drives occur weekly. Servers are automatically updated on a regular basis with new security patches.

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 WSP WAN servers. The following is an example of how such an event would be handled by either the DMAIRM, in the case of the CASTNET server, or the WSP IT staff. If the WSP 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 WSP 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

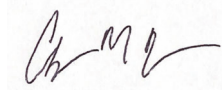
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TITLE: SOFTWARE MANAGEMENT PLAN

Effective

Date: 10-11-2023

Prepared by: Christopher M. Rogers
Project Manager



Digitally signed by Rogers,
Christopher (USCR718689)
Date: 2023.10.11 16:00:01 -04'00'

Reviewed and Approved by: Marcus O. Stewart
QA Manager



Digitally signed by Stewart,
Marcus (USMS719399)
Date: 2023.10.11 15:52:25 -04'00'

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Annual Review			
Reviewed by:	Title:	Date:	Signature:

SOFTWARE MANAGEMENT PLAN

1.0 PURPOSE

This Software Management Plan (SMP) is furnished to provide consistent guidance to WSP USA Environment & Infrastructure Inc.(WSP) 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 (O₃), 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. Key software components used to perform these tasks:

- The CASTNET databases,
- The iCASTNET data application

These 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.

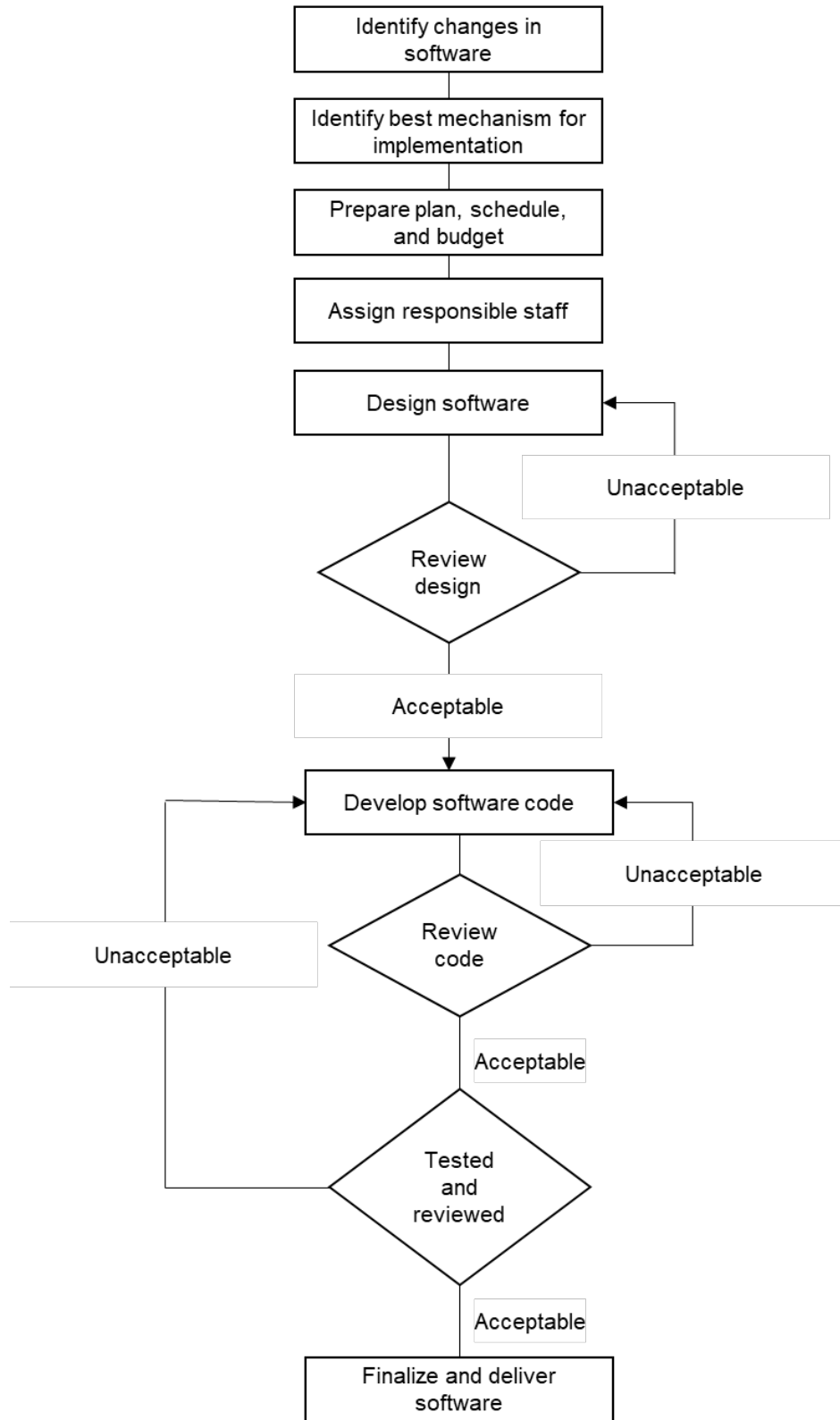
The term “software,” as used in this document, includes code, documentation, associated data, and “firmware,” which is software installed in a medium that cannot be dynamically changed. For the purposes of this document, the CASTNET databases are referred to as the “SQL database and the Oracle database,” and the data validation and analysis application as the “iCASTNET.” 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 and iCASTNET are used almost exclusively by people working on CASTNET, not by EPA employees or outside users.

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 version 2022 hardware
SQL Server-related software
Oracle 19c database hardware
Oracle 19c 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 with data requirements and updated technology.

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 WSP 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 WSP 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 WSP 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 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 iCASTNET). 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. WSP'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 Manager 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.

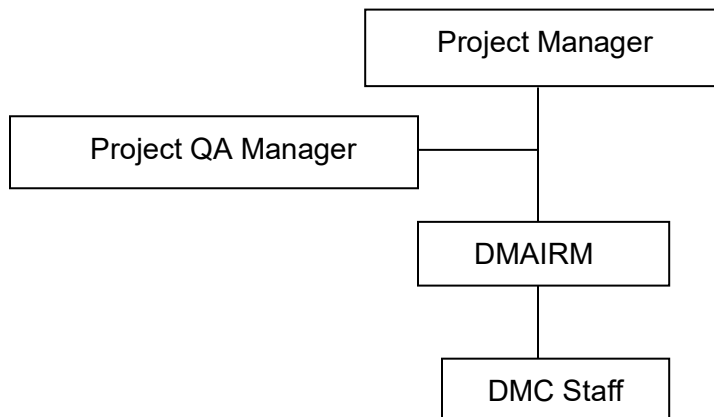
6.1.3 Software Development

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 WSP 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 WSP IT group.

6.2.2 Risk Management

6.2.2.1 New Technologies

New technologies are not normally utilized in software developed for CASTNET. Generally, only proven programming techniques, products, and procedures are utilized. New technology may only be utilized after testing and subsequent client approval.

6.2.2.2 Backup – Recovery

Weekly scheduled backups of the SQL Server and Oracle 19c 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 servers located in WSP's Gainesville, FL office. The CASTNET

database system is comprised of a physical server that hosts two virtual servers, and is located in the Gainesville, FL office. After the backups are complete, the files created by the database backup process are stored locally on the servers and on three external hard drives used in rotation to permit onsite and offsite backups. Onsite backups are stored in a fire proof safe in a room equipped with an automated fire control system. Gainesville and Jacksonville office servers, used to store project related files, are backed up daily to the cloud, a process that is managed by WSP IT staff.

Critical software and electronic documents are backed up to the Gainesville or Jacksonville office servers, which are backed up daily to the cloud in a system managed by WSP's IT staff. Should a disaster occur that renders the CASTNET server inoperable, the database management software will be rapidly re-loaded onto another server, and the data restored from the archived backup files. WSP 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 one week.

Other program-critical software and digital storage is and will continue to be maintained in a similar way. The iCASTNET application is housed on both the Jacksonville and Gainesville office servers, and the current version is backed up daily to the cloud. Therefore, server failure or a catastrophic event will have minimal effect on iCASTNET. Documents and reports prepared for CASTNET are stored on the Jacksonville or Gainesville WSP office server and are subject to the same daily backup procedure. SharePoint, an electronic document management system, is also used 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 WSP. A RAID subsystem increases performance and/or provides greater fault tolerance and provides protection against data loss from physical drive failure. The servers use RAID5 with a hot spare disk, which provides a striped set with distributed parity.

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 software 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 iCASTNET, 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 WSP 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 WSP.

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 WSP 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 WSP DMC also provides the hardware, iCASTNET software, data security, and computer programming necessary to manage, maintain, and deliver the CASTNET data. The CASTNET DMC uses Microsoft SQL and Oracle 19c 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 Manager 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 iCASTNET, 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 is 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 iCASTNET, or the CASTNET database structure is changed significantly. 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 iCASTNET, and any critical flaws are reviewed and evaluated to minimize change to other systems.

Code Reviews

The DMC staff performs all code reviews. 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.

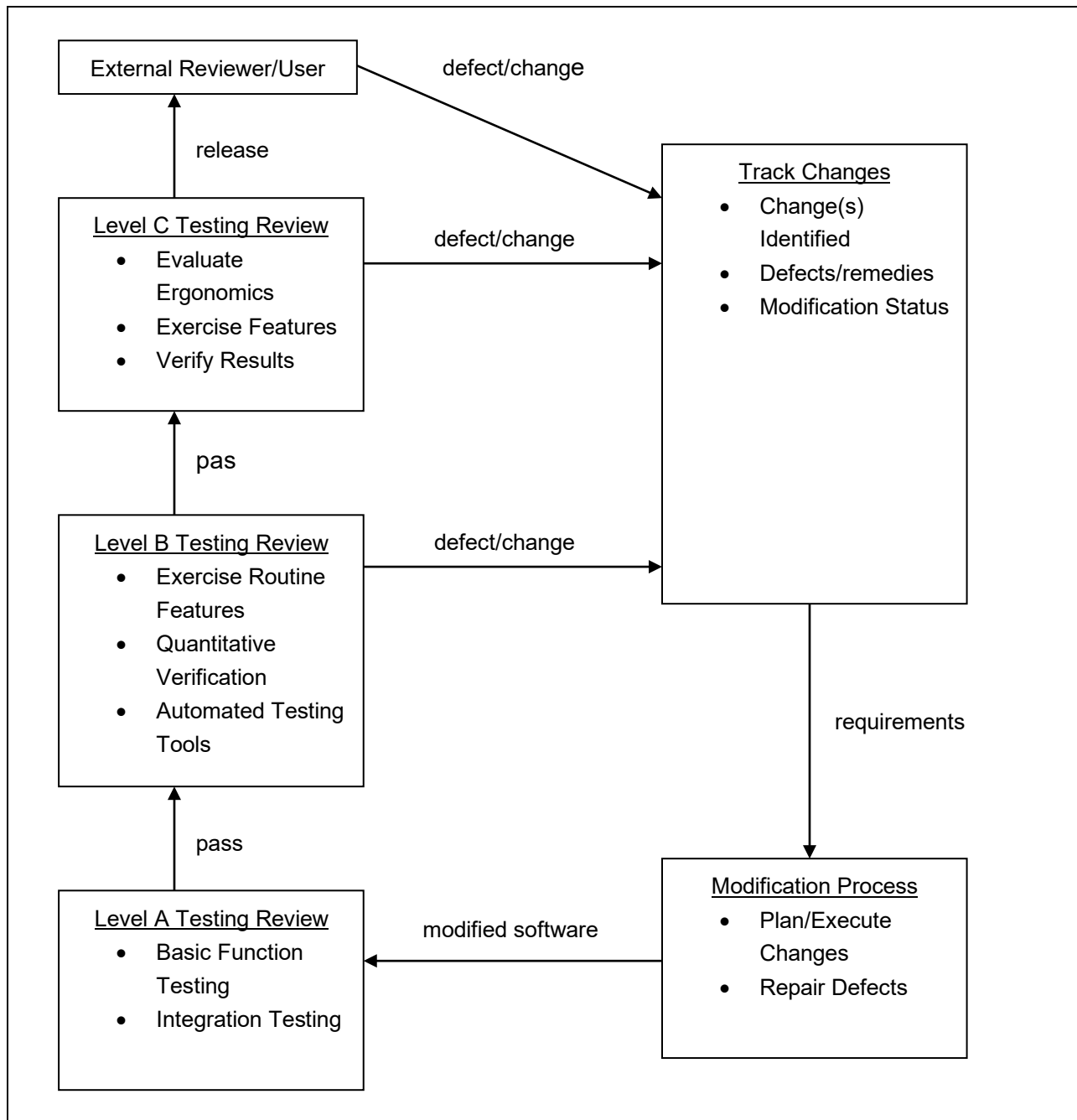
6.3.7.6 Operational Testing and Evaluation Review

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 WSP 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 WSP 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 iCASTNET 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 WSP's IT group. Prior to implementing any new software, the DOM or his designee confirms that the software operates correctly across WSP'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

WSP uses a version control system for software configuration management.

6.4.3.1 Configuration Identification

WSP's DMC staff has implemented a version control system for 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, WSP develops documentation for computer programmed systems (such as iCASTNET), 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 iCASTNET was created during its initial

development. Additional program code continues to be documented as it is developed. Documentation of iCASTNET also includes the database tables. The database tables and the data contained in them are also documented within the SQL Server database itself.

Methods and Approach to Standards Implementation

WSP 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.

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 iCASTNET and the databases.

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

U.S. Environmental Protection Agency (EPA). 1993. *EPA System Design and Development Guidance, Volumes A, B, and C*. EPA Directive 2182.

<https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9101IC7H.TXT>;

<https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=91017ZQZ.TXT>.

U.S. Environmental Protection Agency (EPA). 1990. *EPA Operation and Maintenance Manual*. EPA Directive 2181. <https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9100NWR5.TXT>.

8.0 ATTACHMENTS

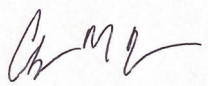
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TITLE: BASIC LOGGERNET OPERATIONS

Effective

Date: 10-11-2023

Prepared by: Christopher M. Rogers
Project Manager



Digitally signed by Rogers,
Christopher (USCR718689)
Date: 2023.10.09 16:04:43 -04'00'

Reviewed and Approved by: Marcus O. Stewart
QA Manager



Digitally signed by Stewart,
Marcus (USMS719399)
Date: 2023.10.06 16:46:17 -04'00'

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Annual Review			
Reviewed by:	Title:	Date:	Signature:

BASIC LOGGERNET OPERATIONS

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide consistent guidance to WSP USA Environment & Infrastructure, Inc. (WSP) 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

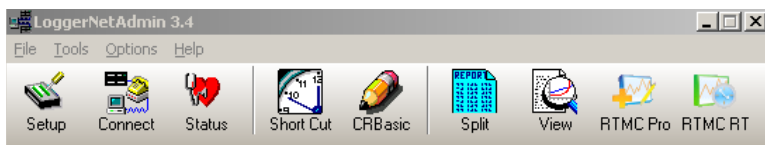


Figure 2

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

Free space: 235,634,759,936 bytes 219.5 GB
Server Time: 12:55:32 PM Pause Schedule
Select View: Active Sites Views...
The statistics for the devices defined on LoggerNet's network map Connected: localhost

- 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

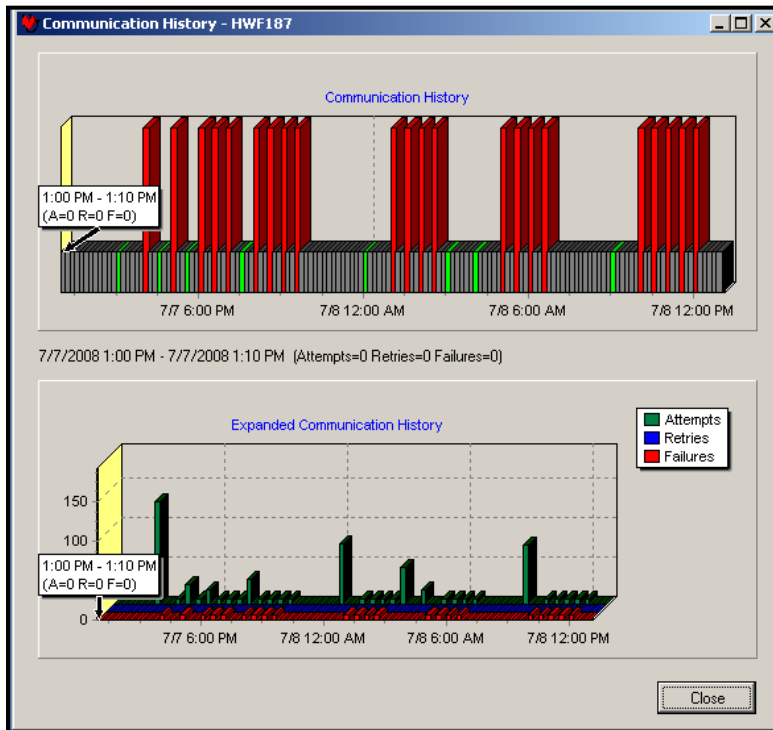


Figure 4

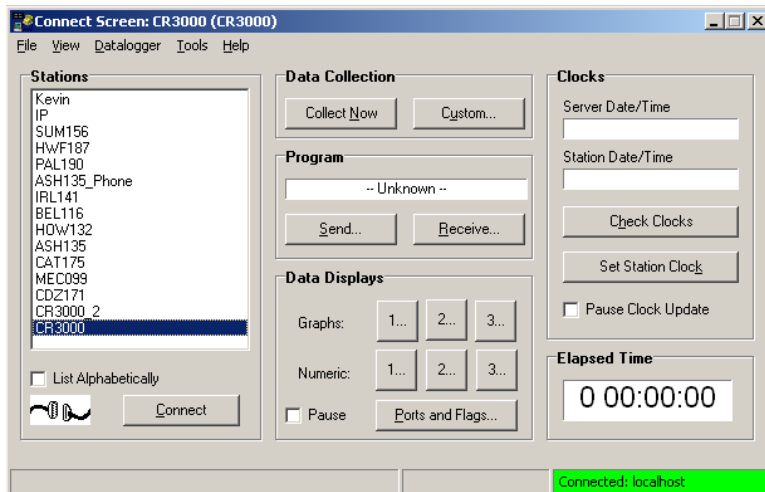


Figure 5

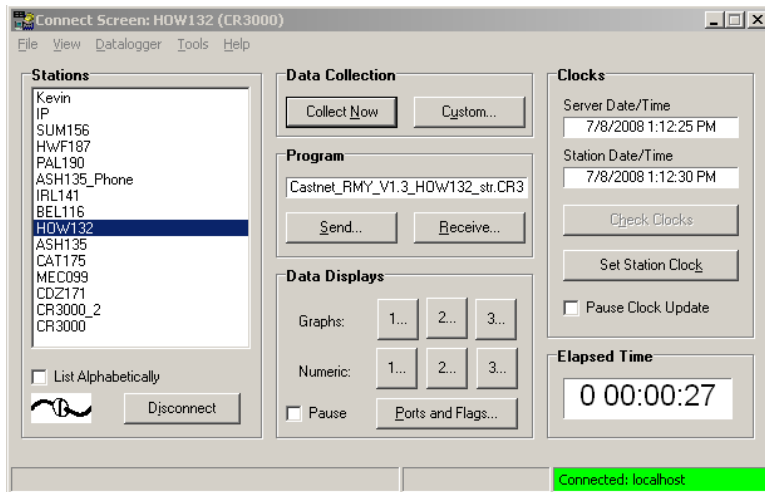
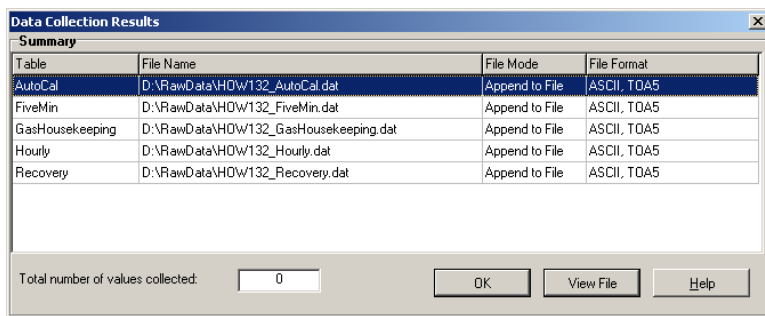


Figure 6



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

TIMESTAMP	RECORD	Batt_Volt	precipitation	precipitation_f	temperature	temperature_f
"2008-07-06 04:00:00"	1122	12.89	0	True	11.36	True
"2008-07-06 05:00:00"	1123	12.89	0	True	10.85	True
"2008-07-06 06:00:00"	1124	12.89	0	True	12.16	True
"2008-07-06 07:00:00"	1125	12.88	0	True	15.62	True
"2008-07-06 08:00:00"	1126	12.88	0	True	16.99	True
"2008-07-06 09:00:00"	1127	12.88	0	True	22.2	True
"2008-07-06 10:00:00"	1128	12.87	0	True	25.19	True
"2008-07-06 11:00:00"	1129	12.87	0	True	26.84	True
"2008-07-06 12:00:00"	1130	12.87	0	True	27.53	True
"2008-07-06 13:00:00"	1131	12.87	0	True	27.95	True
"2008-07-06 14:00:00"	1132	12.86	0	True	28.5	True
"2008-07-06 15:00:00"	1133	12.86	0	True	28.71	True
"2008-07-06 16:00:00"	1134	12.86	0	True	27.86	True
"2008-07-06 17:00:00"	1135	12.86	0	True	27.06	True
"2008-07-06 18:00:00"	1136	12.86	0	True	25.82	True
"2008-07-06 19:00:00"	1137	12.87	0	True	24.31	True
"2008-07-06 20:00:00"	1138	12.87	0	True	22.13	True
"2008-07-06 21:00:00"	1139	12.87	0	True	20.26	True
"2008-07-06 22:00:00"	1140	12.85	0	True	18.82	True
"2008-07-06 23:00:00"	1141	12.85	0	True	17.75	True
"2008-07-07 00:00:00"	1142	12.85	0	True	16.81	True
"2008-07-07 01:00:00"	1143	12.86	0	True	16.86	True
"2008-07-07 02:00:00"	1144	12.84	0	True	17.37	True
"2008-07-07 03:00:00"	1145	12.84	0	True	17.49	True
"2008-07-07 04:00:00"	1146	12.86	0	True	17.75	True
"2008-07-07 05:00:00"	1147	12.86	0	True	17.91	True
"2008-07-07 06:00:00"	1148	12.86	0	True	18.03	True
"2008-07-07 07:00:00"	1149	12.86	0	True	18.41	True
"2008-07-07 08:00:00"	1150	12.85	0	True	19.51	True
"2008-07-07 09:00:00"	1151	12.86	0	True	21.21	True
"2008-07-07 10:00:00"	1152	12.86	0	True	23.63	True
"2008-07-07 11:00:00"	1153	12.86	0	True	25.91	True
"2008-07-07 12:00:00"	1154	12.86	0	True	27.82	True
"2008-07-07 13:00:00"	1155	12.86	0	True	28.37	True
"2008-07-07 14:00:00"	1156	12.86	0	True	28.84	True
"2008-07-07 15:00:00"	1157	12.86	0	True	29.12	True
"2008-07-07 16:00:00"	1158	12.85	0	True	29.42	True

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

RecNum	4,243,318	Batt Volt	12.78	Temp1 Blower Ba	false	Julian Date	190
TimeStamp	13:57:27	Panel Temp	29.24	Temp2 Blower Ba	false	Time	13:57
wind direction	225.20	wind direction f		wind direction v	3,171.79	Down All Channi	false
windspeed	4.30	windspeed f		windspeed v	0.00	wind direction dc	false
shelter temperature	27.08	shelter temperature f		shelter temperatur	0.16	Sample Freq A	93698
temperature	31.06	temperature f		temperature v	894.16	Sample Freq B	108843
temperature2	31.55	temperature2 f		temperature2 v	895.65	Cell Pressure	0.00
temperature delta	-0.49	temperature delta f		temperature delta	0.00	Sample Temperature	38.53
relative humidity	48.10	relative humidity f		relative humidity v	481.05	Sample Flow A	0.754
wetness	0.01	wetness f		wetness v	14.35	Sample Flow B	0.743
precipitation	0.00	precipitation f		precipitation v	0.00	O3 Background	0.10
solar radiation	314.88	solar radiation f		solar radiation v	225.56	O3 Coefficient	1.016
Transfer SR	0.00	transfer sr f		Transfer SR V	184.96	Precip Check	0.00
ozone	54.99	ozone f		ozone v	NAN	Wetness Check	0.00
Transfer Ozone	0.00	transfer ozone f		Transfer Ozone V	NAN	Ozone Date	7-8-2008
flow rate	1.49	flow rate f		flow rate v	1,522.18	Ozone Zero	1.27
so2	0.00	so2 f		so2 v	0.00	Ozone Precision	96.10
co	0.00	co f		co v	0.00	Ozone Span	418.70
no	0.00	no f		no v	0.00	Ozone Serial Onsi	true
noy	0.00	noy f		noy v	0.00	Trace Gas OnSite	false
no diff	0.00	no diff f		no diff v	0.00	Tekran	Public.Trace_Gas_OnSite: f
		windspeed scalar f				Flow FullScale	5.000
		sigma theta f				Flow Offset	-0.040
						Calibrator OnSite	false
AUTO CAL TABLE		HOURLY TABLE		RECOVERY TABLE			
RecNum	149	RecNum	1,179	RecNum	1		
TimeStamp	8:00:07:00	TimeStamp	8:00:00	Flow FullScale	5.000		
AutoCal BeginTime	00:00:00	shelter temperature	26.40	Flow Offset	-0.040		
AutoCal StartTime	8:00:06:00			Ozone Serial Onsi	true		
AutoCal Analyte	ozone			Trace Gas OnSite	false		
AutoCal Mode	span 5						
AutoCal Value	96.10						
AutoCal Expected	90.00						
AutoCal Value f							
RunAutoZero CO	false	Ozone AutoCal RunN	false	RunAutoCal Ozone	false	Zero	false
CO bka	0.00	SO2 AutoCal RunNext	false	RunAutoCal SO2	false	Span1	false
CO AutoZero Valu	0.00	NO AutoCal RunNext	false	RunAutoCal CO	false	Span2	false
CO_Param_Saved	false			RunAutoCal NO	false	Span3	false
				RunAutoCal NPN	false	Span4	false
						Span5	false
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						AutoCal Analyte	
						AutoCal Mode	
						AutoCal Value f	
						AutoCal Expected	0.00
						AutoCal_Include	false

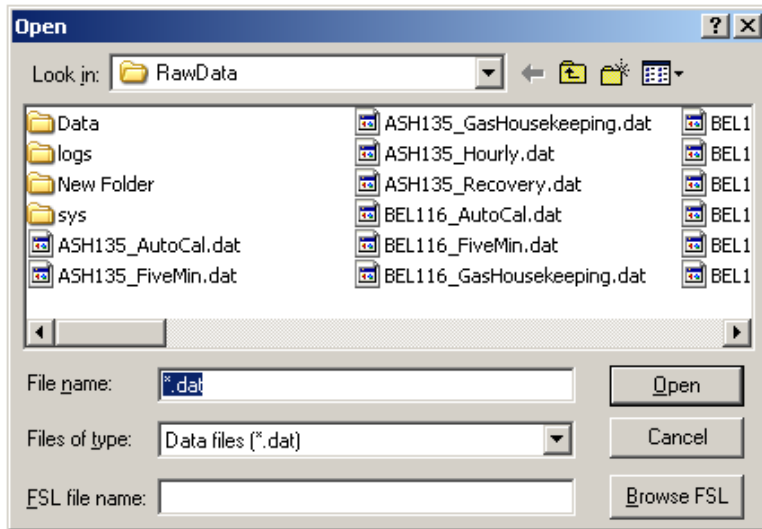
6.0 ENTERING NEW FULL SCALE AND ZERO VALUES FOR MFC

- 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.

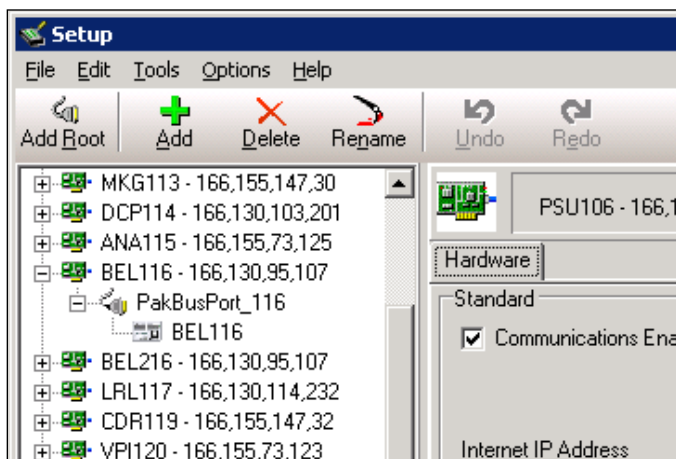
Figure 9



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

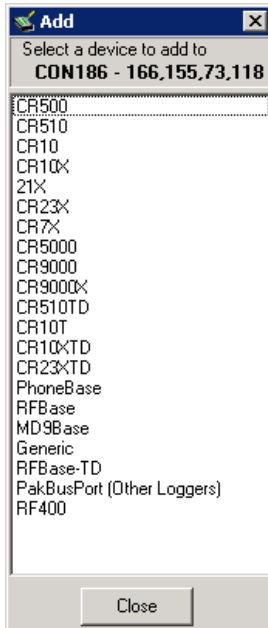


- To add a site using TCP/IP connectivity click “IPPort” (Figure 11). To add a site using a telephone modem connection click “ComPort”. Adding the root node opens the Add Device SubMenu (Figure 12). NOTE: The ComPorts and modems available to the server may already be present in the network tree. In this 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

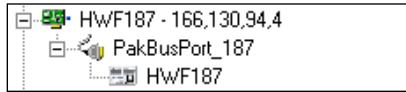
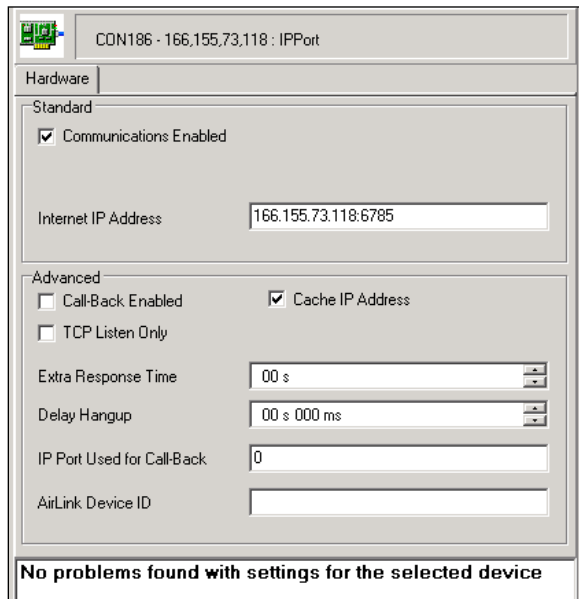


Figure 14



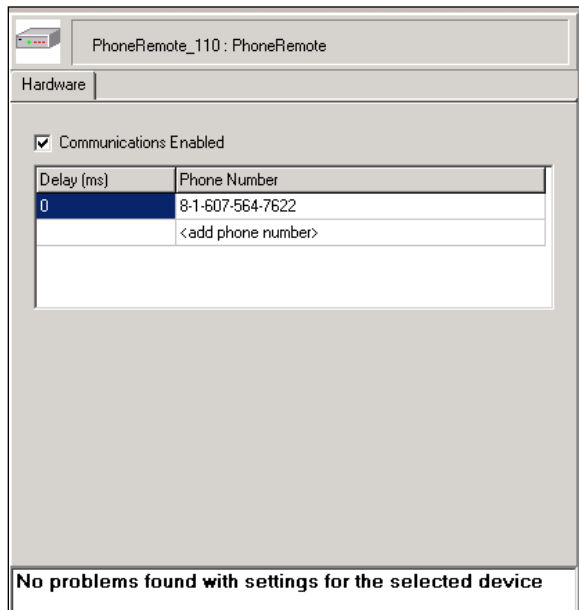
- Selecting the IPPort Root Node will display the configuration options tab shown in Figure 15 below. The IP address and port (6785) should be added to the Internet IP Address line.

Figure 15



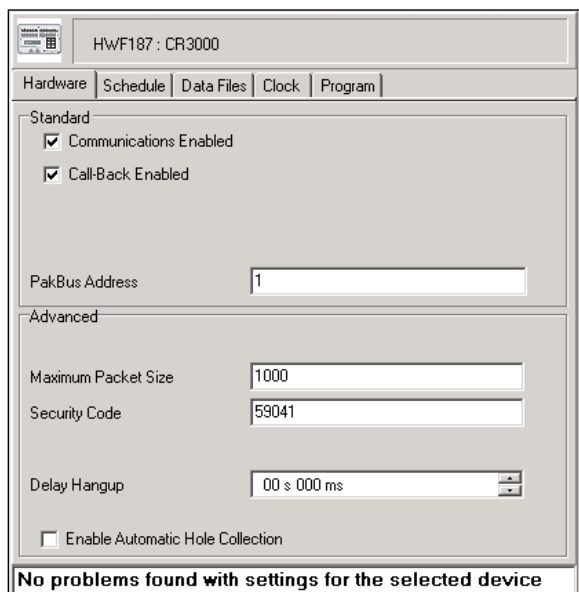
- Selecting the PhoneRemote Node will display the configuration options tab shown in Figure 16. The site phone number including any external dialing codes should be added to the Phone Number list. Some sites may require a delay to allow for remote switching networks.

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

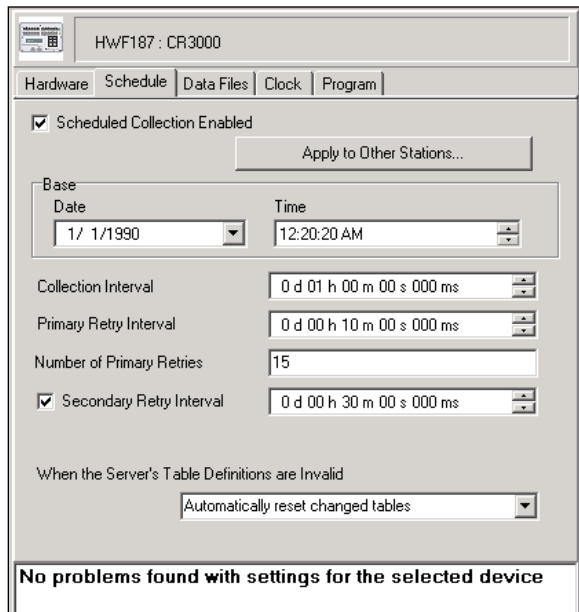
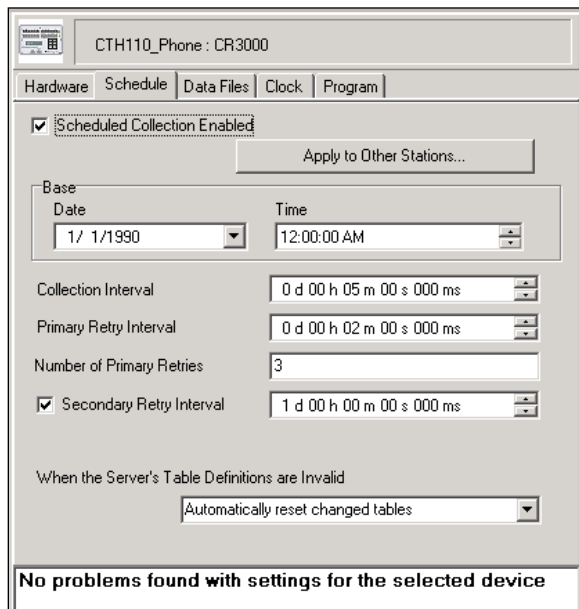
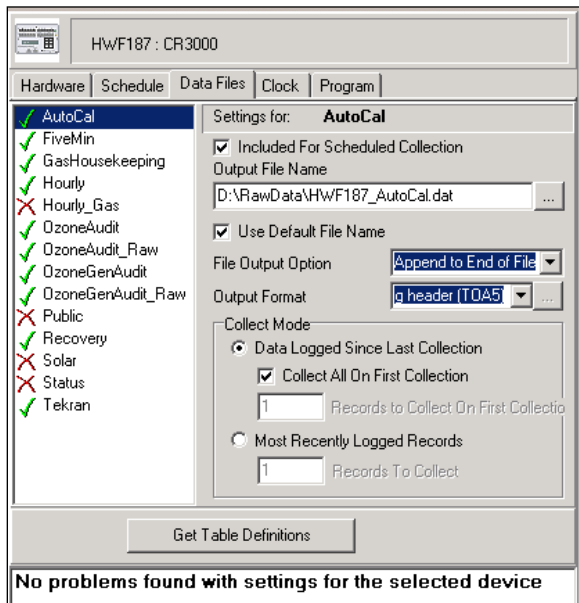


Figure 19



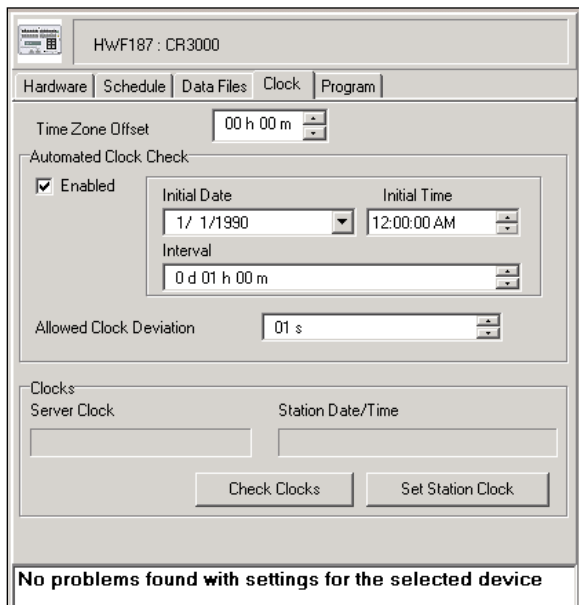
- The data tables collected will vary depending on the equipment operating at each site. An example of the selected tables is shown in the Figure 20. The Public and Status tables should always be disabled.

Figure 20



- The automated clock adjustment should be configured as shown in Figure 21 on the Clock tab.

Figure 21



TITLE: iCASTNET USER HANDBOOK

Effective

Date: 10-11-2023

Isil, Selma
(USSI716379)

Digitally signed by Isil, Selma
(USSI716379)

Date: 2023.10.09 11:13:41
-04'00'

Prepared by: Selma S. Isil
Data Analyst

Reviewed by: Marcus O. Stewart
QA Manager



Digitally signed by Stewart,
Marcus (USMS719399)

Date: 2023.10.06 16:58:13 -04'00'

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- 2.0 Scope
- 3.0 Summary
- 4.0 Materials
- 5.0 Safety
- 6.0 Procedures
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- 8.0 Attachments

Annual Review			
Reviewed by:	Title:	Date:	Signature:

iCASTNET USER HANDBOOK

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide consistent guidance to WSP USA Environment & Infrastructure, Inc. (WSP) Clean Air Status and Trends Network (CASTNET) personnel in the use of the iCASTNET system and related information for review of project data.

2.0 SCOPE

The processes described in this SOP are applicable to the use of the iCASTNET system for review of continuous and discrete data for purposes of determining possible problems with 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, trace gas and concentration data. Data analysts as well as field technical staff 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 various dashboards. The dashboard enables team members to review factors related to the parameter of interest in real time. Users can generate custom reports using the reporting tools contained in the iCASTNET system.

4.0 MATERIALS

Laptop or personal computer
Internet browser software
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.

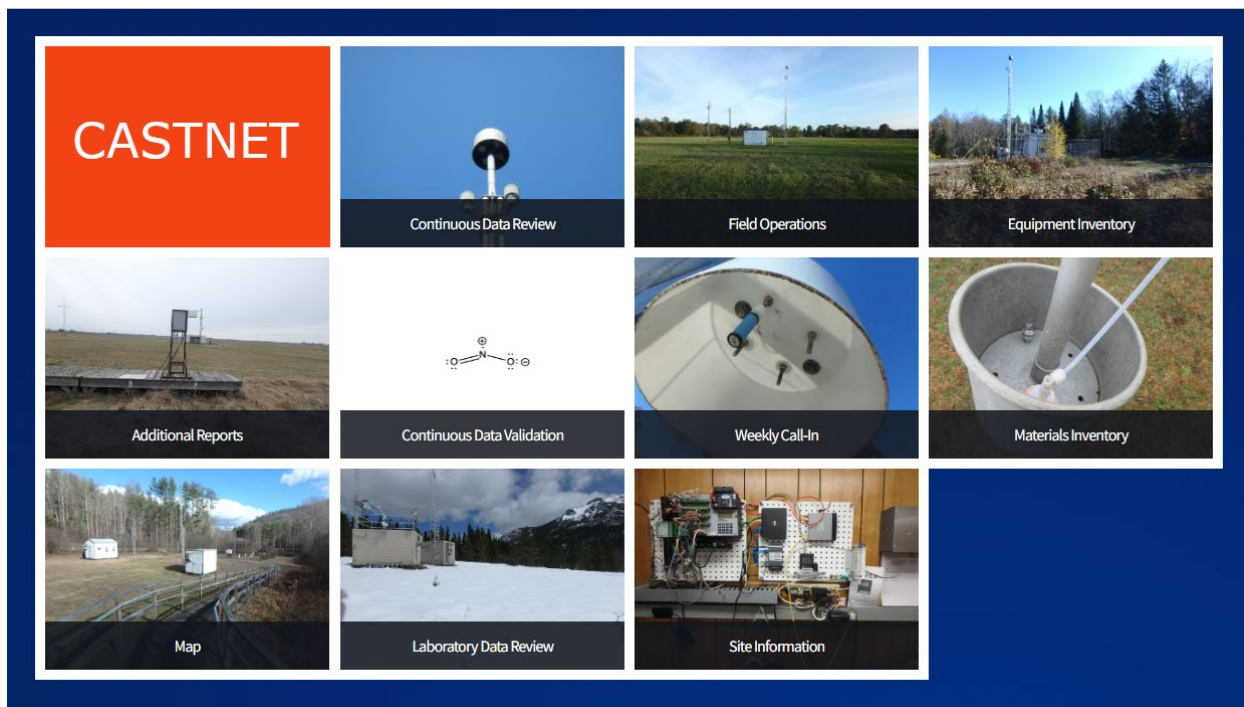
Using a computer is a sedentary activity that consists of repetitive motions. Repetitive motion injuries can be avoided by placing the screen, mouse, and keyboard at locations that are comfortable to use and do not cause strain from overreaching. Maintain good posture while using the computer. Take breaks 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 <https://gnv-web2.corp.pbwan.net/castnet>. The iCASTNET Main Menu will be at the top of the page.

Figure 1. iCASTNET Main Menu



The screen displays tiles that can be selected to perform various tasks as depicted in Figure 1. The screen will be updated based on the tile selected.

Within the task screens, a menu on the left side of the screen will provide navigation to the other tasks (Figure 2).

To return to the Main Menu from task screens at any time, click CASTNET icon on the top right corner of the screen as depicted in Figure 3.

Figure 2. Navigation Menu

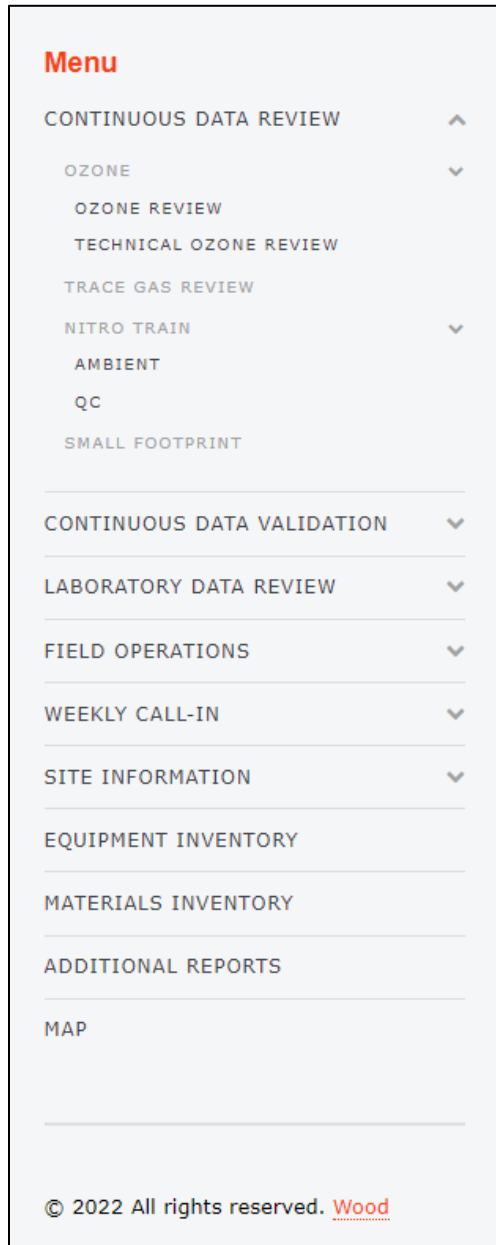
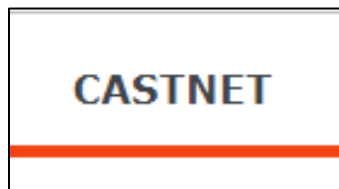


Figure 3. Return to Main Menu Icon



6.2 iCASTNET Map



Open iCASTNET and select the Map tile. This option provides a detailed overlay of the sites spanning the United States (Figure 4). A filter in the top right corner of the map allows the user to choose what is visible on the map using the  icon. Each option also provides a legend when expanded using the  icon. Clicking on a site on the map provides additional information (Figure 5), including its name and associated agency. It also provides an option to zoom in on the site using the magnifying glass icon. Additionally, clicking on the top right of the map alternates the style between normal and satellite.

Figure 4. Map

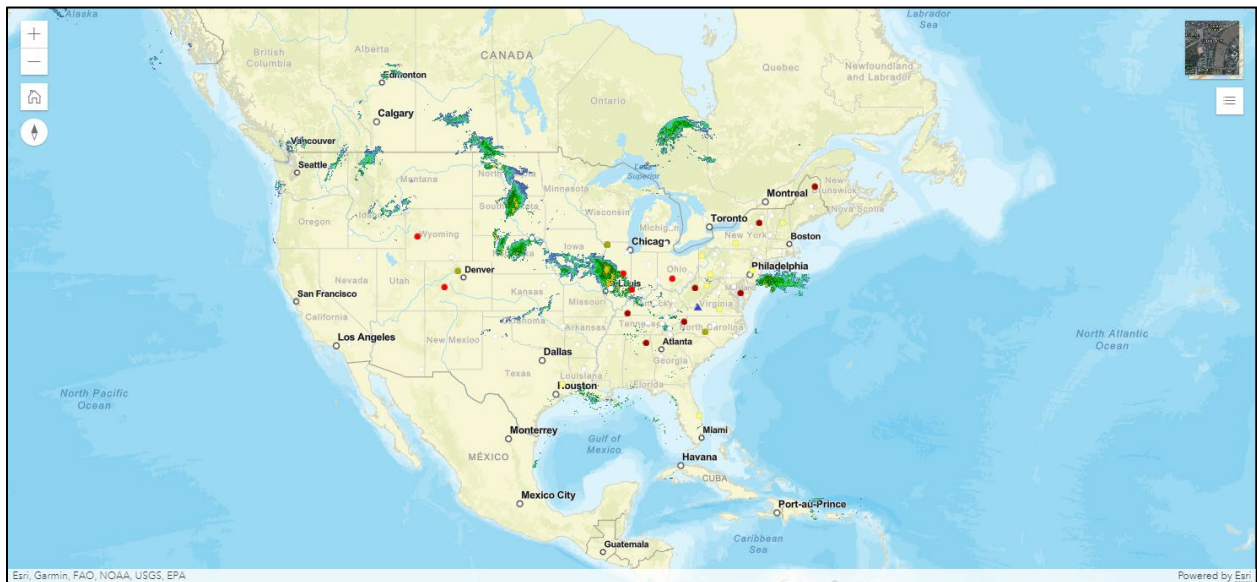
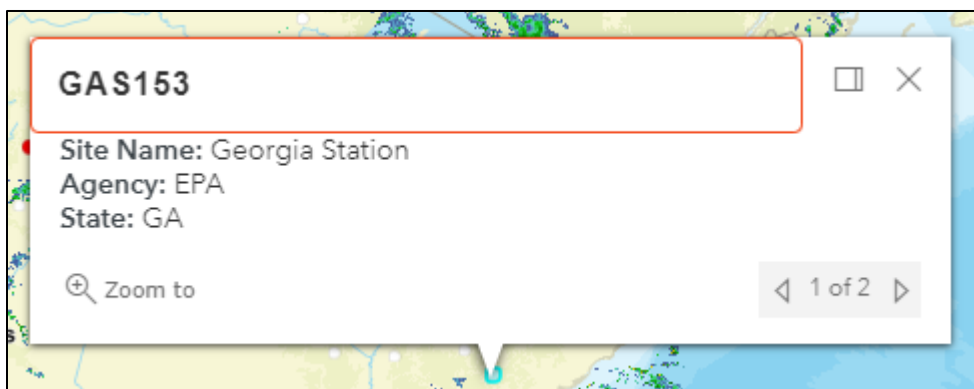


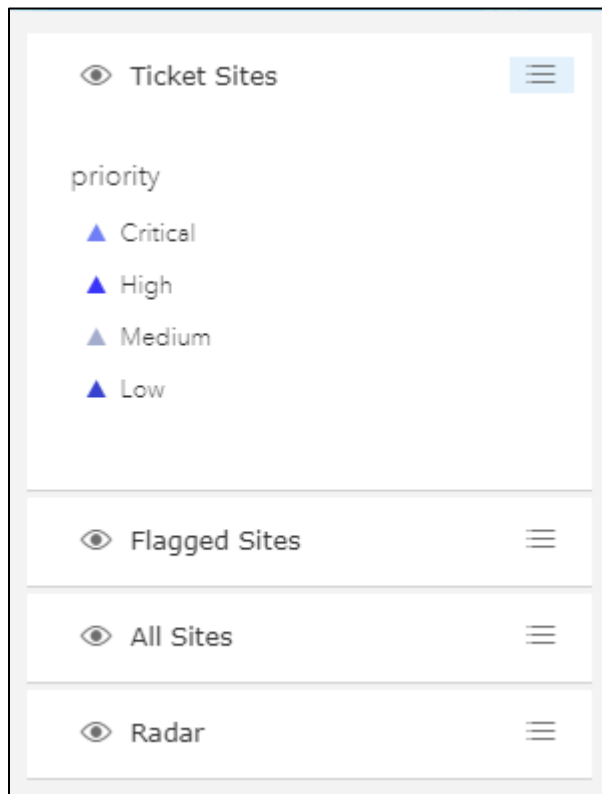
Figure 5. Additional Site Information



6.2.1 Ticketed Sites

This filter shows the location of ticketed sites by priority level, shown on the map by different colored triangles. The priority levels range from low priority to critical, specified by the legend (Figure 6).

Figure 6. Ticket Sites Legend



6.2.2 Flagged Sites

This filter depicts sites that have been flagged due to an ozone or trace gas failure or alarm, depicted on the map by a colored circle. The legend designates what type of failure each color represents.

6.2.3 All Sites

This option shows the location of all the sites, depicted by a white dot. This is not to be confused with the locations of major cities, which are depicted by white dots with black borders.

6.2.4 Radar

When the radar option is visible, the map depicts weather conditions around the sites.

6.3 iCASTNET Site Information

This option provides detailed information about each site.

6.3.1 Sites Table Editor

This table displays relevant information, such as city, state, latitude, longitude, elevation, land use, etc. for all active and inactive sites in the network (Figure 7). Information for new sites can be added by clicking on the Add New Sites tab at the top left corner of the screen. There is also a Search option box at the top right corner of the screen which is used by typing in either the

letters (ARE) or number (128) corresponding to a site name (ARE128). The up and down arrows next to each header are used to sort the list alphabetically/chronologically by each heading.

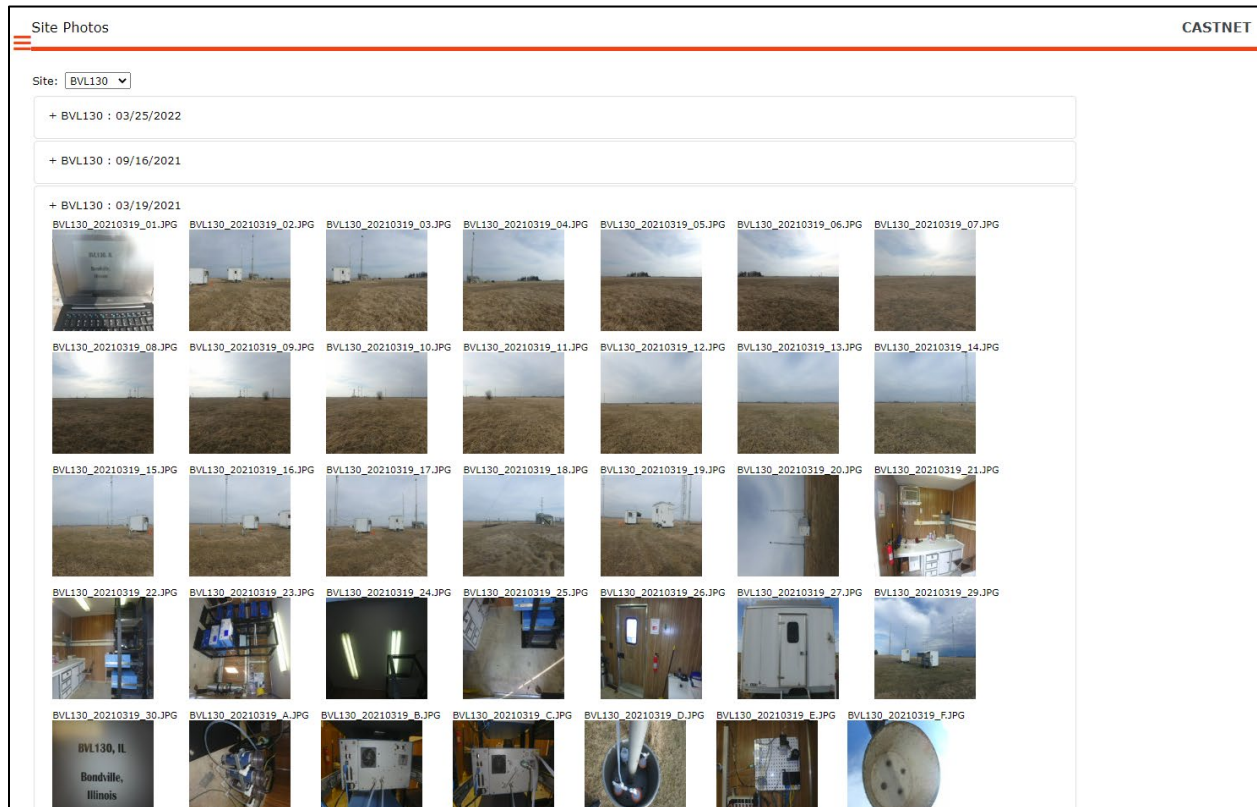
Figure 7. Sites Table Editor

Sites															CASTNET	
Site ID	Site	Active	InActive	Agency	State	County	Time Zone	Latitude	Longitude	Elevation	Map Id	Land Use	Terrain	MLM	NADP ID	NADP Distance
ABT147	Abington	domp	w	EPA	CT	Windham	EA	41.8405	-72.0104	202	Hampton, CT	Urban/Agric	Rolling	Mixed	CT15	0.0236
ACA416	Acadia NP	dom		NPS	ME	Hancock	EA	44.3771	-68.2608	158		Forest	Rolling	Mixed	ME98	0.3466
ALB801	Alberta	d		N/A	AB											
ALC188	Alabama-Coushatta	dom		EPA	TX	Polk	CE	30.7016	-94.674	105		Prairie	Rolling	Yes	TX10	197.72
ALH157	Alhambra	domp	w	EPA	IL	Madison	CE	38.869	-89.6228	164	Pocahontas, IL	Agric	Flat	Yes	IL46	0.0782
ALH257	Alhambra Collocated		domw	EPA	IL	Madison	CE	38.869	-89.6228	164		Agric	Flat	Yes	IL46	0.0782
ALH557	Alhambra Aerosol		a	EPA	IL	Madison	CE	38.869	-89.6228	164	Pocahontas, IL	Agric	Flat		IL46	0.0782
ANA115	Ann Arbor	domp	w	EPA	MI	Washtenaw	EA	42.4166	-83.9022	266	Pinckney, MI	Forest	Flat	Mixed	MI52	0.0136
ANL146	Argonne NL	dom		EPA	IL	DuPage	CE	41.7	-87.99	229	Sag Bridge, IL	Urban/Agric	Rolling	Mixed	IL18	72.8113
ARE128	Arendtsville	domp	w	EPA	PA	Adams	EA	39.9232	-77.3079	266	Arendtsville, PA	Agric	Rolling	Mixed	PA00	0
ARE228	Arendtsville Collocated		domw	EPA	PA	Adams	EA	39.9232	-77.3079	266	Arendtsville, PA	Forest	Rolling	Mixed	PA00	0
ARE528	Arendtsville Aerosol		ain	EPA	PA	Adams	EA	39.9232	-77.3079	266	Arendtsville, PA	Agric	Rolling		PA00	0
ASH135	Ashland	dom		EPA	ME	Aroostook	EA	46.6038	-68.4132	231	Squa Pan, ME	Agric	Flat	Yes	ME00	42.3797
ASH235	Ashland Collocated		dom	EPA	ME	Aroostook	EA	46.6038	-68.4132	231	Squa Pan, ME	Agric	Flat	Yes	ME00	42.3797
BAS601	Basin	dom		BLM	WY	Big Horn	MO	44.28	-108.0411	1242		Prairie	Rolling	Mixed	MT00	151
BBE401	Big Bend NP	dom		NPS	TX	Brewster	CE	29.3027	-103.1778	1052		Forest	Complex	Mixed	TX04	0
BEL116	Beltsville	dom	t	EPA	MD	Prince George's	EA	39.0282	-76.8171	47	Laurel, MD	Range	Flat	Mixed	MD99	0.044
BEL216	Beltsville Collocated		r	EPA	MD	Prince George's	EA	39.0282	-76.8171	47	Laurel, MD	Range	Flat	Mixed	MD99	0.0457
BFT142	Beaufort	domp	w	EPA	NC	Carteret	EA	34.8847	-76.6207	5		Agric	Flat	Yes	NC06	0.0424
BUF603	Buffalo	dm		BLM	WY	Johnson	MO	44.1442	-106.1089	1324		Prairie	Rolling	Mixed	WY99	156
BVL130	Bondville	domt		EPA	IL	Champaign	CE	40.052	-88.3725	213	Bondville, IL	Agric	Flat	Yes	IL11	0.1624
BVL530	Bondville Aerosol		a	EPA	IL	Champaign	CE	40.052	-88.3725	213	Bondville, IL	Agric	Flat		IL11	0.1624


6.3.2 iCASTNET Site Photos



Open iCASTNET and select the Site Information tile. Click the option Site Photos. This option allows the user to see photos taken at specific site locations on specific dates (Figure 8). First, select the location using the drop-down menu on the top left next to Site: and then click on a date to expand and view the site photos.

Figure 8. Site photos



6.3.3 iCASTNET Site Operator

Open iCASTNET and select the Site Information tile. Click the option Site Operator to see the contact information for the site operators at each location. The user can either use the search bar to locate specific operators or use the  icon to sort the list alphabetically/chronologically by each heading.

To see more information on an operator, click the  icon. To print the details, either for the full list or for a specific operator, click the  icon.

6.4 iCASTNET Field Operations

6.4.1 iCASTNET Cell Modem

Open iCASTNET and select the Field Operations tile. Click the option Cell Modem. The user can see lists of both accounts (6.4.1.1) and hardware (6.4.1.2).

6.4.1.1 Accounts

After clicking the option Cell Modem, the user is taken to the list of Cell Modem Accounts. This provides details about each account.

6.4.1.2 Hardware

To access the list of Cell Modem Hardware, click [Go to Hardware](#) in the top right corner of the Accounts page. This shows the hardware used for each modem and the status.

To return to the list of Cell Modem Accounts, click [Go to Accounts](#) in the top right corner of the Hardware page.

6.4.2 iCASTNET Enter Observation

Open iCASTNET and select the Field Operations tile. Click the option Enter Observation. This tab allows the user to view and add observations about specific sites by date. After selecting an Observation Date click on a site name to view either the existing list of observations and/or add additional observations for the date selected. The user can also use the Parameter Group filter at the top of the screen to select a parameter to view only those observations pertaining to the selected parameter.

6.4.3 iCASTNET Access Problem Ticket

Open iCASTNET and select the Field Operations tile. Click the Access Problem Ticket option. This task allows the user to view problem tickets regarding specific sites. Filters at the top of the screen (Figure 9), such as Site, Assigned To, Ticket #, and Priority narrow down the results.

Figure 9. Access Problem Ticket Filters

6.4.4 iCASTNET ERF

Open iCASTNET and select the Field Operations tile. Click the option for ERF. This allows the user to search for Equipment Request Forms. The search results can be specified by site, requestor, equipment and date range, using the tools to the left of **LOAD** (Figure 10). An ERF is filled out when a piece of equipment, analyzer, etc. needs to be shipped to a site and serves as a means to initiate shipping activities as well as a tracking mechanism.

Figure 10. ERF Query Screen


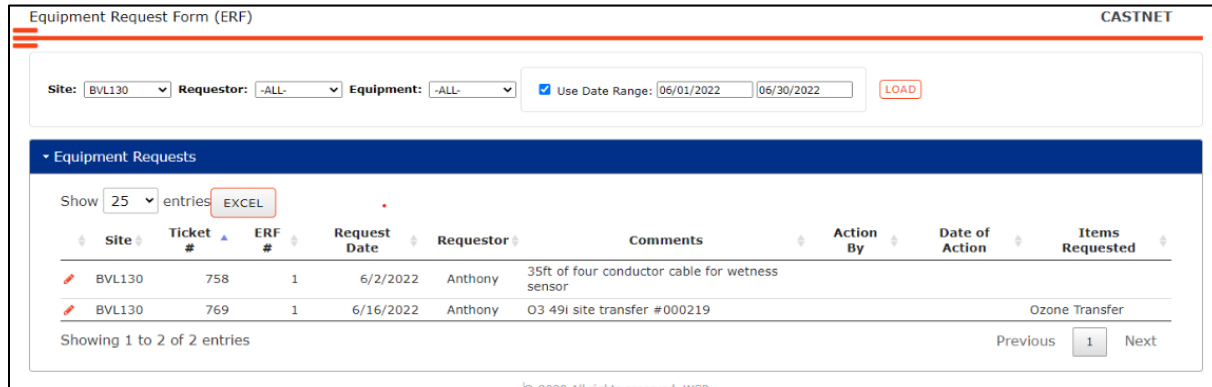
Once loaded, specific reports can be selected and edited using the  icon to the left of the site name (Figure 11).

Figure 11. ERF Screen by Site and Date Range



Equipment Request Form (ERF) CASTNET

Site: BVL130 Requestor: -ALL- Equipment: -ALL- Use Date Range: 06/01/2022 06/30/2022 LOAD

Equipment Requests

Show 25 entries EXCEL

Site	Ticket #	ERF #	Request Date	Requestor	Comments	Action By	Date of Action	Items Requested
BVL130	758	1	6/2/2022	Anthony	35ft of four conductor cable for wetness sensor			
BVL130	769	1	6/16/2022	Anthony	O3 49i site transfer #000219			Ozone Transfer

Showing 1 to 2 of 2 entries Previous 1 Next

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6.5 iCASTNET Weekly Call-In

CASTNET field site operators (FSOs) are required to call-in to the field operations staff every Tuesday to report on site conditions. The information provided by the site operators are recorded in the Call-in Log. To access, open iCASTNET and select the Weekly Call-In tile.

6.7.1 iCASTNET Call-In

From the Weekly Call-In tile, click the option Call-In. This option provides the list of call-ins made on a certain date. The date of interest is entered into the box next to Call-in Date: in the top left corner of the screen by either typing into the box or using the calendar that pops up. The user can also use a search bar in the top right corner. The search option will bring up the call-in entry closest to the specified Call-in date in the Call-in Date box (Figure 12).

Figure 12. Call-in Screen

The screenshot shows the 'Call-Ins' interface in the iCASTNET system. At the top, there is a header with 'Call-In Date: 10/14/2022', a 'Show All Sites' checkbox, and a 'LOAD' button. On the right, there is a '+Create Call-In' button and a search bar. Below the header, there are 'PRINT' and 'EXCEL' buttons. The main area contains a table with the following columns: Site, Date Inserted, Date Updated, MFC Readout, Rotameter Reading, Pump Off, Leak Check, TB Check, Wetness Check, Ozone Zero, Ozone Span, Ozone Precision, Ozone Leak Check, Das Flow, Desiccant Level, Supplies, and User. The table lists various call-in records for different sites, including ABT147, ALC188, ALH157, ANA115, ARE128, ASH135, BEL116, BFT142, BVL130, BWR139, CAD150, CAT175, CDR119, CDZ171, CHE185, and CKT136. Each row includes specific data points for each of these categories, such as MFC Readout values ranging from 1.48 to 1.534 and Ozone Zero values ranging from -0.37 to -0.592.

Site	Date Inserted	Date Updated	MFC Readout	Rotameter Reading	Pump Off	Leak Check	TB Check	Wetness Check	Ozone Zero	Ozone Span	Ozone Precision	Ozone Leak Check	Das Flow	Desiccant Level	Supplies	User
ABT147	10/11/2022	10/11/2022 10:31	1.505	1.5	0	0.001			-0.1	-1.28	-1		1.5	100% (Blue)		Michael
ALC188	10/14/2022	10/14/2022 13:39	1.534	1.5	-0.003	0.003			-0.63	3.37	2.42		1.49	50%		Heidi
ALH157	10/11/2022	10/11/2022 10:02	1.505	1.5	0.019	0.02			-0.592	-0.87	-1.94		1.5	100% (Blue)		Tyler
ANA115	10/11/2022	10/11/2022 11:14							-0.2	-2.9	-0.02			50%		Heidi
ARE128	10/11/2022	10/11/2022 15:30	1.511	1.5	0.031	0.007			-0.01	0.61	0.68		1.5	25%		Tyler
ASH135																
BEL116																
BFT142	10/14/2022	10/14/2022 13:31	1.506	1.5	0.001	0							1.5			Heidi
BVL130	10/11/2022	10/11/2022 12:21	1.48	1.5	0	0.01	0.10	0.99	-0.43	1.16	3.39		1.51	100% (Blue)	1-2 micron filters	Heidi
BWR139	10/11/2022	10/11/2022 16:39	1.51	1.6	0	-0.001			0.59	-0.3	0.22		1.5	75%		Anthony
CAD150	10/11/2022	10/11/2022 11:43	1.478	1.55	-0.009	-0.007			-0.8	-1.4	-2.1		1.5	100% (Blue)		Tyler
CAT175																
CDR119																
CDZ171																
CHE185	10/11/2022	10/11/2022 15:22	1.52	1.5	-0.002	0	0.10	1.00	0.7	80.2	28.4		1.496			Heidi
CKT136	10/11/2022	10/11/2022 10:20	1.52	1.4	0	0.002			-0.37	-0.05	-0.49		1.5	75%		Michael
CKD135	10/11/2022	10/11/2022 1:50	1.500	1.5	0.004	0.04			0.06	2.58	2.26		1.5	50%		Michael

The user can also print the list or export it to an Excel spreadsheet by pressing the associated icons above the list.

To record the information reported by FSOs click on the pencil icon to the left of the site ID that the FSO is calling from. This action will bring up a blank table (Figure 13) that can then be filled out with values reported by the FSO. Click the SAVE button to save all information recorded. This table also displays any Site Operator Requests, previous call-in information, equipment requests, and problem tickets associated with the site in question.

Figure 13. Call-in Information Documentation Screen

Weekly Call-Ins CASTNET

[BACK TO CALL-INS](#)

Site:

Entered By: Selma
Inserted On:

MFC Readout:
DAS Flow:
Ozone Zero:
Shelter Temp FSO:

Rotometer Reading:
Ozone Span:
Ozone Precision:
Min Shelter Temp: 24.3
Max Shelter Temp: 27.79

Pump Off:
TB Check:
Ozone Leak Check:

Leak Check:
Wetness Check:
Ozone Leak Check:

Desiccant Level:
Desiccant Changed:

Supplies:

Comments:

Requests

Requested By	Request Date	Description
No requests found.		

Showing 0 to 0 of 0 entries

Call-ins

Equipment Requests

Tickets

Ticket #	Date	Closed	Priority	Assigned To	Parameter	Parameter Group	Description	Entered By	Date Inserted
81	09/19/2013	O	Low	Heidi	Internal-Walls and Floor	2-Infrastructure	Little of dry rot at the edge of floor and walls. On 03/25/15 AQ5 reports a soft spot in the center of the floor. Comment about floor soft spot repeated on 03/31/16, 03/17/17, 09/14/18, 03/29/2019, 09/20/20	Anna	09/19/2013
292	07/19/2022	N	Hold	Michael	External-Towers	2-Infrastructure	Flow tower leg is broken at ground level.	Michael	07/19/2022
267	05/04/2021	N	Hold	Anna	Internal-Walls and Floor	2-Infrastructure	Some water damage from the water under the counter. Tape was missing to cover open old inlet for wires. New tape put over. The same comment repeated on 09/03/21. Some rotting below hole for	Anna	05/04/2021

6.5.2 iCASTNET Site Operator Contact Request

From the Weekly Call-In tile, click the option Site Operator Contact Request. This option allows a user to request contact with a site operator. To do this, select a site from the drop-down menu, enter the date of request, enter short description for the request, and click , (Figure 14). The request will show up in the Call-in log under the Requests section.

Figure 14. Site Operator Contact Request

Site Operator Contact Request

Site:


Date: Request By: Marcus

Description:

6.5.3 iCASTNET Supply Report

From the Weekly Call-In tile, Click the option for Supply Report. This option allows the user to generate reports of supplies requested by FSO(s) during the call-ins (Figure 15). To generate a supply report, select the site(s) and date to run the report for and choose the Supplies option to generate Supplies report. After clicking **RUN REPORT**, a PDF file with the report will be generated. There is also an option to generate a Comments report to view any comments that may have been generated.

Figure 15. Supply Report



6.6 Continuous Data Review

This task provides graphs for data review of different parameters. The graphs plot data for specific sites for specific date ranges. To use the graphs, select a parameter (ozone, trace gas, nitro train or small footprint) to review and then a site from the dropdown list on the left side of the screen. The screen will be updated with all the available information regarding the selected site. Use the dropdown list to select the start and end dates, if different than what is currently displayed and click GO to update the screen.

By hovering the mouse over a point on a graph a tooltip will show certain information depending on the parameter selected, for example, for ozone the date, value, expected value, percent difference and flagging information will be displayed. Value points on the graph are color coded based on flagging.

6.6.1 iCASTNET Small Footprint

Open iCASTNET and select the Continuous Data Review tile (Figure 16). Click the option Small Footprint and select a site from the pull-down menu labeled 'Site', select a date range from the 'Start Date' and 'End Date' pulldown menus and click GO. The graphs generated show data for filter pack flow, battery voltage for the data logger, and ambient temperature for the selected time period (Figure 17).

Figure 16. iCASTNET Continuous Data Review Options

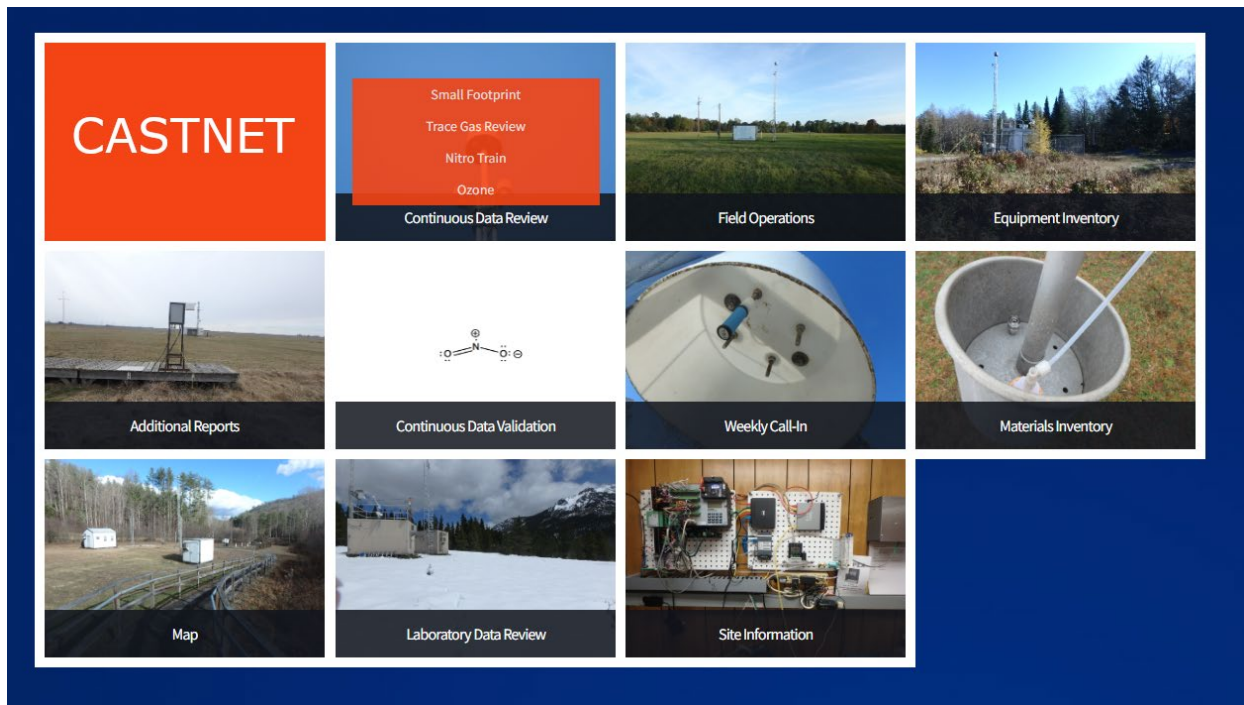
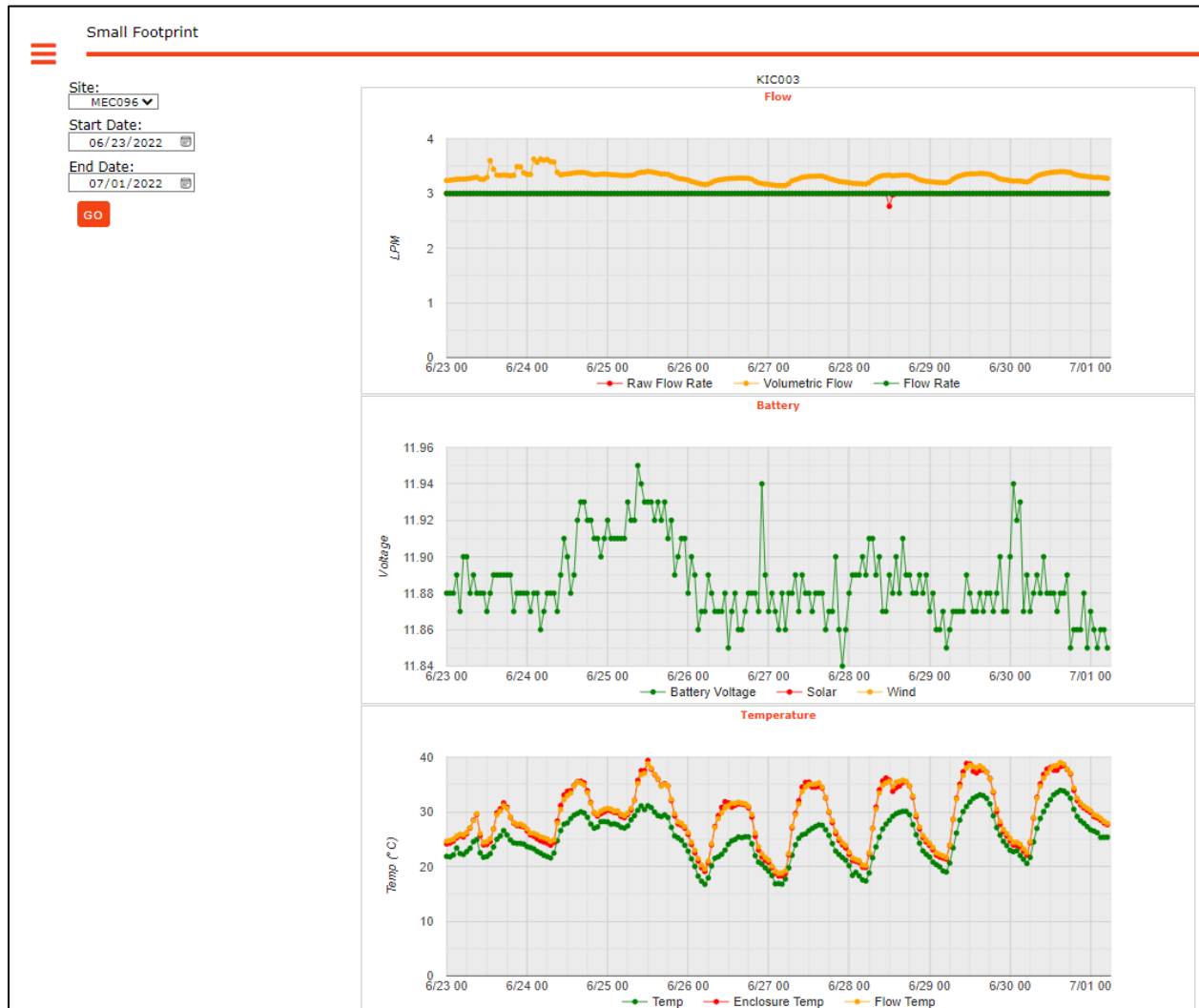


Figure 17. Small Footprint Graph



6.6.2 iCASTNET Trace Gas Review

Open iCASTNET and select the Continuous Data Review tile. Click the option Trace Gas Review. Select a site and date range and click GO. The graphs generated display ambient concentration values for trace gases measured at the site, QC results, and shelter temperature (Figure 18).

Figure 18. Trace Gas Graphs

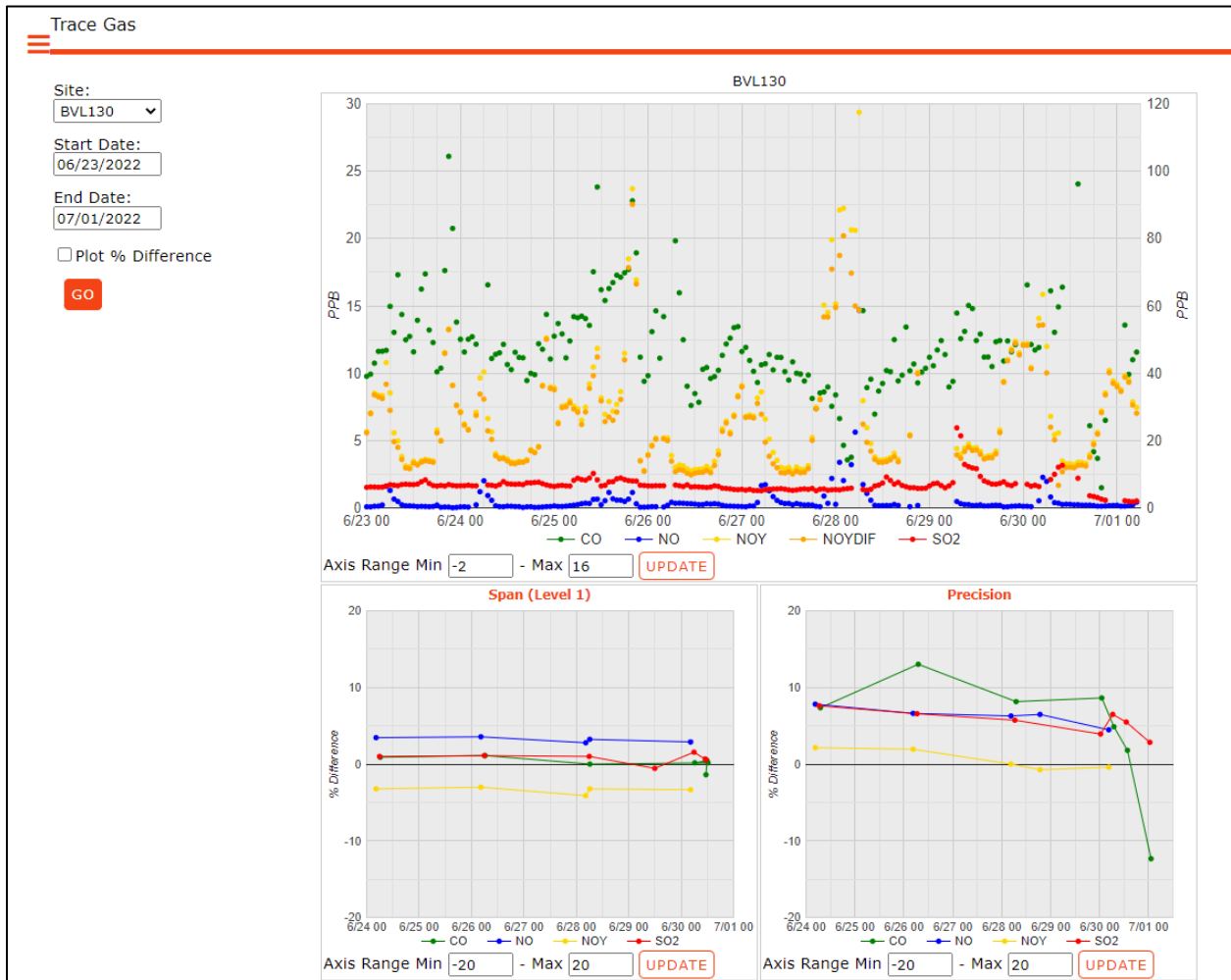
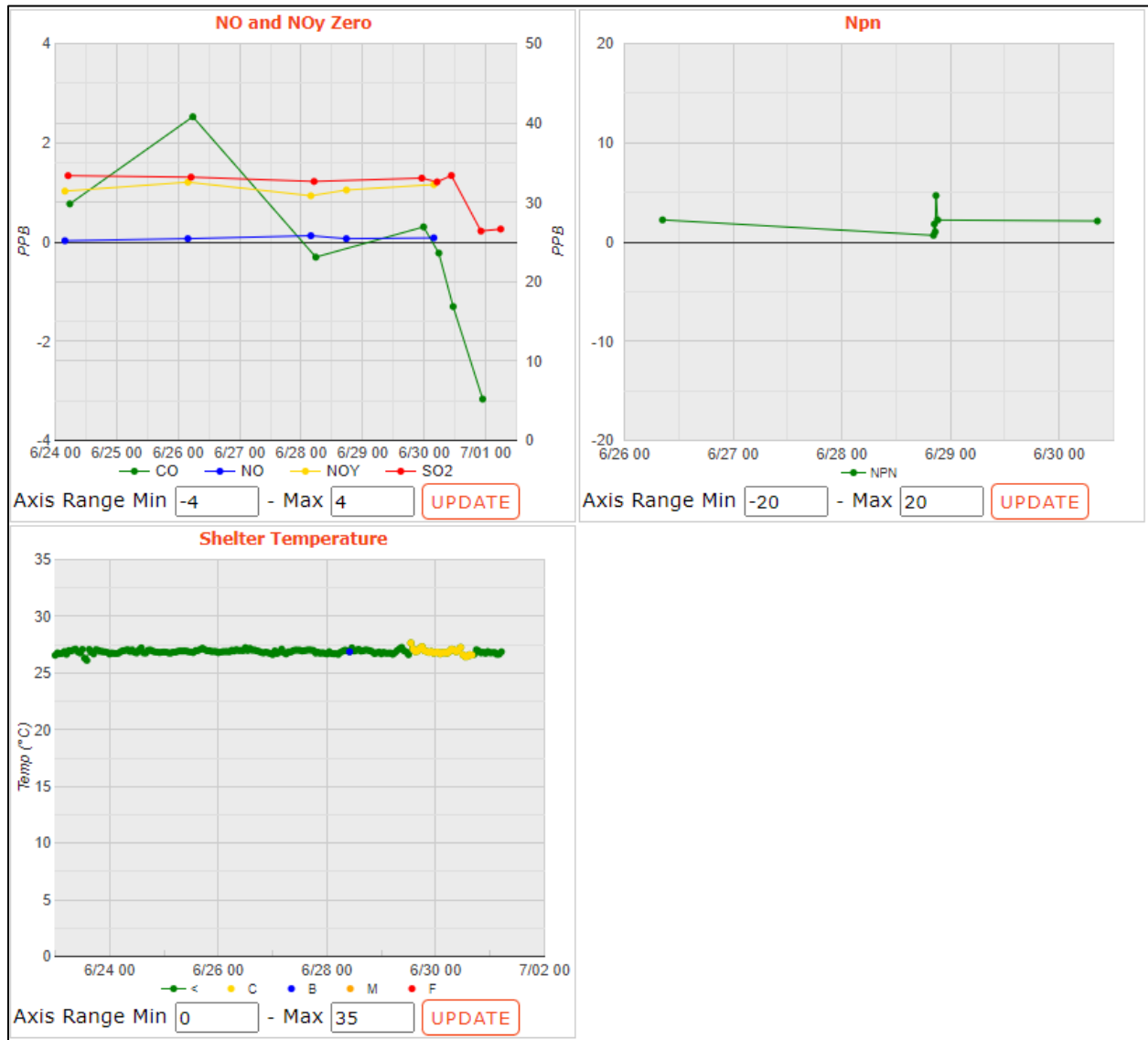


Figure 18. Trace Gas Graphs (Continued)



6.6.3 iCASTNET Nitro Train

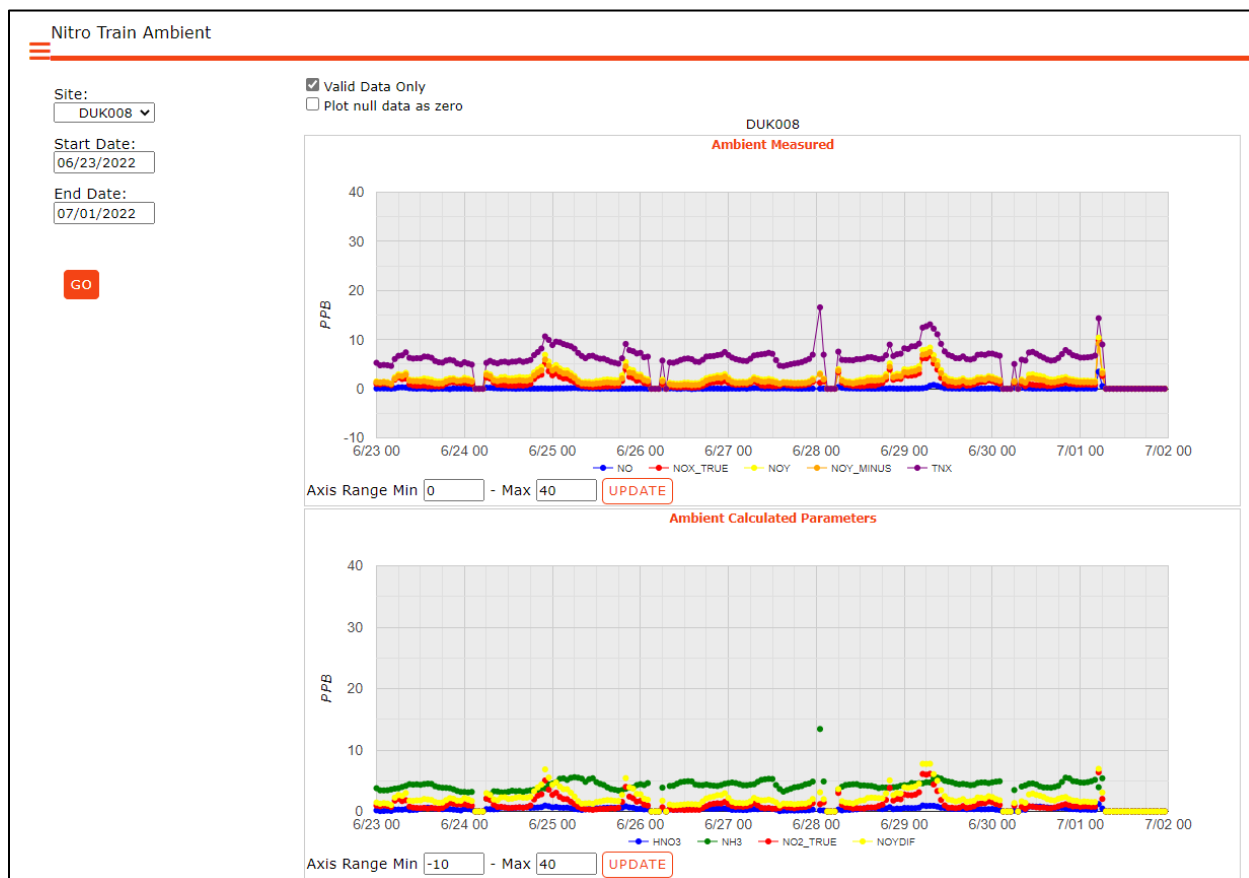
Open iCASTNET and select the Continuous Data Review tile. Under the Nitro Train option select either 'Ambient' or 'QC'. This section provides an overview for site(s) with the nitro train trace gas analyzers. The 'QC' option (Figure 19) provides graphs of zero, span, precision and converter efficiency values for a selected date range.

The 'Ambient' option (Figure 20) displays concentration values for a selected date range for measured and calculated parameters.

Figure 19. QC Graph



Figure 20. Ambient Graph



6.6.4 iCASTNET Ozone

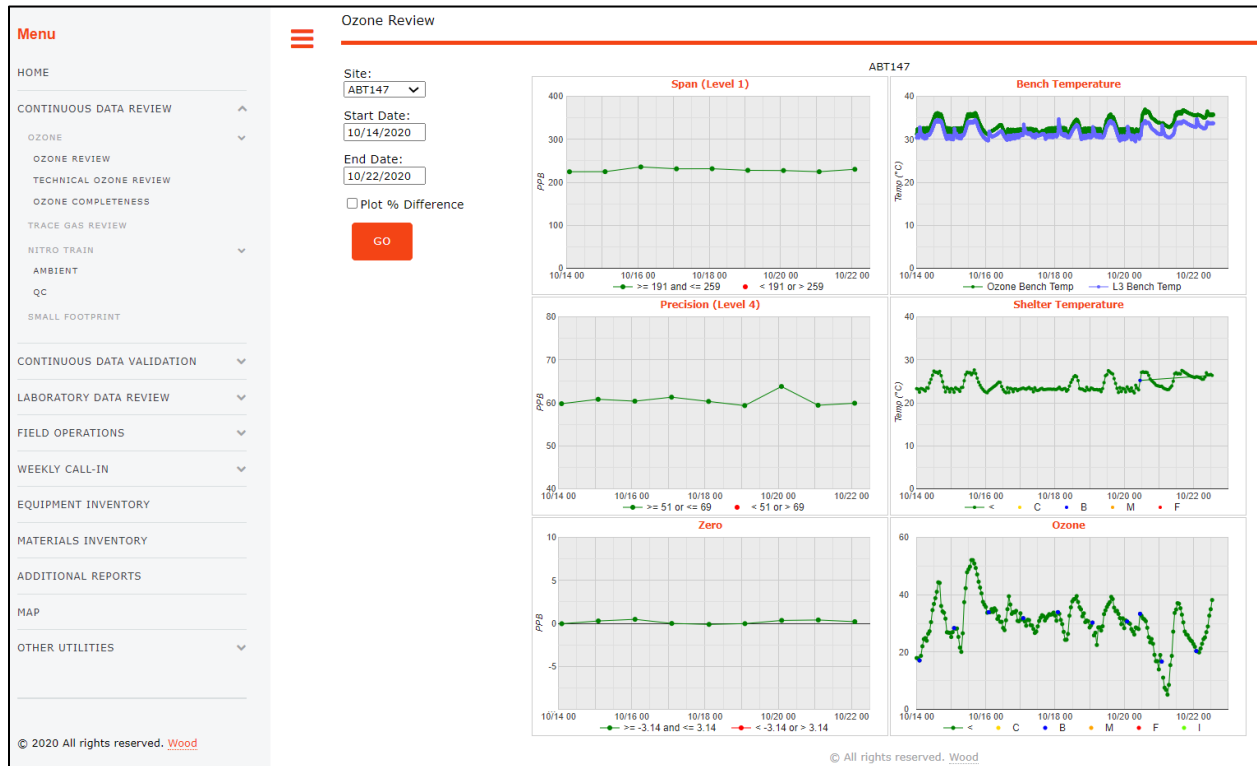
Open iCASTNET and select the Continuous Data Review tile. Click the Ozone option to display detailed ozone information. The ozone menu has three options:

- Ozone Review
- Technical Ozone Review
- Ozone Completeness

6.6.4.1 Ozone Review

The Ozone Review tab shows span, precision and zero values for the site analyzer for the selected time period. Bench and shelter temperatures for a selected time period for are also displayed for both the site O₃ transfer and site O₃ analyzer. Acceptance limits for span are ± 7% of 225 ppb expected. Acceptance limit for precision are ± 7% of 60 ppb expected. Zero acceptance limits are ± 3 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. There is an option to display the graphs as percent difference rather than actual concentration values. (Figure 21).

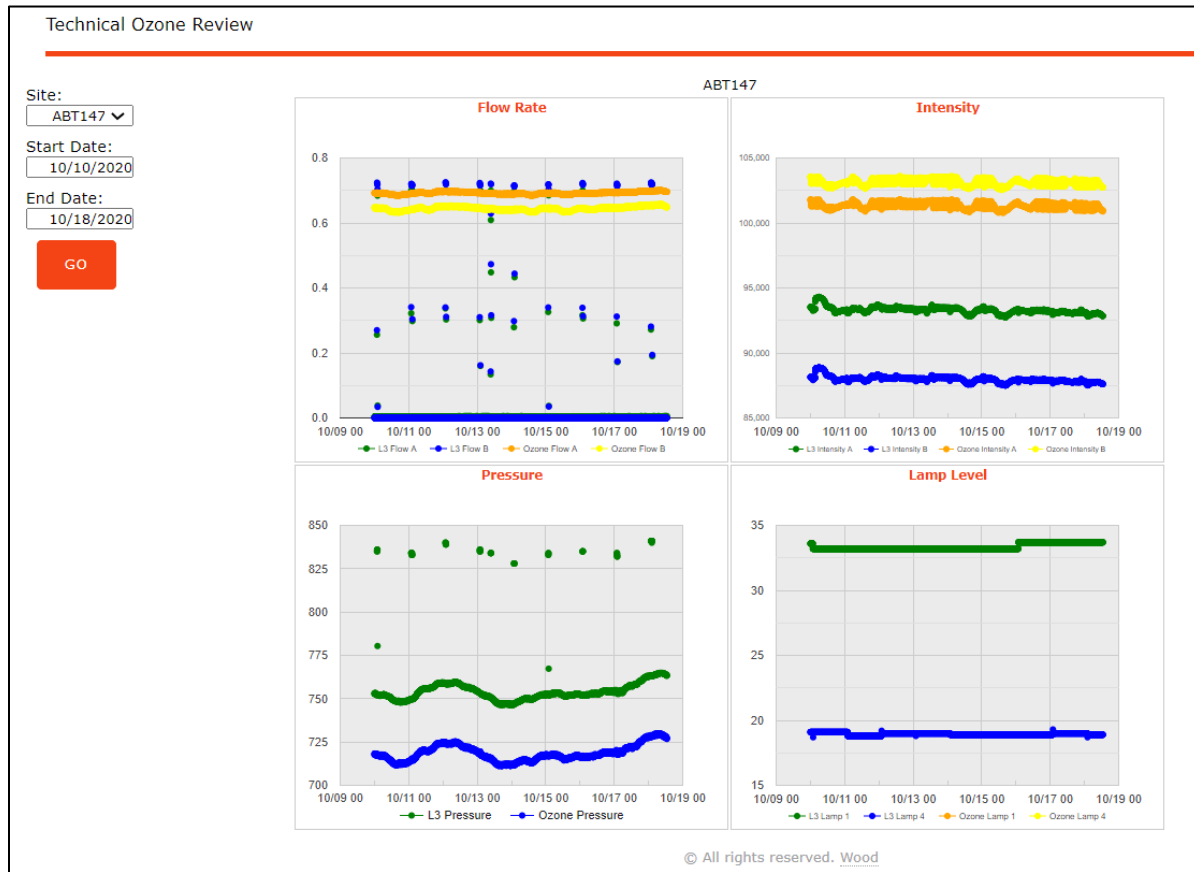
Figure 21. Ozone Review



6.6.4.2 Technical Ozone Review

Technical Ozone Review (Figure 22) provides time series data on instrument flow rate, pressure, lamp level and intensity for both the primary and transfer analyzers.

Figure 22. Technical Ozone Review



6.7 iCASTNET Continuous Data Validation

6.7.1 iCASTNET Met Data Editor

Open iCASTNET and select the Continuous Data Validation tile. Click the Met Data Editor option. This section allows the user to invalidate data from specific sites at specific times as a result of instrument malfunction or failed calibration results. To select the desired data, use the filters at the top to select a site and date/time range. Once the selected block of data populates the table validation occurs by clicking on the pencil icon at the very left of a data record. This will bring up an Edit table/box where the action(s) to be taken are selected for the target parameter (Figure 23). Actions consist of selecting a flag from the Flag drop down menu that corresponds to the parameter in question. Once a flag is selected then a Reason for flagging the data point must be selected from the Reason drop down menu to the right of the Flag box.

Figure 23. Met Data Editor Screen with Edit Box

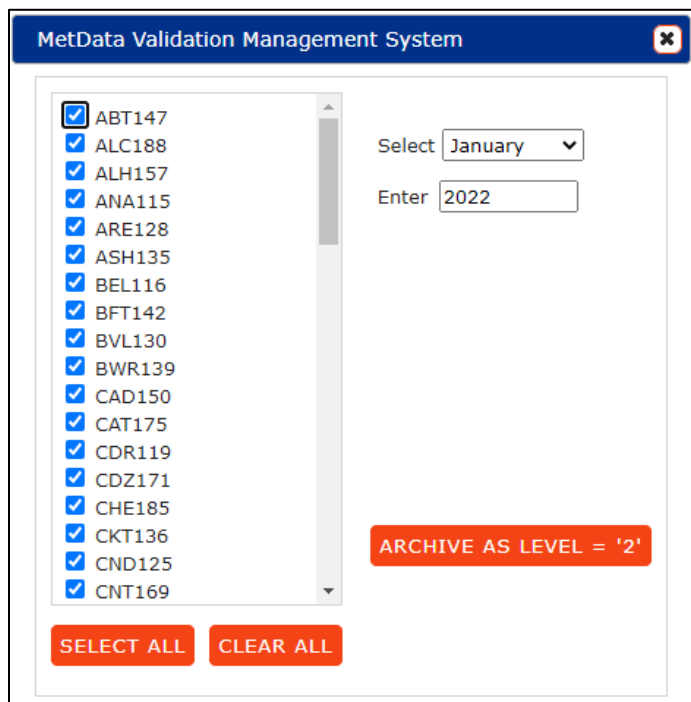
The screenshot displays the 'Met Data Editor' interface for site BFT142. At the top, it shows the site ID 'BFT142' and a date range from '07/01/2022 00:00' to '07/31/2022 23:00'. Below this are buttons for 'GO', 'ARCHIVE', 'GC', 'SD', and 'MRC'. A 'Screen Data found a total of 9 Errors' message is visible. The main area contains a table with columns for Site, Date, and Temp. An 'Edit Box' is open, showing fields for 'TEMPERATURE', 'FLOW_RATE', 'OZONE', and 'SHELTER_TEMPERATURE', each with a value and a 'Flag' dropdown set to 'No Flag'. A 'SAVE' button is present in the edit box. A search bar is located on the right side of the interface.

Site	Date	Temp
BFT142	7/1/22 00:00	22.7
BFT142	7/1/22 01:00	22.4
BFT142	7/1/22 02:00	22.1
BFT142	7/1/22 03:00	21.5
BFT142	7/1/22 04:00	21.7
BFT142	7/1/22 05:00	22.0
BFT142	7/1/22 06:00	24.4
BFT142	7/1/22 07:00	26.4
BFT142	7/1/22 08:00	26.5
BFT142	7/1/22 09:00	25.2
BFT142	7/1/22 10:00	26.1
BFT142	7/1/22 11:00	26.5
BFT142	7/1/22 12:00	26.2
BFT142	7/1/22 13:00	26.3
BFT142	7/1/22 14:00	26.0
BFT142	7/1/22 15:00	25.9
BFT142	7/1/22 16:00	25.7
BFT142	7/1/22 17:00	25.7
BFT142	7/1/22 18:00	25.6
BFT142	7/1/22 19:00	24.8
BFT142	7/1/22 20:00	24.2
BFT142	7/1/22 21:00	23.7
BFT142	7/1/22 22:00	23.7
BFT142	7/1/22 23:00	24.2
BFT142	7/2/22 00:00	24.4
BFT142	7/2/22 01:00	24.2
BFT142	7/2/22 02:00	24.6
BFT142	7/2/22 03:00	24.4
BFT142	7/2/22 04:00	23.5

If a validation action will apply to multiple hours or days of data then the GC (global change) function can be used. The GC button is found at the top of the screen to the right of the archive button.

The Archive button enables the user to archive data for selected sites, month and year from Level 1 data to Level 2 after validation for the selected sites and month has been completed (Figure 24).

Figure 24. Archive Screen



The SD (Screen Data) button to the right of the archive button gives the user the option to apply screening criteria to the selected data to help identify questionable values.

By clicking the MRC (Manage Reason Codes) button the user can add a new reason for validation actions if the reasons already provided in the Edits box (see Figure 23) are not adequate.

There are also options to pull the data table into excel, view the data page by page rather than by scrolling, and to highlight the edits made to the data by clicking on the Highlight Edits button. These buttons are located under Site ID, Start Date, End Date boxes.

6.7.2 iCASTNET Trace Gas Editor

Open iCASTNET and select the Continuous Data Validation tile. Click the option for Trace Gas Editor. This functions similarly to the Met Data Editor (6.7.1), except it is used for sites that have trace gas analyzers.

6.7.3 iCASTNET Met Data Strip Chart

Open iCASTNET and select the Continuous Data Validation tile. Click the option Met Data Strip Chart.

6.7.4 iCASTNET Met Data Daily Review Report

Open iCASTNET and select the Continuous Data Validation tile. Click the option Data Daily Review Report.

6.8 iCASTNET Laboratory Data Review

Open iCASTNET and select the Laboratory Data Review tile. This option allows the user to access and input the laboratory data from the various sites.

6.8.1 iCASTNET SSRF Entry Form

Open iCASTNET and select the Laboratory Data Review tile. Click the option SSRF Entry Form. This task allows users to double enter, edit, and search for Site Status Report Forms (SSRF). To do so, enter in the Site and Filter Pack ID#. If an SSRF has already been double entered for this site and filter pack ID# then an SSRF screen labeled Final SSRF on the upper left corner will come up showing the entered information (Figure 25).

Figure 25. SSRF Entry Form

SSRF Entry Form

Site: Filter Pack#: -

Final SSRF

Filter Pack Information

<p>Filter On Date/Time</p> <p>Date/Time: <input type="text" value="02/01/22"/> <input type="text" value="10:45"/></p> <p>MFC (Pump Off): <input type="text" value="0"/></p> <p>MFC Leak Check (LPM): <input type="text" value="0.002"/></p> <p>DAS Flow (LPM): <input type="text" value="1.5"/></p> <p>Rotameter (LPM): <input type="text" value="1.51"/></p> <p>Elapsed Time: <input type="text" value="166.2"/></p> <p>Return Shipment Prepared By: <input type="text" value="Richard W. Evans"/> <input type="button" value="ADD NEW PREPARER"/></p>	<p>Filter Off Date/Time</p> <p><input type="text" value="02/08/22"/> <input type="text" value="09:54"/></p> <p><input type="text" value="0"/></p> <p><input type="text" value="0.002"/></p> <p><input type="text" value="1.5"/></p> <p><input type="text" value="1.55"/></p>
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Lab Use Only:

Lab Tech Receipt:

Receipt Date:

Lab Comments:

<p>Present Site Observation</p> <p><input type="text" value="Heidi"/></p> <p>% Leaves Fall Color</p> <p><input type="text" value="0-25"/></p>	<p>% Leaves Dropped</p> <p><input type="text" value="76-100"/></p> <p>% Leaves Green</p> <p><input type="text" value="0-25"/></p>
---	---

Field Notes:

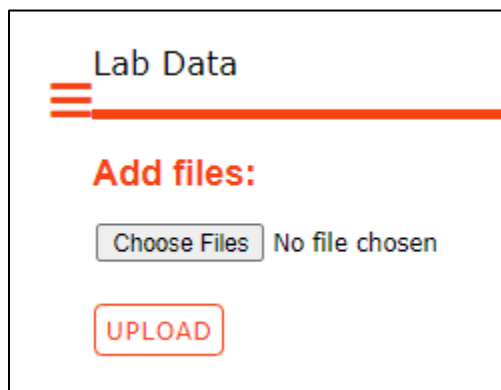
If an SSRF has not yet been entered for this site and filter pack ID# then a blank SSRF screen labeled 1st Entry on the upper left corner will come up. Data entry personnel can then enter the required information on this screen and click the ADD ENTRY 1 button located on the bottom left of the screen to save the entry.

If an SSRF requires 2nd entry, a small screen will pop up titled 'Double Entry Record'. This screen enables the user to either select the 1st entry (for editing purposes) or to select the 2nd entry option for finalizing the double-entry process. Second entry is only done for filter pack on off dates and times.

6.8.2 iCASTNET Import EDDs

Open iCASTNET and select the Laboratory Data Review tile. Click the option Import EDDs. This allows for the importation of lab data from chosen files (Figure 26).

Figure 26. Import EDDs



6.8.3 iCASTNET Concentration Report

Open iCASTNET and select the Laboratory Data Review tile. Click the Concentration Report option. This provides a report of analyte concentrations determined by analysis of the filter pack. The user can select specific sites from the dropdown list on the left (Figure 27). This list can also be filtered to EPA or NPS/BLM sites. The top right section of the screen allows the user to select a specific time range, whether by quarter, month, week, or year. The bottom section allows the user to specify what kind of report to run as well as whether to export it as an Excel file or as a PDF.

Figure 27. Concentration Report

6.8.4 iCASTNET Total Microgram Review

Open iCASTNET and select the Laboratory Data Review tile. Click the option for Total Microgram Review. This tab provides an overall report on analyte concentrations measured at each site during a specific week of the year (Figure 28). Flagged parameters for review at a given site are indicated by a highlighted color, designated by the legend on the bottom.

The buttons labeled CY, CYS, Filter Pack and Outlier Grid provide the user with further options. The CY (compare years) button provides the ability to compare concentrations from the past 1 to 5 years for the selected week. The number of years to compare can be selected from the drop-down menu located to the immediate left of the CY button. The CYS (compare years and sites) button provides the option to compare concentrations for the designated number of years for sites that are geographically close to each other.

The Filter Pack button is used to run a screening program to locate FPs with either erroneous date and time off data or FPs with too much time between FP change outs. The OUTLIER GRID button displays the concentrations table only for those sites flagged as having outliers for the week in question.

Figure 28. Total Microgram Review

Week of Year: Offset % :

Year:

LOAD

Use No. of

Years :

C Y

C Y S

FILTER PACK

OUTLIER GRID

Site ID	Lab Key	Date On	Code	Hours	TSO4	fig	TNO3	fig	TNH4	fig	Ca	fig	Mg	fig	Na	fig	K	fig	Cl	fig	NSO4	fig	NHNO3	fig	WSO2	fig
ABT147	2208001-01	02/22/2022	T1, T4, W3	165	0.72	0.72	0.26	0.065	0.031	0.392	0.048	0.367	0.08	0.48	0.23											
ACA416	2208003-01	02/22/2022	T4, W3	169	0.69	0.39	0.20	0.049	0.052	0.467	0.034	0.633	0.10	0.14	0.22											
ALC188	2208004-01	02/24/2022	T4, W3 12	112	0.80	0.21	0.26	0.074	0.012	0.071	0.066	0.050	U	0.25	0.44	0.33										
ALH157	2208001-02	02/22/2022	T1, T4	169	0.99	2.88	1.01	0.327	0.033	0.184	0.044	0.138	0.22	0.53	0.50											
ANA115	2208001-03	02/22/2022	T1, T4, W3	168	0.75	1.94	0.64	0.305	0.064	0.162	0.023	0.208	0.34	0.28	0.55											
ARE128	2208001-04	02/22/2022	T1, T4, W3	170	1.16	1.48	0.69	0.205	0.034	0.123	0.032	0.074	0.21	0.56	0.56											
ASH135	2208001-05	02/22/2022	T4, W1, W3	214	0.76	0.45	0.26	0.068	0.029	0.177	0.062	0.160	0.15	0.16	0.19											
BAS601	2208005-01	02/22/2022	T1, T4	146	1.08	1.09	0.64	0.083	0.017	0.073	0.035	0.033	0.28	0.15	1.70											
BBE401	2208003-02	02/23/2022	T1, T4	168	1.34	0.72	0.47	0.941	0.052	0.126	0.067	0.018	0.06	0.86	0.82											
BEL116	2208001-06	02/22/2022	T1, T4, W1	171	0.98	1.03	0.46	0.150	0.037	0.188	0.139	0.055	0.13	0.56	0.38											
BFT142	2208001-07	02/22/2022	T1, T4, W3	168	1.57	1.64	0.42	0.156	0.200	1.634	0.090	2.184	0.19	0.17	0.24											
BUF603	2208005-02	02/22/2022	T4	167	0.49	0.18	0.20	0.069	0.014	0.039	0.016	0.017	U	0.07	0.43	0.32										
BVL130	2208001-08	02/22/2022	T1, T4	168	1.02	2.93	1.04	0.276	0.034	0.121	0.034	0.123	0.38	0.35	0.48											
BWRI39	2208001-09	02/22/2022	T1, T4, W3	167	1.16	1.07	0.53	0.108	0.037	0.235	0.050	0.132	0.19	0.54	0.55											
CAD150	2208001-10	02/22/2022	T4	168	1.35	0.91	0.61	0.187	0.019	0.056	0.056	0.033	U	0.16	0.76	0.19										
CAN407	2208003-03	02/24/2022	T1, T4 12	119	0.47	0.67	0.19	0.278	0.044	0.123	0.055	0.071	0.05	U	0.49	0.17										
CAT175	2208001-11	02/22/2022	T1, T4, W3	164	0.70	0.50	0.31	0.087	0.015	0.106	0.071	0.089	0.07	U	0.36	0.16										
CDR119	2208001-12	02/22/2022	T1, T4, W3	168	1.39	0.55	0.55	0.164	0.021	0.052	0.044	0.033	U	0.22	1.04	0.56										
CDZ171	2208001-13	02/22/2022	T1, T4	167	1.58	1.72	0.98	0.217	0.025	0.070	0.043	0.033	U	0.47	1.12	0.88										
CHA467	2208003-04	02/22/2022	T1, T4	167	0.42	0.42	0.18	0.317	0.041	0.107	0.060	0.064	0.03	U	0.27	0.27										
CHE185	2208004-02	02/22/2022	T1, T4	169	1.14	2.35	0.81	0.560	0.041	0.100	0.068	0.033	U	0.08	0.73	0.25										
CKT136	2208001-14	02/22/2022	T1, T4, W3	167	1.32	0.71	0.60	0.149	0.017	0.055	0.035	0.033	U	0.24	1.09	0.50										
CND125	2208001-15	02/22/2022	T1, T4, W1	167	1.19	1.05	0.31	0.094	0.057	0.434	0.084	0.051	0.14	0.47	0.26											
CNT169	2208001-16	02/22/2022	T4, N1	168	0.28	0.10	0.11	0.040	0.009	0.018	0.009	0.017	U	0.03	0.16	0.10										
COW137	2208001-17	02/22/2022	T1, T4, W3	161	0.81	0.41	0.26	0.070	0.028	0.180	0.071	0.039	0.07	U	0.20	0.11										
CTH110	2208001-18	02/22/2022	T1, T4, W3	161	0.88	0.97	0.45	0.138	0.023	0.160	0.030	0.185	0.18	0.30	0.27											

RED -- Failed Min/Max

YELLOW -- Failed Lower/Upper Std. Dev.

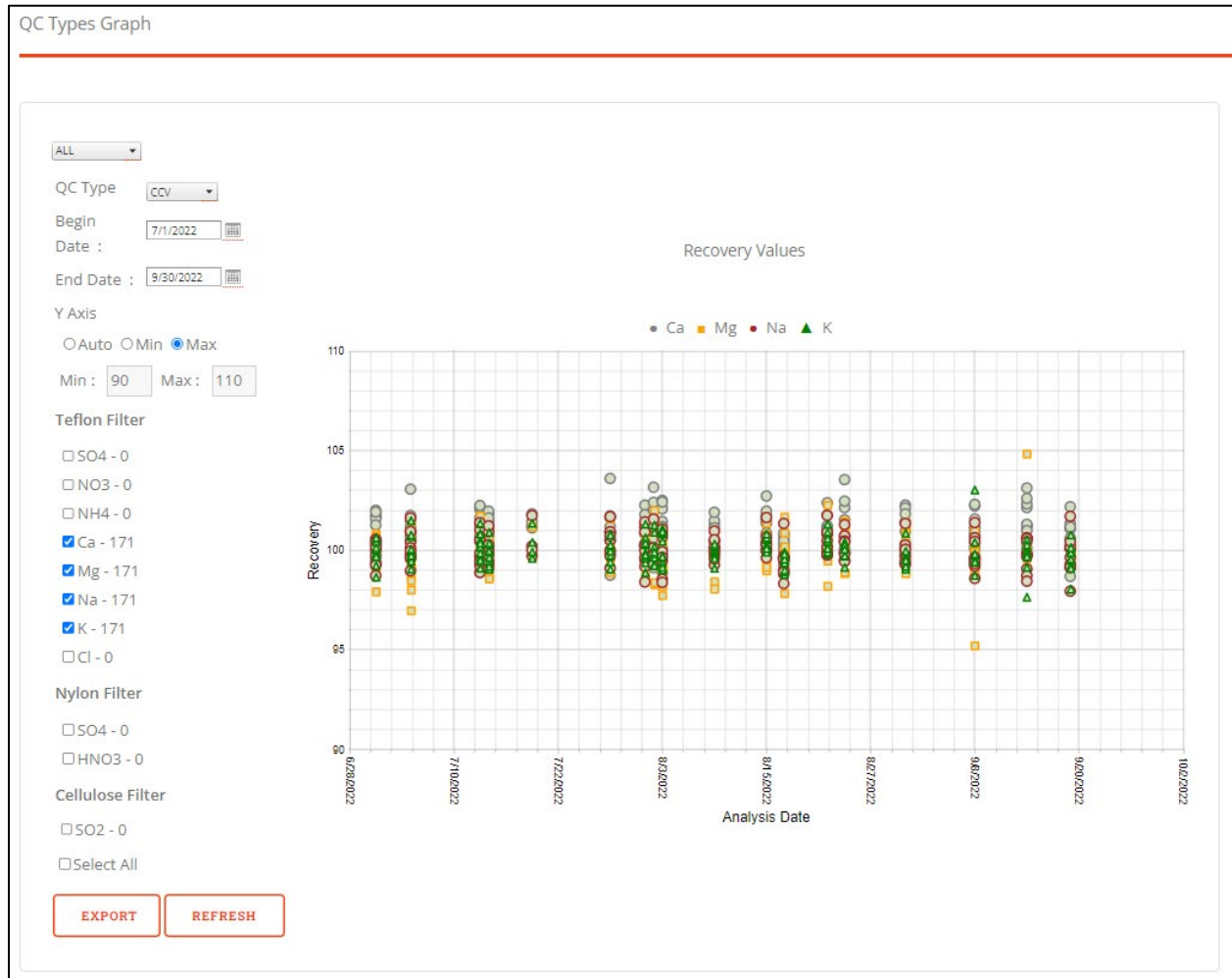
GREEN -- Fewer than 9 records included in the quarterly aggregate in DRYCHEM SUMMARY used for the comparison

CYAN -- Possible Filter Switch

6.8.5 iCASTNET QC Type Analysis

Open iCASTNET and select the Laboratory Data Review tile. Click the QC Type Analysis option. The user can then select the type of QC sample desired (field blank, lab blank, reference sample, replicate, etc.), the dates of interest, type of graph to plot (auto, minimum, maximum) and the analyte of interest which are listed by filter type (Teflon, nylon, cellulose) (Figure 29). The graph is then generated by clicking on the Refresh button located at the bottom left of screen next to the Export button. The graphs generated can be downloaded by clicking the Export button.


Figure 29. QC Type Analysis Screen

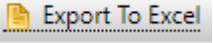


6.9 iCASTNET Equipment Inventory

Open iCASTNET and select the Equipment Inventory tile. This provides a comprehensive record of the equipment used by the sites and maintained at the Gainesville office (Figure 30). Each row represents a different piece of equipment, with columns that provide additional information designated by headings. On the top right corner of the screen there are options to add new equipment to the list, conduct an end of year rollover, and generate site-specific equipment reports

Below those options, there is a search tool for specific equipment. The Select Site: option allows the user to select a specific site. The Search By: option allows the user to search using a CNET Number, Model Number, Bar Code, or Serial #. The Group By: option allows the user to search by Site ID or status.

In the equipment list table, there are various filters to limit what appears on the list. To use these filters, a user must type into one of the text boxes below the headings and then click the  icon.

Above the filters, on the top right side of the equipment table screen, click  to create a copy of the list in Excel.



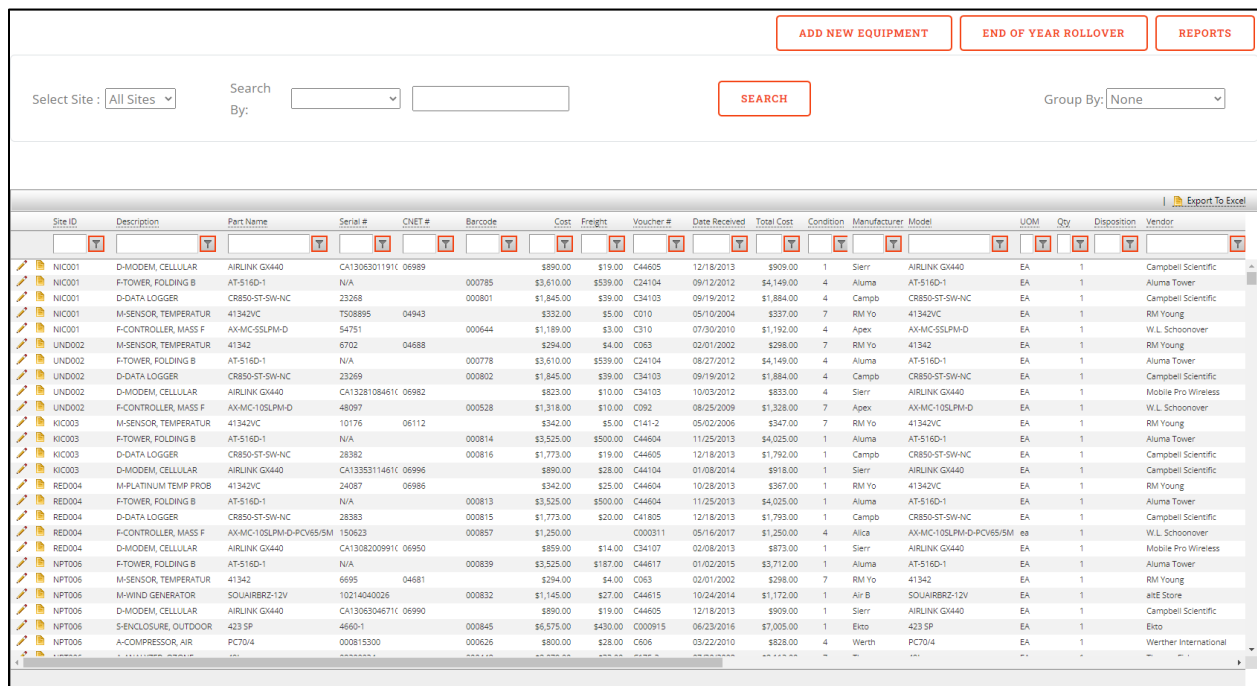
The equipment list provides options to edit each record using the  icon and track changes made to each record using the  icon.

Figure 30. Equipment Inventory



Site ID	Description	Part Name	Serial #	CNET #	Barcode	Cost	Freight	Voucher #	Date Received	Total Cost	Condition	Manufacturer	Model	UOM	Qty	Disposition	Vendor
NIC001	D-MODEM, CELLULAR	AIRLINK GX440	CA1308301191C 06989			\$890.00	\$19.00	C44605	12/18/2013	\$909.00	1	Sierr	AIRLINK GX440	EA	1		Campbell Scientific
NIC001	F-TOWER, FOLDING B	AT-516D-1	N/A		000785	\$3,610.00	\$539.00	C24104	09/12/2012	\$4,149.00	4	Aluma	AT-516D-1	EA	1		Aluma Tower
NIC001	D-DATA LOGGER	CR850-ST-SW-NC	23268		000801	\$1,845.00	\$39.00	C34103	09/19/2012	\$1,884.00	4	Campb	CR850-ST-SW-NC	EA	1		Campbell Scientific
NIC001	M-SENSOR, TEMPERATUR	4134ZVC	TS08895	04943		\$332.00	\$5.00	C010	05/10/2004	\$337.00	7	RM Yo	4134ZVC	EA	1		RM Young
NIC001	F-CONTROLLER, MASS F	AX-MC-SSLPM-D	54751		000644	\$1,189.00	\$3.00	C310	07/30/2010	\$1,192.00	4	Apex	AX-MC-SSLPM-D	EA	1		W.L. Schoonover
UNDO002	M-SENSOR, TEMPERATUR	4134Z	6702	04688		\$294.00	\$4.00	C063	02/01/2002	\$298.00	7	RM Yo	4134Z	EA	1		RM Young
UNDO002	F-TOWER, FOLDING B	AT-516D-1	N/A		000778	\$3,610.00	\$539.00	C24104	08/27/2012	\$4,149.00	4	Aluma	AT-516D-1	EA	1		Aluma Tower
UNDO002	D-DATA LOGGER	CR850-ST-SW-NC	23269		000802	\$1,845.00	\$39.00	C34103	09/19/2012	\$1,884.00	4	Campb	CR850-ST-SW-NC	EA	1		Campbell Scientific
UNDO002	D-MODEM, CELLULAR	AIRLINK GX440	CA1328108461C 06982			\$823.00	\$10.00	C34103	10/03/2012	\$833.00	4	Sierr	AIRLINK GX440	EA	1		Mobile Pro Wireless
UNDO002	F-CONTROLLER, MASS F	AX-MC-10SLPM-D	48097		000528	\$1,318.00	\$10.00	C092	08/25/2009	\$1,328.00	7	Apex	AX-MC-10SLPM-D	EA	1		W.L. Schoonover
KIC003	M-SENSOR, TEMPERATUR	4134ZVC	10176	06112		\$342.00	\$5.00	C141-2	05/02/2006	\$347.00	7	RM Yo	4134ZVC	EA	1		RM Young
KIC003	F-TOWER, FOLDING B	AT-516D-1	N/A		000814	\$3,525.00	\$500.00	C44604	11/25/2013	\$4,025.00	1	Aluma	AT-516D-1	EA	1		Aluma Tower
KIC003	D-DATA LOGGER	CR850-ST-SW-NC	28382		000816	\$1,773.00	\$19.00	C44605	12/18/2013	\$1,792.00	1	Campb	CR850-ST-SW-NC	EA	1		Campbell Scientific
KIC003	D-MODEM, CELLULAR	AIRLINK GX440	CA1355311481C 06996			\$890.00	\$28.00	C44104	01/08/2014	\$918.00	1	Sierr	AIRLINK GX440	EA	1		Campbell Scientific
RED004	M-FULCRUM TEMP PROB	4134ZVC	24087	06996		\$342.00	\$25.00	C44604	10/28/2013	\$367.00	1	RM Yo	4134ZVC	EA	1		RM Young
RED004	F-TOWER, FOLDING B	AT-516D-1	N/A		000813	\$3,525.00	\$500.00	C44604	11/25/2013	\$4,025.00	1	Aluma	AT-516D-1	EA	1		Aluma Tower
RED004	D-DATA LOGGER	CR850-ST-SW-NC	28383		000815	\$1,773.00	\$20.00	C41805	12/18/2013	\$1,793.00	1	Campb	CR850-ST-SW-NC	EA	1		Campbell Scientific
RED004	F-CONTROLLER, MASS F	AX-MC-10SLPM-D-PCV65/5M	150623		000857	\$1,250.00		C002011	05/16/2017	\$1,250.00	4	Nlca	AX-MC-10SLPM-D-PCV65/5M	ea	1		W.L. Schoonover
RED004	D-MODEM, CELLULAR	AIRLINK GX440	CA1308200991C 06950			\$559.00	\$14.00	C34107	02/08/2013	\$573.00	1	Sierr	AIRLINK GX440	EA	1		Mobile Pro Wireless
NPT006	F-TOWER, FOLDING B	AT-516D-1	N/A		000839	\$3,525.00	\$187.00	C44617	01/02/2015	\$3,712.00	1	Aluma	AT-516D-1	EA	1		Aluma Tower
NPT006	M-SENSOR, TEMPERATUR	4134Z	6695	04681		\$294.00	\$4.00	C063	02/01/2002	\$298.00	7	RM Yo	4134Z	EA	1		RM Young
NPT006	M-WIND GENERATOR	SOLAIRBR2-12V	10214040026		000832	\$1,145.00	\$27.00	C44615	10/04/2014	\$1,172.00	1	Air B	SOLAIRBR2-12V	EA	1		airB Store
NPT006	D-MODEM, CELLULAR	AIRLINK GX440	CA1309304671C 06990			\$890.00	\$19.00	C44605	12/18/2013	\$909.00	1	Sierr	AIRLINK GX440	EA	1		Campbell Scientific
NPT006	S-ENCLOSURE, OUTDOOR	423 SP	4660-1		000845	\$6,575.00	\$430.00	C000915	06/23/2016	\$7,005.00	1	Elco	423 SP	EA	1		Elco
NPT006	A-COMPRESSOR, AIR	PC704	000815300		000626	\$800.00	\$28.00	C606	03/22/2010	\$828.00	4	Werth	PC704	EA	1		Werther International

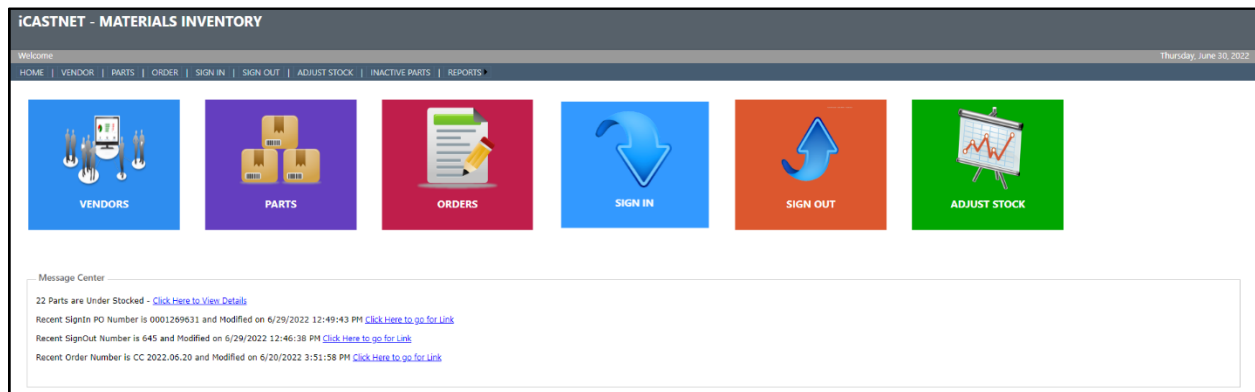
6.10 iCASTNET Materials Inventory

Open iCASTNET and select the Materials Inventory tile. This option allows the user to track the stock of materials.

6.10.1 Home

After selecting the Materials Inventory tile, the user is taken to the Materials Inventory Home Page (Figure 31). This provides navigation to the functions of the iCASTNET Materials Inventory. There is also a message center to display and provide access to important notifications.

Figure 31. Materials Inventory Home Page



6.10.2 Vendor

This function provides a list of vendors to buy materials from. The search bar allows the user to locate vendors. Using the dropdown menu, the user can search by Vendor Name, Vendor Number, Phone Number, Street, City, State, or Zip Code. Multiple filters can be applied simultaneously using [Add Filter](#).

The user can also add a vendor to the list using the [Add New Vendor](#) option in the top right corner.

6.10.3 Parts

This function provides the list of parts and their current stock (Figure 32). Red text indicates that a part is either low in inventory or out of stock.

Figure 32. Parts Screen

Part Number	Description	Vendor Name	Cost	In Stock	Units	Order Qty	Reorder Qty	Vendor PartNumber 1	Vendor PartNumber 2
1001-002	FILTER,47MM INLET COZONE,5 MICRONS	Sevlex	\$4.69	397	ea		200	450-47-4	
1001-002A	FILTER,47 MM, MEMBRANE,1-2 MICRON	Sevlex	\$4.74	60	ea		50	450-47-3	
1001-003	PROPELLER	RM Young Company	\$38.00	10	ea		5	08254	
1001-011	BALSTON FILTER # 9933-05-DQ	Classic Controls	\$23.00	55	ea		50	9933-05-DQ	
1001-011A	BALSTON FILTER, LARGE	Classic Controls	\$34.10	5	ea		1	9933-11-DX	
1001-017	FIRST-AID KIT	Staples	\$9.88	0	ea		5	285466	

The search bar allows the user to locate parts. Using the dropdown menu, the user can search by Part Number, Part Description, or Vendor Name. Multiple filters can be applied simultaneously using [Add Filter](#).

The user can also add a part to the list using the [Add New Part](#) option in the top right corner.

The user can edit a part using the icon or delete it from the list using the icon. Additionally, the list can be copied to Excel using the [Export to Excel](#) option.

6.10.4 Orders

This function provides the list of orders for materials, both open and closed.

The search bar allows the user to locate orders. Using the dropdown menu, the user can search by Order Number, Order Date, or Part Number. Multiple filters can be applied simultaneously using [Add Filter](#).


The user can also add an order to the list using the [Add New Order](#) option in the top right corner.

The user can edit an order using the  icon or delete it from the list using the  icon.

6.10.5 Sign In

This function provides a list of when materials were signed in.

The search bar allows the user to locate materials. Using the dropdown menu, the user can search by PO Number, PO Date, or Sign In Date. Multiple filters can be applied simultaneously using [Add Filter](#).

The user can edit an item on the list using the  icon.

6.10.6 Sign Out

This function provides a list of when materials were signed out.

The search bar allows the user to locate materials. Using the dropdown menu, the user can search by Part Number, Part Description, Sign Out Date, or Sign Out Number. Multiple filters can be applied simultaneously using [Add Filter](#).

The user can edit an item on the list using the  icon or delete it from the list using the  icon.

6.10.7 Adjust Stock

This function allows the user to adjust the listed stock of a material in the inventory (Figure 33). To do this, select the part from the drop-down menu, enter the date of when the adjustment is made, list how much is in stock and the quantity, enter any additional notes, and save.


Figure 33. Adjust Stock

The screenshot shows a web form titled "Adjust Stock". At the top left of the form area, the title "Adjust Stock" is displayed in blue. Below the title, there are several input fields: a "Parts" dropdown menu with the text "Select Part" and a search icon; a "Date" field with the value "6/30/2022" and a calendar icon; two empty text boxes labeled "InStock" and "Quantity"; and a larger text area labeled "Notes" with a small icon in the bottom right corner. At the bottom of the form, there are two blue buttons labeled "Save" and "Cancel".

6.10.8 *Inactive Parts*

This function provides the list of inactive parts in the inventory.

The search bar allows the user to locate parts. Using the dropdown menu, the user can search by Part Number, Part Description, or Vendor Name. Multiple filters can be applied simultaneously using [Add Filter](#).

The user can edit a part on the list using the  icon.

6.10.9 *Reports*

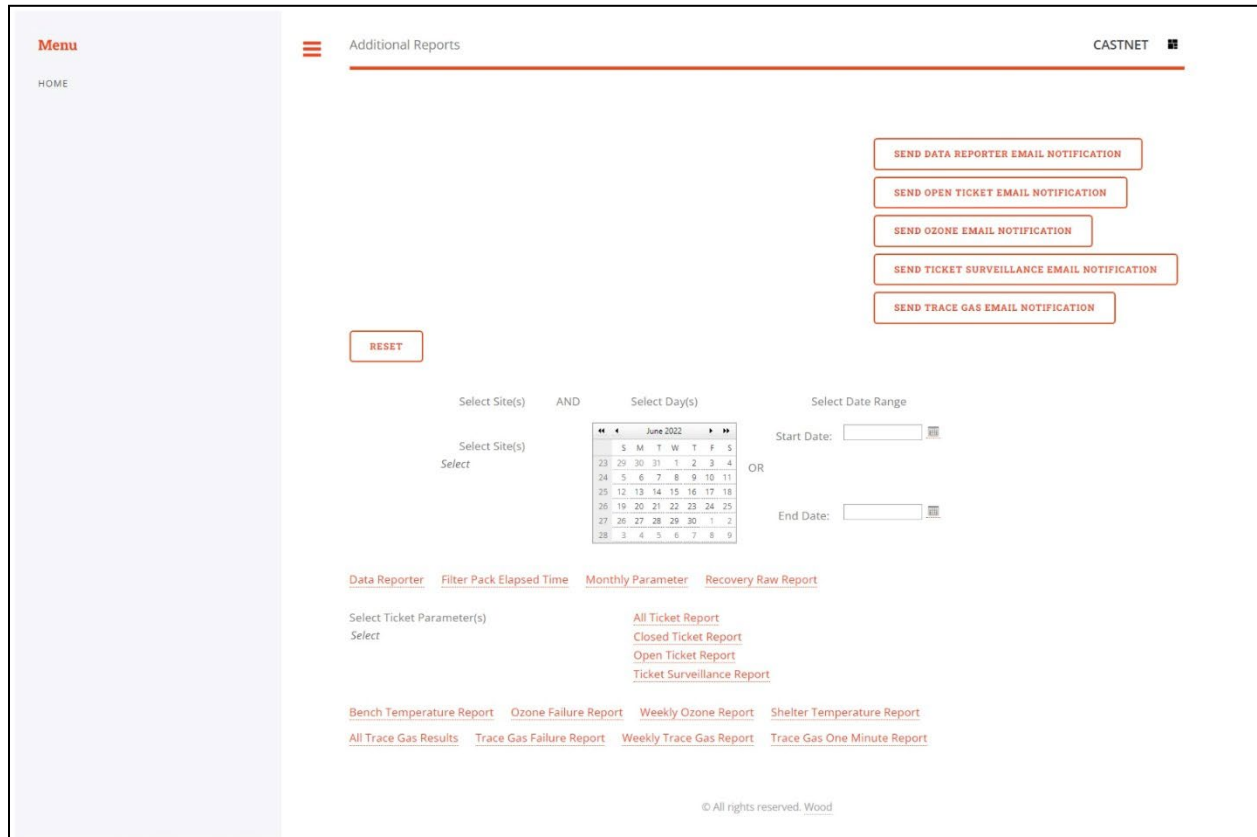
This function allows a user to generate reports on Parts Stocked, N/A Parts, Sign Out Detail List, Sign In Detail List, Parts Understocked, Inventory, Total Inventory Cost, and Annual Physical.

These reports can be filtered using similar search bars as the other functions.

6.11 iCASTNET Additional Reports

Click the Additional Reports tile on the iCASTNET Main Menu to display database driven reports (Figure 34).

Figure 34. Additional Reports



6.11.1 Selecting sites for reports

Click *Select* under Select Site(s) to select a monitoring site(s) from the dropdown list. Reports can be generated using all sites or specific sites.

6.11.2 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 in the middle of the screen under Select Day(s).
- You can select a date range using the start date and end date boxes to the right of the calendar under Select Date Range.

Unless specified, the default date range used for reports is from the previous day until the current date and time.

6.11.3 Reports

There are numerous reports available for viewing as excel files. These reports are listed under the calendar.

Data Reporter: The Data Reporter lists site names, dates and results for selected sites and dates that failed basic screening criteria for ozone, filter pack flow, and temperature parameters. (Figures 35).

Figure 35. Data Reporter

Report 10/12/2022								
Records Screened by Automated Process								
Site	Date	Parameter	Original	Flg	New	Flg	Editor	Reason
Records Adjusted by Automated Process								
Site	Date	Parameter	Original	Flg	New	Flg	Editor	Reason
Flow Rate Criteria								
Site	Date	Assumed Flow	Flow Rate	Diff	Flg			
HOX148	10/12/22 15:00	1.5	0.1	-94.8				
HOX148	10/12/22 16:00	1.5	0.0	-98.5				
HOX148	10/12/22 17:00	1.5	1.1	-26.7				
KEF112	10/12/22 4:00	1.5	1.3	-11.4				
KEF112	10/12/22 5:00	1.5	1.3	-14.9				
KEF112	10/12/22 6:00	1.5	1.2	-17.7				
KEF112	10/12/22 7:00	1.5	1.2	-19.3				

Filter Pack Elapsed Time: This report displays the difference between the number of hours the filter pack is expected to run during a normal week of operation versus the actual time the filter pack ran and is used as a diagnostic tool to spot operational problems related to the filter pack.

Monthly Parameter: This report displays either the ozone or shelter temperature values for a site for the selected month and year (Figure 36). The GO button defaults to ozone. To view shelter temperature the Shelter Temperature Report button must be clicked. Reports produced are in pdf format.

Figure 36. Monthly Parameter Report

Monthly Parameter Report

<

Select Site: ABT147 ▾

Select Month:

Jun ▾

2022 ▾

GO

OZONE REPORT

SHELTER TEMPERATURE REPORT

>

6.11.4 Recovery Raw Report:

This report lists the instrument settings by site, date, parameter, and calibration personnel (Figure 37).

Figure 37. Recovery Raw Report

Recovery Raw					
SITE ID	DATE	PARAMETER	VALUE	CALIBRATOR	UPDATE DATE
UMA009	5/20/22 7:13	alpha_t1	0.0038	TEW	5/20/22 11:20
UMA009	5/20/22 7:13	enable_auto_	0	TEW	5/20/22 11:20
UMA009	5/20/22 7:13	enable_mode	1	TEW	5/20/22 11:20
UMA009	5/20/22 7:13	flow_setpt	3.013	TEW	5/20/22 11:20
UMA009	5/20/22 7:13	l3_intercept	-0.15	TEW	5/20/22 11:20
UMA009	5/20/22 7:13	l3_slope	0.9931	TEW	5/20/22 11:20
UMA009	5/20/22 7:13	prog_sig	55281	TEW	5/20/22 11:20
UMA009	5/20/22 7:13	pump_on	0	TEW	5/20/22 11:20
UMA009	5/20/22 7:13	ro_t1	1000.8	TEW	5/20/22 11:20

6.11.5 Ticket Reports:

The four Ticket Reports clustered in the middle all deal with equipment/analyzer issues/problems at the sites and are more commonly referred to as problem ticket reports. The All Ticket report lists all problems at a site for a designated date range, the Open Ticket report lists problems still needing to be resolved and the Closed Ticket report will retrieve problems that have been resolved. The Ticket Surveillance report lists all open tickets by site and priority level (Figure 38).

Figure 38. Ticket Surveillance Report

Critical Priority Tickets				
No tickets.				
High Priority Tickets				
Site	Ticket #	Days Open	Parameter	Action
DUK008	287	11	TNX	We should be working with FSO this week.
KEF112	428	3	FLOW_RATE	FSO replaced balston filter on 10/11.
Medium Priority Tickets				
Site	Ticket #	Days Open	Parameter	Action
EGB181	72	76	COMMUNICATIONS	Hourly data was received on 9/21.
SUM156	385	8	FLOW_RATE	FSO reported erroneous readings on 10/4/22. MFC was tared and flows normal. FSO on 10/11/22 report.
ALC188	427	8	OZONE	FSO was unable to replace pump on 10/07. One of the baseplate thumb screw heads was stripped.
Low Priority Tickets				
Site	Ticket #	Days Open	Parameter	Action
CNT169	349	15	FLOW_RATE	Priority has been changed from Medium to Low
New Tickets				
Site	Ticket #	Days Open	Parameter	Action
BVL130	806	1	NOY	5.8 PPB Zero and 24% Level4 failures. Expected 14.9, response 18.6
VPI120	478	1	OZONE	-18.9% Level4 failure. Expected 59, response 47
NPT006	163	1	OZONE	BFSO reset the switch and router. Site is now polling and all data collected.
IRL141	445	1	OTHER EQUIPMENT	sending new 20slpm mfc #000721

The eight reports listed across the bottom of the screen, except for the shelter and bench temperature reports, all deal with either ozone or trace gas quality control check results. Figure 39 below is an example of an Ozone Failure report.

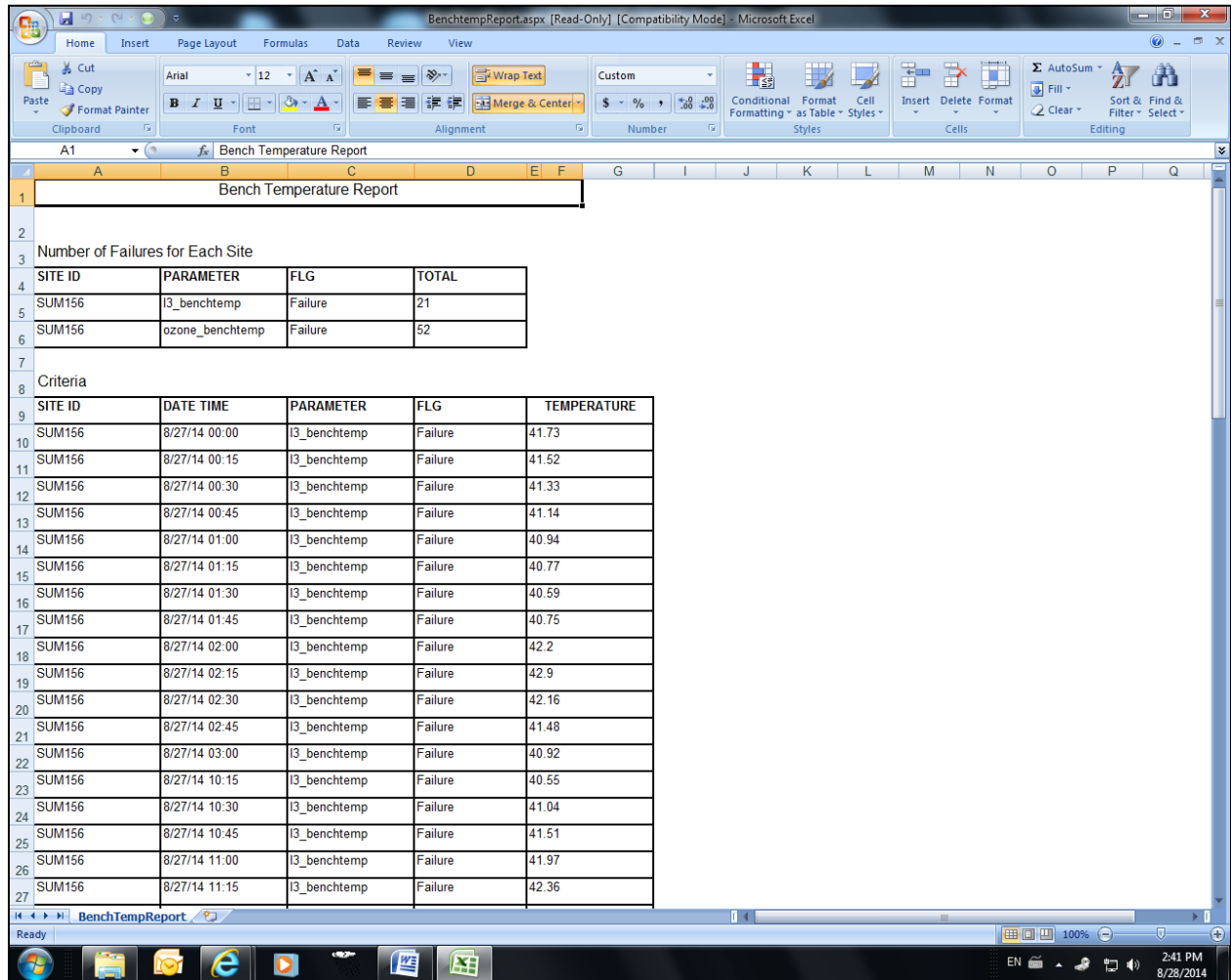
Figure 39. Ozone Failure Report

Ozone Report 10/2/22 - 10/9/22							
Criteria/Flag Alarms							
SITE ID	START DATE	END DATE	TYPE	EXPECTED VALUE	VALUE	VALUE F	DIFF
BFT142	10/5/22 01:51	10/5/22 01:58	level 1	220.7	25.75		-88.333
BFT142	10/5/22 02:04	10/5/22 02:11	level 4	60.72	28.55		-52.981
BFT142	10/5/22 02:11	10/5/22 02:18	zero	24.35	30.06		-5.71
BFT142	10/5/22 02:50	10/5/22 02:58	level 1	223.7	25.28		-88.699
BFT142	10/5/22 02:58	10/5/22 03:07	level 4	58.62	25.27		-56.892
BFT142	10/5/22 03:07	10/5/22 03:14	zero	20.32	24.79		-4.47
BFT142	10/6/22 01:50	10/6/22 01:57	level 1	231.3	14.47		-93.744
BFT142	10/6/22 02:04	10/6/22 02:11	level 4	61.64	13.52		-78.066
BFT142	10/6/22 02:12	10/6/22 02:19	zero	14.54	17.87		-3.33
BFT142	10/6/22 02:53	10/6/22 03:01	level 1	226.2	17.6		-92.219
BFT142	10/6/22 03:03	10/6/22 03:10	level 4	61.3	17.25		-71.86
BFT142	10/6/22 03:11	10/6/22 03:18	zero	14.97	18.36		-3.39
BVL130	10/2/22 01:47	10/2/22 01:55	level 1	230.3	205.6		-10.725
BVL130	10/3/22 01:57	10/3/22 02:04	level 4	58.6	42.44		-27.577
BVL130	10/3/22 02:04	10/3/22 02:12	zero	-0.123	-4.649		4.526
BVL130	10/8/22 02:10	10/8/22 02:17	zero	-0.122	-8.25		8.128
ESP127	10/6/22 01:58	10/6/22 02:06	level 4	59.85	52.01		-13.099
ESP127	10/7/22 01:56	10/7/22 02:03	level 4	58.76	53.91		-8.254
IRL141	10/2/22 02:39	10/2/22 02:47	level 5	38.17	38.31		0.367
PND165	10/2/22 02:24	10/2/22 02:32	level 4	49.93	50.28		0.701
PND165	10/2/22 02:37	10/2/22 02:45	level 5	42.19	43.23		2.465
VIN140	10/2/22 02:31	10/2/22 02:39	level 5	48.06	47.66		-0.832
VPI120	10/4/22 02:09	10/4/22 02:16	zero	-0.218	-5.51		5.292

6.11.6 Bench Temperature report

This report summarizes failures of ozone bench temperature criteria by number of failures per site as well as listing the failing bench temperature values in 15-minute increments. See Figure 40 for an example.

Figure 40. Bench Temperature Report



6.11.7 Shelter Temperature Report

Report summarizes number of missing records, failures, and alarms by site as well as listing each hour by site with either an alarm, failure or missing flag. See Figure 41 for an example report.

Figure 41. Shelter Temperature Report

The screenshot shows an Excel spreadsheet with the following data:

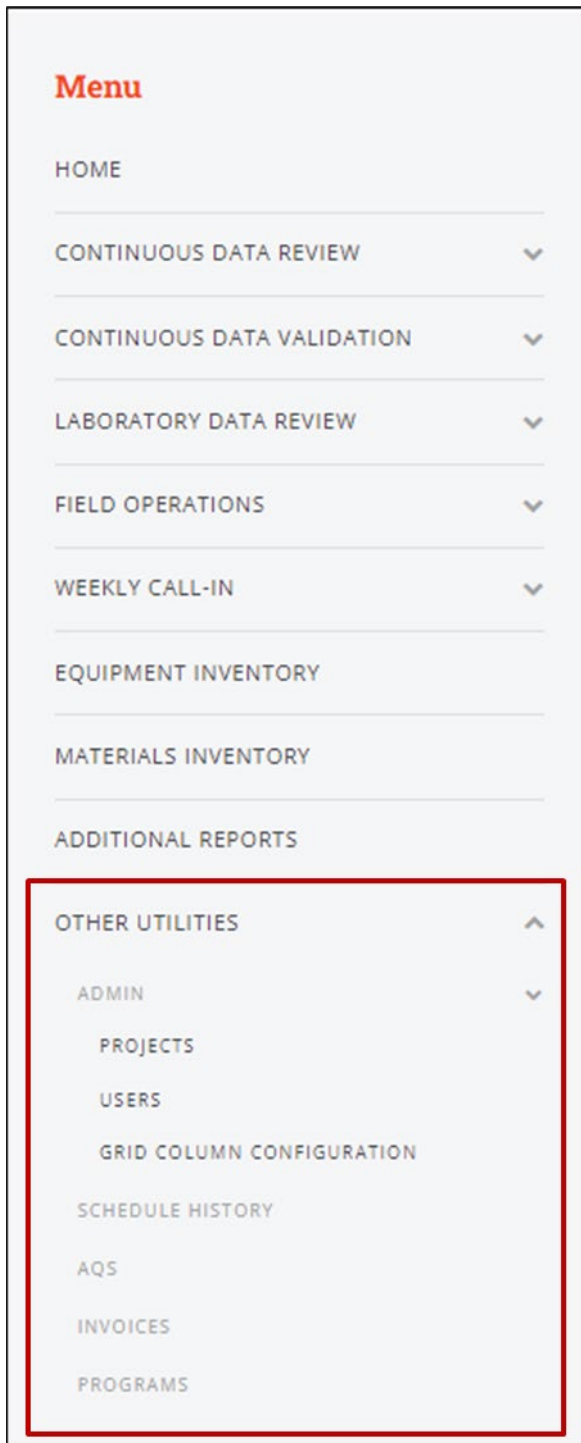
Number of Records Missing for Each Site		
SITE ID	FLG	TOTAL
ABT147	M	6
ALC188	M	7
ALH157	M	7
ANA115	M	6
ARE128	M	6
ASH135	M	6
BEL116	M	6
BFT142	M	6
BVL130	M	7
BWR139	M	6
CAD150	M	7
CDR119	M	6
CDZ171	M	6
CKT136	M	6
CND125	M	6
CNT169	M	8
COW137	M	6
CTH110	M	6
CVL151	M	7
DCP114	M	6
ESP127	M	7
GAS153	M	6
GTH161	M	7
HOW191	M	6
HOX148	M	6

The four SEND boxes at the top right corner of the screen (Figure 35) will send an email notification to project personnel that these reports are available with the full report attached to the email as an excel file.

6.12 Other Utilities

Open iCASTNET and select the Other Utilities tile. This section contains various types of information for administrative and managerial staff (Figure 42).

Figure 42. Other Utilities



7.0 REFERENCES

Placeholder

8.0 ATTACHMENTS

This SOP does not contain attachments.