# IMPROVE Standard Operating Procedure for Data Processing and Validation SOP 351

***IMPROVE Program***
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UCDAVIS CROCKER NUCLEAR LABORATORY

## DOCUMENT HISTORY

| Version No. | Date Modified | Initials | Section/s Modified | Brief Description of Modifications |
|---|---|---|---|---|
| 2.0 | 7/2008 | LLA/NPH/ CEM | Entire document | Revised and reorganized SOP. Added appendices with computer code. |
| 2.1 | 3/2016 | XC | Entire document | Revised and reorganized SOP. Eliminated the part we don't do anymore. Updated concentration, uncertainty, and minimum detection limit equations. |
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# SOP 351: DATA PROCESSING AND VALIDATION

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# 1. PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) document provides an overview of the procedures for processing and validating IMPROVE data. Data processing and data validation are performed in parallel.

# 2. RESPONSIBILITIES

This section describes the responsibilities of the individuals involved in data processing and validation.

## 2.1 PROJECT MANAGER

The project manager oversees all aspects of the program.

## 2.2 QUALITY ASSURANCE OFFICER

The quality assurance officer

- devises techniques that improve the efficiency, traceability, and accuracy of the data management
- characterizes measurement deficiencies
- quantifies measurement uncertainty
- analyzes IMPROVE data to assess the influence of specific components of the measurement process and to assess the quantitative ramifications of procedural changes
- conducts ongoing evaluation of the program's progress in data quality
- develops and applies approaches for assessing data quality
- proposes program improvements
- develops automated data quality checks to increase the objectivity and consistency of the data validation process

## 2.3 DATA VALIDATION MANAGER

The data validation manager

- receives analyzed data
- reviews ion and carbon data for errors
- reviews and evaluates flow data
- examines flow data for disparities and errors
- builds the concentration database
- examines concentration data site by site for consistency
- notes and resolves inconsistencies in the data
- submits data to project sponsors (CIRA)

### 2.4 LABORATORY AND FIELD OPERATIONS MANAGER

The laboratory and field operations manager

- oversees all field operations including site installation, maintenance, and routine operations
- coordinates annual routine maintenance
- maintains documentation on the flow rate calibration for each module
- verifies that the flow rates are within acceptable tolerances
- oversees all weighing-room operations from filter acceptance to gravimetric mass data quality checks
- reviews independent audits of the IMPROVE network
- oversees maintenance shop operations

### 2.5 FIELD OPERATIONS TECHNICIANS

The field operations technicians

- perform annual routine maintenance
- perform annual audits and calibrations of sites
- maintain site documentation, such as pictures, global positioning system coordinates, and site details
- implement any required equipment and/or procedure changes
- train site operators on new equipment and/or procedural changes
- train shop technicians on in-house equipment repairs and field techniques
- install new site locations

### 2.6 LABORATORY TECHNICIANS

The laboratory technicians

- review log sheets for completeness and check the validity of the samples
- upload flashcard data to the Crocker computer system
- communicate with operators about problems and questions
- maintain the records on site and sampler operations
- maintain timely filter preparation and recovery
- maintain balance calibrations and quality control of measurements
- review final shipments for independent analysis
- perform acceptance tests on new filter lots for use in the network

### 2.7 LABORATORY STUDENTS

The undergraduate student members of the laboratory staff

- review log sheets for completeness and check the validity of the samples
- perform filter preparation and recovery
- prepare filters for analysis
- prepare filters for archive

## 3. REQUIRED EQUIPMENT AND MATERIALS

The data processing and validation requires the logs files, weights files, carbon files generated by DRI, the ions files generated by RTI, the PIXEXRF (elements) files, and the laser absorption files. The logs file is used to control the data processing by BuildDBF, SWAP, and other programs. It contains all the information known about the sample related to processing, including the site, date collected, flow rate measurements, elapsed time, validity status, field comments, and other sample specific information. The flow rate calibration files and the flashcard files are required for calculating flow rates, and the balance calibrations are required for calculating filter masses. All these files are stored in subdirectories in the U:\IMPROVE\ directory on the Crocker Nuclear Laboratory server. Appendix A contains the data dictionaries for all these files.

**SWAP**: This program (written in FoxPro) allows access to the data files for viewing the data, calculating summary statistics, and correcting errors. We began using SWAP in March 2005. Additional capabilities were added to SWAP over the next 14 months. Prior to March 2005, Auxdata was used to perform most of these functions; Auxdata is described in the first version of this SOP. SWAP has two levels of access for different users. Figure 1 shows the main menu screen for SWAP. SWAP provides access (by site and by quarter) to the following information for all users:

- ions, carbon, XRF, laser, and SO2 data files
- logs files for status codes and flow readings
- problems file
- flow rate calibration files
- weights files, along with calculated filter mass difference
- flashcard data
- ions field blanks, sortable by any ion in ascending and descending order, along with access to median values
- carbon secondary filters, sortable by any carbon fraction in ascending and descending order, along with access to median values
- number of field blanks and their percentage by month and module with comparison to the target value, which is 1-2% of the sample filters
- balance equation data files
- flow rates, including relative standard deviations (see below)

SWAP allows access to several additional subprograms and data files for selected users; all options listed under "Data Processing" are restricted. The following features are used to calculate concentrations and validate data.

- **ArtHist** provides access to the artifact history file so the data validation manager can review the current artifact data in context with prior data.
- **FlowRSD** calculates the relative standard deviation (RSD) of the 15-minute flow and temperature readings for each 24-hour period and presents a table of the results for each module. All RSD values exceeding 3% (2% on Module D) are highlighted. The number of data readings is also highlighted if it does not equal 96. It can be run for all sites to generate a report of only those values exceeding the threshold. This is valuable for data validation before generating concentration files.

- **FlowRate** calculates the average flow rate measurements from the flashcard data and highlights any values outside the "LF" flag limits (discussed in Section 6.3). It also calculates the mean temperature. The background color of the resulting grid cells indicates flow rate RSD ranging from green (low RSD) to yellow (high RSD).

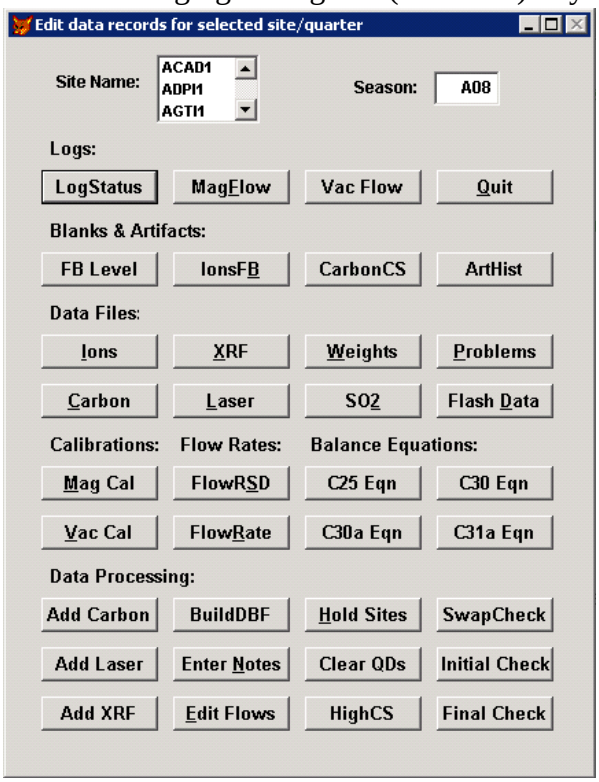



Figure 1. Menu screen for SWAP

- **Add Carbon, Add Laser, and Add XRF** are used to add new data to FoxPro data tables. At this writing the carbon and laser data have been incorporated into SQL tables so these options are not used. Once the XRF data are ingested into a SQL table the Add XRF option will be dropped.
- **BuildDBF** calculates the concentrations for a month at any single site or at all sites. It produces two output files, one for data validation and one for submission to CIRA. They are identical except that the data validation file includes the composite variables (described in Section 5.5). The data validation file is imported into Excel and used to perform the data validation described in Section 6.4. BuildDBF was first used to process June 2002 data but has been modified to deliver data from as far back as January 2000; it was used to redeliver all the data to CIRA from January 2000 through December 2004. Plans are underway to replace it with a SQL Server based data management system.
- **Edit Notes** opens a form to systematically add comments and document changes to the database during validation.
- **Edit Flows** is used to review the flow rate file produced by a SQL query from Flashcard data. This option does not now allow editing.

- **Hold Sites** provides viewing and editing access to the data file that records sites not included in the generated delivery file.
- **Clear QDs** replaces all "QD" flags remaining in the logs file for a given month. It does not clear them if the site is in the HOLDS file.
- **High CS** executes a SQL query that isolates cases where the carbon secondary filter has higher concentrations than the carbon primary filter. This option will find possible swapped primary/secondary filters.
- **SwapCheck** examines the concentration files produced by BuildDBF for potential swaps between the A and B modules, and between the A and C modules.
- **Initial Check** performs some of the checks described below under "Final Check" but does not look for temporary status flags that are intended to be reset during data validation. It's a useful check on data to start performing data validation.
- **Final Check** opens the output file for a selected month and year. It then runs through a series of checks on the file to be sure it's ready to deliver to CIRA. It shows all records where $PM_{2.5}$ mass is greater than $PM_{10}$ mass (MF>MT) along with a measure of the significance of the difference, all records where the flow rate has been flagged as "RF", "CG", or "CL", all records with a "QD" flag for any module, all records with an "SA" or "QA" flag, and a list of all sites in the HOLDS file for that month. It also shows all sites that have an unusually large or small number of records for the month.

## 4. DATA PROCESSING AND VALIDATION OVERVIEW

Data processing for IMPROVE consists of reducing and combining information collected in the field and laboratories to calculate concentrations, uncertainty estimates, and minimum detectable limits (mdl). Several custom software packages are used to perform these manipulations. Figure 2 shows the data involved; the process moves from left to right in the figure, and the concentration data are the final products.

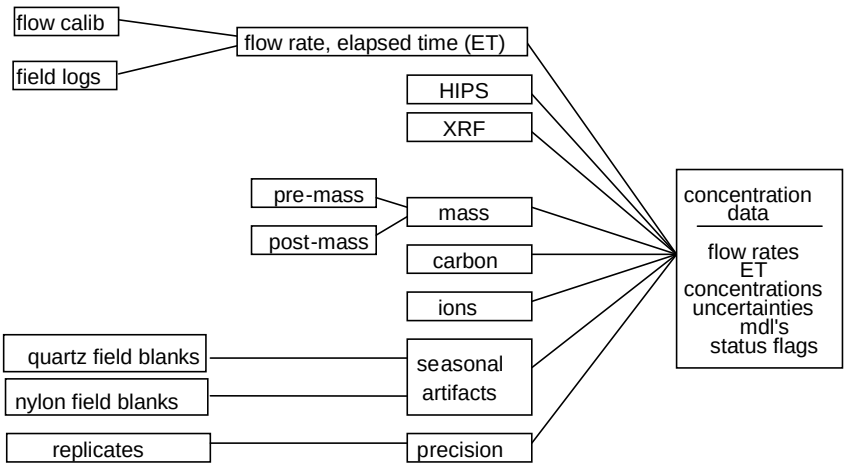



Figure 2. Data processing flow chart

Data validation is not a linear process, and a significant amount of data validation is performed by the analytical laboratories before the data are delivered to the data validation manager. The SOPs for the analytical laboratories describe their data validation procedures in detail.

Watson et al. (1995) define a three-level data validation process for environmental measurement studies. The levels are only intended as general guidelines. The IMPROVE data delivered to CIRA are considered to be a mixture of Level 1B and Level 2 validated data. The levels are applied to IMPROVE as follows:

**Level 0:** Data at this level are, in essence, raw data, obtained directly from the data-acquiring instruments. These data can be reduced or reformatted, but are unedited and unreviewed, without any adjustments for known biases or problems that might have been identified during preventative maintenance checks or audits. These data may monitor instrument operations on a frequent basis. Averaging times represent the minimum intervals recorded, and these data may need to be aggregated to obtain averages for the sampling periods. Level 0 data have not been edited for instrument downtime, nor have procedural adjustments for baseline shifts, span changes, or known problems been applied. Examples of data at Level 0 validity are

- 15-minute averaged pressure transducer and temperature data downloaded from the sampler flashcards before automated validation tests
- balance measurements before automated validity tests
- XRF raw spectra

**Level 1A:** Data at this level have passed several qualitative reviews for accuracy and completeness. The focus of Level 1A validation is to obtain as complete a data set as possible. IMPROVE Level 1A data validation consists of

- replacing invalid data values with -999 (the invalid data code) and setting status flags to reflect sampler malfunctions, site or laboratory operator errors, or power outages
- reviewing operator log sheets to verify operation of the sampler
- verifying operator log sheet entries against sampler flashcard data
- setting status flags to use log sheet temperatures if flashcard temperatures are faulty
- replacing flow rate data with data from a backup system (orifice transducer or log sheet readings) in the event of failure of the primary cyclone transducer system
- identifying, investigating, and flagging data that are beyond reasonable bounds or that are unrepresentative of the variable being measured (e.g., flow rate measurements that change significantly over the sampling period)

**Level 1B:** Data at this level have passed additional automated quantitative and qualitative reviews for accuracy and internal consistency. Objective consistency tests are applied by the data validation manager. Discrepancies that cannot be resolved are reported to the measurement laboratories for investigation. Data that deviate from consistency objectives are individually examined for errors. Obvious outliers (e.g., -85 °C temperature) are invalidated by setting a status flag. Changes to the data (e.g., swapping dates on consecutive samples) are recorded and documented by setting status flags. Level 1B data review is carried out using custom software developed for this purpose. IMPROVE level 1B data validation includes

- immediately verifying balance measurements to ensure that
    - the range is within specified limits
    - the postweight is greater than the preweight

- examining daily flow rates based on a report from the FlowRSD program that identifies flow rates with significant variations over 24 hours
- setting status flags when deviations from nominal operational settings have occurred (e.g., flow rates outside quantitative tolerances)
- examining the ion field blank and the carbon secondary filter analyses for evidence of swaps with sample filters
- examining individual data points identified by SwapCheck as potential sample swaps between two adjacent dates on module A, B, or C
- comparing the analytical data to expectations based on prior years

**Level 2:** Level 2 data validation takes place after data from various measurement methods have been assembled in the database. Level 2 tests involve comparisons of collocated measurements and internal consistency tests. The Level 2 data review is conducted site by site by the data validation manager on the final data set before it is submitted to CIRA. Data submitted to CIRA are considered to be validated at Level 1B and Level 2, depending on the specific types of checks applied to the data. Additional Level 2 data validation is performed by CIRA.

IMPROVE Level 2 data validation consists of a site-by-site examination of time series and scatter plots of data, including

- comparing sulfur and sulfate concentrations
- comparing light-absorbing carbon and organic mass by carbon to LRNC and organic mass by carbon
- examining $PM_{10}$ mass and $PM_{2.5}$ mass for cases where $PM_{2.5}$ is greater than $PM_{10}$

**Level 3:** This level of data review is applied after the submission of concentration files to CIRA, when the results from different data analysis approaches are compared with each other and with measurements. At this level, the data are reconciled with other research findings, such as modeling results or theoretical predictions. The first assumption upon finding a measurement that is inconsistent with physical expectations is that the unusual value is due to a measurement error. If, upon tracing the path of the measurement, nothing unusual is found, the value can be assumed to be a valid result of an environmental or statistical cause. Level 3 validation continues for as long as the database is maintained.

## 5. DATA PROCESSING

The following section is a discussion of the equations used to calculate aerosol concentrations and the associated uncertainty and mdl. Except for the flow rate calculations, all these calculations are performed by BuildDBF to generate the output data file. Appendix A lists the data dictionaries for all files needed by BuildDBF. Appendix B contains flow charts for the BuildDBF procedures. Appendix C lists the FoxPro source code for BuildDBF. Appendix D lists the FoxPro source code for SWAP, and Appendix E lists the FoxPro source code for Network_Metric_Checks. Appendix F gives more detail about the origins of the flow rate equations.

## 5.1 UNITS

Table 1 lists the data names, type, and units for all data submitted to CIRA. For the mass, ions, carbon, elements, and LRNC, the units listed are also for the error and mdl.

Table 1. Units of data delivered to CIRA

| Data type | Data names | Units |
|---|---|---|
| Flow Rate | Flow_a, Flow_b, Flow_c, Flow_d | Liters per minute |
| Elapsed Time | Time_a, Time_b, Time_c, Time_d | Hours |
| Gravimetric mass | MF, MT | $ng/m^3$ |
| Ions | Cl, $NO_2$, $NO_3$, $SO_4$ | $ng/m^3$ |
| Carbon fractions | O1, O2, O3, O4, OP, E1, E2, E3 | $ng/m^3$ |
| Elements | H, Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, As, Pb, Se, Br, Rb, Sr, Zr | $ng/m^3$ |
| Light absorption | LRNC | $Mm^{-1}$ |

## 5.2 ARTIFACTS

An *artifact* is defined as any increase or decrease of material on the filter that positively or negatively biases the measurement of ambient concentration. We make artifact corrections on the ion, carbon, and XRF measurements. Five examples of artifacts are

- contamination of the filter medium
- contamination acquired by contact with the cassettes or in handling
- adsorption of gases during collection that are erroneously measured as particles
- volatilization of particles during collection and in handling
- fall-off of particles during handling after collection

The first three are positive artifacts and the last two are negative.

For the ions measurements, our artifact correction method attempts to account for the first two types of artifacts. The sum of the two contamination artifacts is estimated through the analysis of field blanks (FB status flag). The field blanks are handled as normal filters (loaded into cassettes and cartridges, shipped to and from the field, and left in the sampler for a week) except that no air is drawn through them. The field blanks are collected randomly at all sites on a periodic basis. When there are >= 3 nylon field blanks in that month, the ions artifact correction values are calculated as the median loading measured on the field blanks. Otherwise values of last month are used. These artifact values are subtracted from each ambient concentration for the corresponding month. The standard deviation of the field blank loadings is used to calculate the mdl. Prior to June 2002, artifacts were calculated by seasonal quarter instead of by month.

For the carbon measurements, our artifact correction method attempts to account for the first three types of artifacts. Prior to the sample date of 2005, these artifacts are estimated using

secondary filters (CS status flag). Secondary filters were loaded into the filter cassettes behind the primary filters at select sites only (6-13 sites, depending on the time period). The assumption is that the first filter collects all the particles and absorbs some organic gases while the secondary filter absorbs an equivalent amount of organic gases. The carbon artifact correction values for each carbon fraction were calculated as the median loading measured on the secondary filters each month. Starting from 2005, the artifact correction values are based on the field blanks. The median loading is determined from all the available field blanks for the month. From August 2008 to January 2013 field blanks were collected at only the sites with secondary filters, and the field blanks also used both a primary and secondary filter; analyses of these stacked field blanks showed that each of the individual field blank filters had significantly lower loadings than the single field blanks (http://vista.cira.colostate.edu/improve/Activities/Meetings/2012Pres/Dillner_OCArtifactAdjustmentIMPROVEOct2012.pdf). Therefore, loadings from the paired field blank filters are multiplied by a factor of 1.42 to adjust the loading to be equivalent to single field blank (FB)loadings. However, if there are <= 2 available measurements (CS for data prior to 2005, FB and FP for data from 2005), values of last month are used. These artifact values are subtracted from each ambient concentration for the corresponding month. The standard deviation of the secondary filter loadings is used to calculate the mdl.

We do not correct any measurements for the two negative artifact types, volatilization and fall-off. The measured low-temperature organics may be much less than in the atmosphere because of volatilization of particles during the remainder of the sampling. We assume that any volatilization of nitrate and chlorine from nylon is not significant. Depending on the environmental conditions, some ammonium nitrate collected on Teflon® filters may volatilize. In those cases the fine mass on the Teflon® filter may underestimate the ambient mass concentrations.

## 5.3 VOLUME

The volume is the product of the flow rate and the sample duration. The sample duration is determined using elapsed time (ET), as recorded by the sampler controller on the memory card. The fractional uncertainty of the volume is the quadratic sum of the fractional uncertainties of flow rate and duration. Since the fractional uncertainty of the duration is much smaller than that of the flow rate, it is neglected.

For the $PM_{2.5}$ modules, the flow rate is measured using two independent methods. The first method measures the pressure drop across the cyclone using a pressure transducer and employs a measuring orifice equation. The second method measures the pressure immediately before the critical orifice and employs the equation for flow through a critical orifice. If the cyclone transducer measurements are determined to be in error, the critical orifice transducer measurements are used. The equations for flow rate are described in more detail in Appendix F.

The uncertainty in the average flow rate has two components. The first component is the accuracy of the measured values. Internal audits indicate that the root mean square difference between an audit and the sampler measurement is 3-4%. Since the precision of most audit devices is 2-3%, the sampler flow rate uncertainty is estimated to be 3%.

The second component of flow rate uncertainty results from the averaging method employed because the equations used to calculate flow rate from the pressure measurements are not linear.

Prior to January 2005, we averaged the 15-minute pressure measurements over the sample period (nominally 24 hours) and then calculated the flow rate from the average pressure measurements. The more accurate method is to calculate the flow rate for each 15-minute pressure measurement and then calculate an elapsed time-weighted average flow rate for the sampling period. If the sampler flow rate drops during sampling (due to filter clogging, for example), the two methods will produce different results (1-3% difference); otherwise they are nearly identical. We moved to the second method beginning with the January 2005 data.

The sampler flow rate for modules A, B, and C is calculated by

$$Q = 10^{a} M^{b} * F(elev) * \sqrt{\frac{T + 273.15}{293.15}} \qquad (351\text{-}1)$$

where Q = volumetric flow rate (calculated from site-specific temperature and pressure, not STP)

a, b = calibration coefficients

M = cyclone transducer reading. If the transducer readings are taken off the controller screen, they can be plugged into equation 351-1 directly; if the transducer readings are taken off the flashcard file, they must be divided by 100.

*F(elev)* = elevation factor to account for pressure difference between sea level and the site (see Appendix F)

T = ambient temperature in degrees Celsius at time of sampling.

For module D, the sampler flow rate is calculated by

$$Q = (c + d * G) * F(elev) * \sqrt{\frac{\mathrm{T} + 273.15}{293.15}} \qquad (351\text{-}2)$$

where Q = volumetric flow rate

c, d = calibration coefficients

G = critical orifice transducer reading. If the transducer readings are taken off the controller screen, they can be plugged into equation 351-2 directly; if the transducer readings are taken off the flashcard file, they must be divided by 100.

*F(elev)* = elevation factor to account for pressure difference between sea level and the site (see Appendix F)

T = ambient temperature in degrees Celsius at time of sampling.

Equation 351-2 may be used to calculate the flow rate on Modules A, B, or C if the cyclone transducer readings are invalid.

## 5.4 CONCENTRATION, UNCERTAINTY, AND MINIMUM DETECTABLE LIMIT (MDL)

The calculations described in this section are performed by BuildDBF. The mass of material on the filter is equal to the difference between the mass measured on the sample and the mass on the unused filter. The mass on the unused filter is determined from the preweight of each individual Teflon® filter for the gravimetric analysis, from the median of field blank loadings for the ion

measurements, and from the median of the secondary filter loadings for the carbon measurements. The concentration equals this number divided by the volume:

$$C = \frac{\text{A - B}}{\text{V}} \tag{351-3}$$

where C = ambient concentration (ng/m$^3$)

A = mass measured on sample (ng/filter or ng/cm$^2$)

B = artifact mass (ng/filter) = preweight, monthly median of ion field blanks (FB), or monthly median of carbon field blanks (FB). Prior to June 2002, artifacts were calculated by seasonal quarter instead of by month.

V = sample air volume (m$^3$) = Q * Elapsed Time

The uncertainty is reported with each concentration. The general model for the uncertainty is a quadratic sum of two components of uncertainty as shown in Equation 351-4.

$$\sigma(c) = \sqrt{\left[fC\right]^2 + \left[\frac{\sigma_a}{V}\right]^2} \tag{351-4}$$

where f = fractional uncertainty. This term results from various sources of proportional uncertainties, such as the analytical calibration and flow rate measurements.

$\sigma_a$ = constant analytical uncertainty. This term results from additive sources of uncertainty, such as those related to background contamination of the filters. For large concentrations, this is small compared to the fractional term.

The minimum detectable limit (mdl) is also provided with each concentration in the database. For the ion and carbon measurements, the mdl corresponds to twice the standard deviation of the field blanks. For mass and absorption, the mdl corresponds to twice the analytical uncertainty determined by laboratory blanks. For XRF, the mdl is based on standard deviation of field blanks.

### 5.4.1 $PM_{2.5}$ and $PM_{10}$ Mass (Module A)

$PM_{2.5}$ mass is measured gravimetrically on the PTFE filter from Module A. $PM_{10}$ mass is measured gravimetrically on the PTFE filter from Module D. The postweight and preweight are stored as milligrams per filter in the weights file. The constant analytical uncertainty, $\sigma_a$, in equation 351-4 is equal to 5 μg for all filters. The mass concentration, uncertainty, and mdl in nanograms per cubic meter are calculated using the following equations:

$$C_{Mass} = 10^6 \, ng/mg * \left(\frac{Postweight - preweight}{V}\right) \tag{351-5}$$

$$\sigma_{Mass} = 1000 \, ng/\mu g * \sqrt{\left(\left(\frac{5\mu g}{V}\right)^2 + \left(\frac{C_{Mass} * f}{1000 \, ng/\mu g}\right)^2\right)} \tag{351-6}$$

$$mdl_{Mass} = 1000 \, ng/\mu g * \frac{10 \mu g}{V} \quad (351\text{-}7)$$

### 5.4.2 Ions (Module B)

Ions are measured by ion chromatography using the nylon filter from Module B. The ions measurements–chloride ($Cl^-$), nitrite ($NO_2^-$), nitrate ($NO_3^-$), sulfate ($SO_4^=$), and ammonium ($NH_4^+$)–are stored as micrograms per filter in the ions data files from RTI. The ion concentration, uncertainty, and mdl in nanograms per cubic meter are calculated using the following equations:

$$C_{ion} = 1000 \frac{ng}{\mu g} * \frac{(A_{ion} - B_{ion})}{V_{B\,module}} \quad (351\text{-}8)$$

$$\sigma_{ion} = 1000 \frac{ng}{\mu g} * \frac{\sqrt{\left(Max(\sigma_{dfb}, mdl_{analytical})\right)^2 + \left(f * (A_{ion} - B_{ion})\right)^2}}{V_{B\,module}} \quad (351\text{-}9)$$

$$mdl = 1000 \frac{ng}{\mu g} * 2 * \frac{Max(\sigma_{dfb}, mdl_{analytical})}{V_{B\,module}} \quad (351\text{-}10)$$

where

$B_{ion}$ = median of the field blank measurements when there are >= 3 field blanks in that month, otherwise the number from the previous month will be used.

$mdl_{analytical}$ = 0.03 for chloride, 0.01 for nitrite, 0.05 for nitrate, 0.07 for sulfate, and 0.12 for ammonium. The analytical mdl for each ion is to be used as the overall mdl in the event that the median value of the field blanks is lower than the respective analytical mdl.

$\sigma_{dfb}$ = standard deviation of the field blank measurements for the appropriate ion.

The fractional analytical uncertainty, $f_a$, for each ion species is given in Table 2; these values have been used to report uncertainties back to January 2005.

Table 2. Fractional uncertainty for the ions

| Species | f |
|---|---|
| Chloride | 0.08 |
| Nitrite | 0.22 |
| Nitrate | 0.04 |
| Sulfate | 0.02 |
| Ammonium | 0.02 |
| Sulfur Dioxide | 0.04 |

### 5.4.3 Carbon (Module C)

Carbon is measured by thermal optical reflectance (TOR) using the quartz filter from Module C. Carbon measurements are stored in the carbon file as micrograms per filter. For the eight carbon species, the primary source of fractional uncertainty is the separation into temperature ranges. This may be associated with temperature regulation, but it may also be from the inherent variability of the species involved. The concentration, uncertainty, and mdl in nanograms per cubic meter for the carbon fractions – O1, O2, O3, O4, OPTR, OPTT, E1, E2, and E3 – are calculated using the following equations:

$$C_{fraction} = 1000\frac{ng}{\mu g} * \frac{\left(A_{fraction} - B_{fraction}\right)}{V_{C\,module}} \quad (351\text{-}11)$$

$$\sigma_{fraction} = 1000\frac{ng}{\mu g} * \frac{\sqrt{\left(Max\left(\sigma_{dfb}, t\right)\right)^2 + \left(f\ * \left(A_{fraction} - B_{fraction}\right)\right)^2}}{V_{C\,module}} \quad (351\text{-}12)$$

$$mdl = 1000\frac{ng}{\mu g} * 2 * \frac{Max\left(\sigma_{dfb}, t\right)}{V_{C\,module}} \quad (351\text{-}13)$$

where

$B_{fraction}$ = median of the field blank measurements when there are >= 3 field blanks in that month, otherwise the number from the previous month will be used.

$\sigma_{dfb}$ = standard deviation of the field blank measurements for the appropriate carbon fractions.

t = analytical detection limits quoted by DRI, shown in Table 3.

Table 3. Analytical detection limits for the carbon species

| Species | t |
|---|---|
| O1 | 0.51 |
| O2 | 0.51 |
| O3 | 0.51 |
| O4 | 0.51 |
| OP (OPTR) | 0.15 |
| OPTT | 0.15 |
| E1 | 0.15 |
| E2 | 0.15 |
| E3 | 0.15 |

The fractional uncertainty, f for each carbon species is given in Table. These values have been used to report uncertainties back to January 2005.

Table4. Fractional uncertainty for the carbon species

| Species | f |
|---|---|
| O1 | 0.23 |
| O2 | 0.15 |
| O3 | 0.13 |
| O4 | 0.15 |
| OP (OPTR) | 0.13 |
| OPTT | |
| E1 | 0.10 |
| E2 | 0.17 |
| E3 | 0.42 |

### 5.4.4 $SO_2$

$SO_2$ measurements ceased in early 2008. $SO_2$ was collected at only a few sites in the network using a separate module containing quartz filters impregnated with potassium carbonate. A Teflon® prefilter removes particulate sulfate so that all the sulfate measured on the filter can be attributed to $SO_2$. The analysis is by ion chromatography. $SO_2$ measurements are returned from the analysis contractor as micrograms of sulfate per filter. The $SO_2$ concentration, uncertainty, and mdl are currently not calculated. They would be calculated using the following equations:

$$C_{SO_2} = 1000\,{}^{ng}\!/_{\mu g} * {}^{2}\!/_{3} * \frac{\left(A_{SO_2} - B_{SO_2}\right)}{V_{D\,module}} \quad (351\text{-}14)$$

$$\sigma_{SO_2} = 1000\,{}^{ng}\!/_{\mu g} * {}^{2}\!/_{3} * \frac{\sqrt{\sigma_{dfb}{}^{2} + 2 * B_{SO_2} * f_a{}^{2} * \left(A_{SO_2} - B_{SO_2}\right) + \left(f_a * \left(A_{SO_2} - B_{SO_2}\right)\right)^2 + \left(f_V * \left(A_{SO_2} - B_{SO_2}\right)\right)^2}}{V_{D\,module}} \quad (351\text{-}15)$$

$$mdl = 1000\,{}^{ng}\!/_{\mu g} * 2 * \left({}^{2}\!/_{3}\right) * \frac{\sigma_{dfb}}{V_{D\,module}} \quad (351\text{-}16)$$

The factor of 2/3 in the above equations converts the analyzed sulfate to $SO_2$. The variable $s_{dfb}$ refers to the standard deviation of the field blank measurements for $SO_2$ (as sulfate).

### 5.4.5 Elements (Module A)

Elements are measured using X-ray fluorescence (XRF) (PANalytical Epsilon 5) on the Teflon® filters from Module A since 2011. From December 2001 through the end of 2010, all elements, except hydrogen, are analyzed with XRF systems; hydrogen is analyzed with proton elastic scattering analysis (PESA). Prior to December 2001, particle induced x-ray emission (PIXE) was used to analyze the light elements (sodium through manganese) and XRF was used to

analyze the heavier elements (iron through lead). The areal densities, areal uncertainty, and areal mdl are calculated and stored in the database. The artifact values (B in equation 351-3) are assumed to be zero for all elements. The elemental concentration, uncertainty, and mdl are calculated using the following equations:

$$C_{element} = \frac{A_{element} * (Deposit\ area)}{V} \quad (351\text{-}17)$$

$$\sigma_{element} = \frac{U_{element} * (Deposit\ area)}{V} \quad (351\text{-}18)$$

$$mdl_{element} = \frac{M_{element} * (Deposit\ area)}{V} \quad (351\text{-}19)$$

where

$A_{element}$ = areal concentration of the element measured by XRF

Deposit area = area of sample deposit on the filter ($cm^2$), determined from the filter holder or mask size

$U_{element}$ = max(((blankStat.Percentile95 - blankStat.Median) * p.EValue), y.DL[(ug/cm2)]) , which is the areal uncertainty reported for the element measured by XRF

$M_{element}$ = max(((blankStat.Percentile95 - blankStat.Median) * p.EValue), y.DL[(ug/cm2)])*1000, which is the areal mdl reported for the element measured by XRF.

where

p.EValue is the element calibration factor,

y.DL is the static MDL value that we were previously using,

blankStat values are specific to a batch of 35 filters analyzed on a specific instrument and during the time period that the current sample month was analyzed. The 95th percentile is the 33rd filter in rank order and median is the 17th filter in rank order.

### 5.4.6 Laser Absorption (Module A)

Optical absorption is measured by a hybrid integrating plate and sphere using the Teflon® filter from Module A. The laser absorption measurements are stored in the laser file as reflectance (R) and transmittance (T) values. The LRNC values (all in unit Mm) are calculated using the following equations:

(351-20)

$$LRNC = \left(10000 * Log\left(\max\left(\frac{1025.5 - 1.235 * R}{T}, 0.1\right)\right) * \frac{(Deposit\ area)}{V}\right) * \frac{1}{100}$$

(351-21)

$$\sigma_{LRNC} = \sqrt{\left(\frac{(10000 * 0.014)}{\left(V/Deposit\,area * 100\right)}\right)^2 + (f_v * LRNC)^2}$$

(351-22)

$$mdl = 10000 * 0.032 * \left(\frac{Deposit\,area}{V}\right) * \frac{1}{100}$$

Where

$f_v$ = 0.03, the fractional analytical uncertainty. This value has been used since February 28, 1995.

## 5.5 EQUATIONS OF COMPOSITE VARIABLES

The following composite variables are combinations of the measured concentrations of particles collected on the fine filters. These are used in the Level 2 validation procedures, described in Section 6.0. The concentration is determined along with the uncertainty and mdl. In our calculations of the uncertainty of the composite variables, we assume that the component concentrations are independent and the multiplicative factors have no uncertainty. The independence assumption is not strictly valid for many composites because of common factors, such as volume. However, the effect on the overall uncertainty is too small to warrant the more complicated calculations. The following sections are divided by composite variable.

### 5.5.1 Sulfate by XRF (S3) and Ammonium Sulfate (NHSO)

Sulfur is predominantly present as sulfate in the atmosphere. To compare the sulfur by XRF and the sulfate by ion chromatography, the XRF concentration is multiplied by the ratio of sulfate to sulfur atomic mass (96.06/32.06 = 3.0). This composite is labeled S3 in the data validation file.

The sulfate is generally present as ammonium sulfate, $(NH_4)_2SO_4$, although it can be present as ammonium bisulfate, $(NH_4)HSO_4$, sulfuric acid, $H_2SO_4$, gypsum, $CaSO_4 \cdot 2H_2O$, and, in marine areas, as sodium sulfate, $NaSO_4$. In many cases, the particle will include associated water, but we omit this from the calculation. In order to simplify the calculation we assume all the sulfur is present as ammonium sulfate. The concentrations, uncertainties, and mdl's are given by

$$NHSO = 4.125 * S$$

$$S3 = 3 * S \qquad (351\text{-}23)$$

$$\sigma_{NHSO} = 4.125 * \sigma(S)$$

$$\sigma_{S3} = 3 * \sigma(S) \qquad (351\text{-}24)$$

$$mdl(NHSO) = 4.125 * mdl(S)$$

$$mdl(S3) = 3 * mdl(S) \qquad (351\text{-}25)$$

For ammonium bisulfate, sulfuric acid, and sodium sulfate the factors are 3.59, 3.06, and 4.43, respectively. In the first two cases, the actual dry mass associated with sulfate will be less than NHSO, and in the third case, more.

### 5.5.2 Ammonium Nitrate (NHNO)

This composite is the total dry concentration associated with nitrate, assuming 100% neutralization by ammonium. For all sites, we define the ammonium nitrate concentration and uncertainty by

$$NHNO = 1.29 * NO_3^- \quad (351\text{-}26)$$

$$\sigma_{NHNO} = 1.29 * \sigma(NO_3^-) \quad (351\text{-}27)$$

$$mdl(NHNO) = 1.29 * mdl(NO_3^-) \quad (351\text{-}28)$$

### 5.5.3 Soil

The soil component consists of the sum of the predominantly soil elements measured by XRF, multiplied by a coefficient to account for oxygen for the normal oxide forms ($Al_2O_3$, $SiO_2$, CaO, $K_2O$, FeO, $Fe_2O_3$, $TiO_2$), and augmented by a factor to account for other compounds not included in the calculation, such as MgO, $Na_2O$, water, and $CO_2$. The following assumptions are made:

- Fe is split equally between FeO (oxide factor of 1.29) and $Fe_2O_3$ (oxide factor of 1.43), giving an overall Fe oxide factor of 1.36.
- Fine K has a non-soil component from smoke. Based on the K/Fe ratio for average sediment (*Handbook of Chemistry and Physics*) of 0.6, we use 0.6*Fe as a surrogate for soil K and then add the oxide factor for K $\left( K_2O, \frac{39.1*2+16.0\ g/mol}{39.1*2\ g/mol} = 1.2 \right)$ to get a total Fe factor of 0.72*Fe (0.6*1.2) for the potassium oxide in soil. This increases the factor for Fe from 1.36 to 2.08.
- Because aluminum has not always been detected with as high a frequency as the other major soil elements, we have eliminated Al from the soil parameter. Fortunately, the correlation between Al and Si has a relatively constant ratio of Al/Si of 0.45 at all sites with the exception of the Virgin Islands site, where the Al/Si ratio is 0.60; the soil parameter is then low by 6%. With the oxide factors for $Al_2O_3$ and $SiO_2$ the multiplicative factor for Si increases from 2.14 to 2.99.
- The oxide forms of the soil elements account for 86% of average sediment; in order to obtain the total mass associated with soil, the final factors are divided by 0.86 (*Handbook of Chemistry and Physics*). The final equations for fine soil concentrations and uncertainty are:

$$SOIL = 3.48 * \max\left(Si, \frac{Si\_mdl}{2}, 0\right) + 1.63 * \max\left(Ca, \frac{Ca\_mdl}{2}, 0\right) + 2.42 * \max\left(Fe, \frac{Fe\_mdl}{2}, 0\right) + 1.94 * \max\left(Ti, \frac{Ti\_mdl}{2}, 0\right) \quad (351\text{-}29)$$

$$\sigma(SOIL) = \sqrt{\left(3.48 * \max\left(\sigma(Si), \frac{Si\_mdl}{2}, 0\right)\right)^2 + \left(1.63 * \max\left(\sigma(Ca), \frac{Ca\_mdl}{2}, 0\right)\right)^2 + \left(2.42 * \max\left(\sigma(Fe), \frac{Fe\_mdl}{2}, 0\right)\right)^2 + \left(1.94 * \max\left(\sigma(Ti), \frac{Ti\_mdl}{2}, 0\right)\right)^2} \quad (351\text{-}30)$$

$$mdl(SOIL) = 0 \quad (351\text{-}31)$$

The soil variable is calculated for all valid XRF analyses. If an element is below the mdl, the concentration and uncertainty are both assumed to be equal to mdl/2. The soil variable is always positive. Note that the soil equation (**Error! Reference source not found.**) is used only at CNL for data validation. The Regional Haze Rule uses a different form of the soil equation that includes aluminum.

### 5.5.4 Non-soil Potassium (KNON)

Non-soil potassium is the measured fine potassium minus the soil potassium estimated from iron. Non-soil potassium is a qualitative tracer of smoke. The problem is that the ratio of potassium/smoke mass may change as the aerosol ages. Particulate smoke potassium is probably produced by the transformation of volatilized potassium, and appears to be in a smaller size range than most smoke mass. Close to the smoke source, the particulate potassium may not have time to form. For long-range transport, most other smoke mass may settle out more than potassium mass. The concentration and uncertainty of KNON are

$$KNON = (K - 0.6 * FE) \quad (351\text{-}32)$$

$$\sigma(KNON) = \sqrt{\sigma^2(K) + [0.6 * \sigma(Fe)]^2} \quad (351\text{-}33)$$

$$mdl(KNON) = 0 \quad (351\text{-}34)$$

The soil factor of 0.6 may vary slightly with the site; this will produce a small positive or negative offset for baseline values when no smoke is present. Therefore, negative values are retained. KNON is defined for all valid XRF analyses. If a concentration is less than the mdl, the concentration and uncertainty are assumed to be equal to the mdl.

### 5.5.5 Light-Absorbing Carbon (LAC(EC))

The concentration of carbon on quartz is determined in seven temperature ranges, plus a correction fraction for pyrolized organic carbon. The light-absorbing carbon (LAC) component is assumed to be all carbon evolved at 550°C and above after the laser indicates that reflectance has returned to the initial value. The equation for LAC concentration is

$$LAC(EC) = E1 + E2 + E3 - OP \quad (351\text{-}35)$$

where

OP = optical reflectance (OPTR) measurement

LAC may be negative. The uncertainty of LAC is not the quadratic sum of the uncertainties of the fractions because the components are not independent. Based on replicate measurements, the following empirical formula is used to calculate the uncertainty:

$$\sigma(LAC) = \sqrt{(34)^2 + (0.07 * LAC)^2} \text{ ng/m}^3 \quad (351\text{-}36)$$

$$mdl(LAC) = 0 \quad (351\text{-}37)$$

The constant term (34) is appropriate for volumes near 32.4 $m^3$, which is typical for 24-hour IMPROVE samples. For other volumes they should be multiplied by (32.4/V).

### 5.5.6 Organic Mass by Carbon (OMC)

The organic carbon (OC) component is assumed to be all carbon evolved at 550°C and below in a pure helium environment, plus the pyrolized organic fraction. To determine the total amount of organic mass associated with the organic carbon, we assume a ratio of organic mass to organic carbon of 1.4. The equation for organic mass concentration is

$$OMC = 1.4 * (O1 + O2 + O3 + O4 + OP) \quad (351\text{-}38)$$

OMC may be negative. The uncertainty of OMC is not the quadratic sum of the uncertainties in the fractions because the fractions are not independent. Based on replicate measurements, the following empirical formula is used to calculate the uncertainty:

$$\sigma(OMC) = \sqrt{(168)^2 + (0.05 * OMC)^2} \text{ ng/m}^3 \quad (351\text{-}39)$$

$$mdl(OMC) = 0 \quad (351\text{-}40)$$

The constant term (168) is appropriate for volumes near 32.4 $m^3$, which is typical for 24-hour samples. For other volumes they should be multiplied by (32.4/V).

### 5.5.7 Reconstructed Mass using Carbon Measurements (RCMC)

The reconstructed mass is the sum of sulfate, soil, non-sulfate potassium, salt, elemental carbon, and organic carbon. Organic and elemental carbon are from the quartz filter. The only components not included are water and nitrate. The RCMC accounts for only about 60% of the measured fine mass at the site. The equations for RCMC are

$$RCMC = \max(NHSO,0) + \max(SOIL,0) + 1.4 * \max(KNON,0) + 2.5 * \max(Na, mdl(Na)/2,0) + \max(LAC,0) + \max(OMC,0) \quad (351\text{-}41)$$

$$\sigma(RCMC) = \sqrt{\begin{array}{l}(\max(\sigma(NHSO),0))^2 + (\max(\sigma(SOIL),0))^2 + (1.4 * \max(\sigma(KNON),0))^2 \\ + (2.5 * \max(\sigma(Na), mdl(Na)/2,0)^2 + (\max(\sigma(LAC),0))^2 + (\max(\sigma(OMC),0))^2\end{array}} \quad (351\text{-}42)$$

$$mdl(RCMC) = 0 \quad (351\text{-}43)$$

RCMC will always be positive.

RCMC is more relevant at sites where the neutralization of sulfate may be less than 100%, at sites with high nitrate, and at marine sites.

### 5.5.8 Reconstructed Fine Mass (RCMN)

As mentioned above, the RCMC accounts for only about 60% of the measured fine mass at the site. Adding ammonium nitrate (NHNO) to the RCMC can make the reconstructed mass very close to the measured one.

$$RCMN = RCMC + 1.29 * NHNO \quad (351\text{-}44)$$

## 6. DATA VALIDATION

Data validation involves assessing the quality, reliability, and integrity of the data. It occurs throughout the measurement process. This section explains the components of the data validation process that occur once the data are received from the laboratory and field.

### 6.1 DEFINITION OF STATUS FLAGS

Standardized abbreviations describing the status of individual results in samples, known as status flags, are assigned during the Level 1A and 1B validation processes. The abbreviations and their meanings are listed in Table 4. Those listed as “terminal” flags indicate that the sample could not be processed to a valid result. “Temporary” flags are replaced before final data reporting.

Table 4. Status flags and their definitions

| Abbreviation | Meaning | Result |
|---|---|---|
| BI | Bad Install | terminal |
| CG | Clogging | |
| CL | Clogged | terminal |
| DA | Do not analyze | terminal |
| DE | Estimated value | |
| EP | Equipment Problem | terminal |
| LF | Low Flow | |
| NA | Not Applicable | |
| NM | Normal | |
| NR | Not Reanalyzed by DRI | |
| NS | No Sample | terminal |
| OL | Off Line | terminal |
| PM | Undefined but allowed by SWAP as informational | |
| PO | Power Outage | terminal |
| QA | Quality Assurance | temporary |
| QC | Quality Control | temporary |
| QD | Questionable Data | temporary |
| RF | Really Low Flow Rate | |
| SA | Sampling Anomaly | |
| SO | Still out | temporary |
| SP | Field Blank/Sample Swap | |
| SW | Swapped Sample Dates | |
| TU | Time incorrect (used when time shift >= 6hrs) | |
| UN | Undetermined Weight | |
| XX | Destroyed/No Filter | terminal |

## 6.2 LEVEL 1 VALIDATION TESTS

Level 1 validation is conducted throughout the sample handling process. It refers to quality assurance performed on measured or derived data in the weights file, the logs file, and the element, ions, and carbon files. Level 1A validation is conducted as soon as samples return to the laboratory by review of log sheets and flashcard data files. Level 1B validation is conducted numerous times throughout sample handling and processing. During preweight, range checking

is performed by the balance program to ensure that only one filter is weighed at a time. During postweight, the balance program warns the operator if the net weight is greater than 1 mg.

### 6.2.1 Validation of laboratory analyses

Level 1 data validation for the ion, carbon, XRF, and $SO_2$ analyses is done by the laboratory responsible for the analysis. The contractors' quality assurance procedures are recorded at http://vista.cira.colostate.edu/improve/Publications/IMPROVE_SOPs.htm.

## 6.3 FLOW RATE VALIDATION

Starting with May 2004 data, the data validation manager has looked for flow rate inconsistencies using the option FlowRSD, accessed using the FoxPro program SWAP. The FoxPro source code for SWAP is in Appendix D

Inconsistencies are identified as a variation in flow rate over the 24-hour testing period of greater than 3%. The program, however, flags all inconsistencies, reporting even small deviations regardless of whether they result from a problem with the equipment or from a steady drop in flow rate due to filter loading. The data validation manager looks at each day reported as having inconsistencies, to determine whether the data reported for that day can be considered valid and whether the sampling occurred for the required eighteen hours. The data are flagged if necessary.

### 6.3.1 Automated flow rate validation

The flow rate validation procedure uses four flow-related flags. The flags used for $PM_{2.5}$ data are listed in Table 5, along with the criteria for applying them. The criteria are applied using computer code integrated into the flashcard database. The $PM_{2.5}$ flow rate criteria for the 'LF' flag were revised following the 2006 cyclone characterization tests, which determined that the original Water John equations are applicable to the IMPROVE cyclones. The revised 'LF' criteria, listed in Table 5, were applied beginning with the January 2005 samples.

The criteria are based on calculation limitations, performance testing, and cut point requirements. The criterion for applying a CL flag, $PM_{2.5}$ flow rate less than 15 L/min for more than 6 hour, is based on the fact that the flow rate equation is inaccurate below approximately 15 L/min. Figure 6 shows a typical relationship between flow rate and pressure transducer measurements. The dashed line shows the calculated flow rate and the solid line shows the actual flow rate. This figure illustrates that below approximately 15 L/min, the calculated flow rate is not accurate. Only twenty-four 15-min flow rates below 15 L/min will be allowed before the air quality data are invalidated (replaced with -999) and flagged as CL. The cyclone cut point is 3.6 μm at 15 L/min.

The criterion for applying a CG flag ($PM_{2.5}$ flow rate less than 18 L/min for more than 6 hour) is based on cut point characterization of the cyclone. The cut point is 3.0 μm at 18 L/min. Only twenty-four 15-minute flow rates below 18 L/min will be allowed before the sample is flagged as CG.

Table 5. Flow rate related validation flag definitions and application criteria (John and Reischl, 1980) for $PM_{2.5}$.

| Validation Flag | Definition | Concentration Reported? | Criteria for Application for $PM_{2.5}$ Samples |
|---|---|---|---|
| CL | Clogged Filter | No | Flow rate < 15 L/min for more than 6 hours if flashcard data are used[1] |
| CG | Clogging Filter | Yes | Flow rate < 18 L/min for more than 6 hours if flashcard data used;<br>Average flow rate < 18 L/min if logs values are used |
| LF | Low/high flow rate | Yes | Average flow rate < 19.7 L/min or > 24.1 L/min[2] |
| RF | Really high flow rate | Yes | Average flow rate > 27 L/min[3] |

[1] A small number of filters (5-15) in each quarter may pass this criterion but be classified as clogged (CL) after visual inspection of the flow rate and concentration data.

[2] Prior to January 2005 samples, the $PM_{2.5}$ LF flow rate limits were 21.3 and 24.3 L/min.

[3] Prior to January 2005 samples, $PM_{2.5}$ samples with flow rates less than 19 L/min were flagged RF.

The criterion for applying the LF flag is based on defining a range of particle cut points for a sample to be labeled as $PM_{2.5}$. The new cyclone characterization tests show that the LF flag is applied when the flow rates yield cut points outside 2.25 and 2.75 μm. The LF flag limits used prior to January 2005 yielded cut points outside 2.23 and 2.54 μm.

The criterion for applying the RF flag (flow rate greater than 27 L/min) is based on the cut point of the cyclone. The cut point is not accurately known because it isn't characterized beyond 26 L/min and is below 2 μm. In addition, as with the CL flag, the flow rate equation is less accurate at 27 L/min.

A similar set of flags is applied to the $PM_{10}$ data, but with several differences, due principally to the lower flow rate at which the $PM_{10}$ sampler operates. The flags used for $PM_{10}$ data as well as the criteria for applying them are listed in Table 6. The $PM_{10}$ average flow rate limits for the LF flag are > 19 L/min and < 15 L/min, and the limits for the RF flag are > 21 L/min and < 13 L/min. The CG flag is applied if the average flow rate is < 14 L/min if logs values are used to determine the flow rate; if flashcard data are used, then the flow rate should be less than 14 L/min for more than 6 hours. CL flags are assigned when the flow rate is less than 10 L/min for more than 6 hours, only when flashcard data are used .

Table 6. Flow rate related validation flag definitions and application for $PM_{10}$

| Validation Flag | Definition | Concentration Reported? | Criteria for Application for $PM_{2.5}$ Samples |
|---|---|---|---|
| CL | Clogged Filter | No | Flow rate < 10 L/min for more than 6 hours if flashcard data are used |
| CG | Clogging Filter | Yes | Flow rate < 14 L/min for more than 6 hours if flashcard data are used;<br>Average flow rate < 14 L/min is logs values are used |
| LF | Low/high flow rate | Yes | Average flow rate < 15 L/min or > 19 L/min |
| RF | Really high flow rate | Yes | Average flow rate < 13 L/min or > 21 L/min |

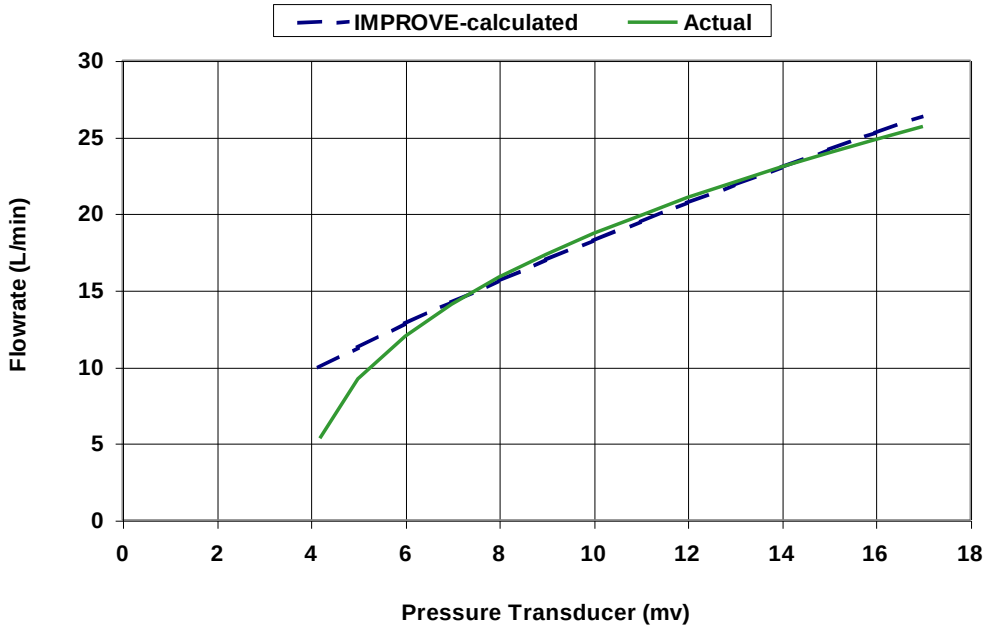



Figure 3. Flow rate versus the pressure transducer reading for the IMPROVE-calculated flow rate and the actual flow rate.

### 6.4 LEVEL II VALIDATION PROCEDURES

Level II validation is performed by comparing elements or species among modules using the Excel spreadsheet "QA Data_0.3.xls". A new spreadsheet is created for each 3-month season as

the data are validated. The B (sulfates and nitrates), C (organic and inorganic carbon), and D ($PM_{10}$) modules measure one or more species that can be compared to those measured by module A (most elements from Na through Pb). The following sampler module comparisons provide information on the quality of the reported data on a site-by-site basis:

### 6.4.1 Module A versus Module B data

Quality assurance for the A and B modules consists of comparing the measured concentrations of sulfur and sulfate. Sulfur concentrations are reported through elemental analysis of the Teflon® filter from Module A, while sulfate concentrations are determined by ion chromatography analysis of the nylon filter from Module B. Since both modules sample simultaneously and have the same nominal flow rate and aerosol size cut point, the collected data should correlate.

The SwapCheck button on the SWAP program prompts the analyst for a month and year to examine. It then opens the data file for that time period and examines the data for each site for potential swaps. Successive pairs of data are examined using the algorithm outlined below. In the following equations, the subscripts refer to successive time periods for S3 or SO4. The ratio of S3/SO4 is calculated for each time period, and the ratio is also calculated assuming the sulfate values are swapped. Two indices of a swap are then calculated:

$$Index1 = \left(\frac{S3_1}{SO4_1} - 1\right) \times \left(\frac{S3_2}{SO4_2} - 1\right) \text{ and } Index2 = \left(\frac{S3_1}{SO4_2} - 1\right) \times \left(\frac{S3_2}{SO4_1} - 1\right). \quad (351\text{-}45)$$

Normally, the corresponding values of S3 and SO4 are very close to each other so their ratio is close to unity. If the data are not subject to a swap, Index1 is close to zero and Index2 is large (and may be either positive or negative). If the S3/SO4 ratio is less than 0.667 or greater than 1.5 the date is flagged for a closer look. The more important indicator of a potential swap is when Index1<-0.03 and ABS(Index2)< 0.05. The thresholds of -0.03 and 0.05 have been set empirically. These dates are also flagged in a report for the data validation analyst.

All outlier points are carefully reviewed for flow rate entry errors or analytical errors. If no reason for a discrepancy can be found the data are flagged as normal. Adjustments are made (e.g., elapsed time, flow rate, or terminal flags) only if a definitive cause can be found to support them. Figure 4 shows typical time series and scatter plots of sulfur (*3) and sulfate that are used to look for discrepancies between Module A and Module B. These plots are color-coded in conformance with the color scheme assigned to sampling modules. The red line in the time series and the red axis in the scatter plot corresponds to sulfur (S3=sulfur*3) measured on Module A, while the yellow line and axis corresponds to sulfate measured on Module B. The green dots are the ratio of $S3/SO_4^{=}$, and are used to look for systematic biases between the two measurements. A systematic bias would reveal itself in the ratio being consistently above or below unity. Ratios within the range 0.8-1.2 are generally acceptable, but if all are high or low it may indicate an error in flow rate for Module A or Module B.

In Figure 4 all but one of the S3 and $SO_4^{=}$ pairs are in agreement. On 1/25 the sulfate is zero because the B module did not operate. The scatter plot in Figure 4 shows that the regression slope is between 0.95 and 1.05, which is within our acceptance criteria. The black line includes a floating intercept, and the blue line is forced through a zero intercept, and the red line is just a regression of the latest month of data.

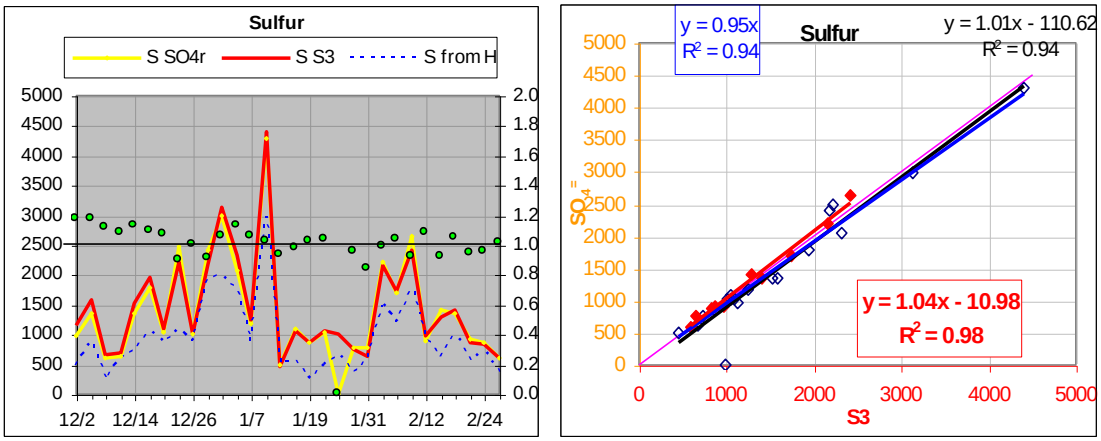



Figure 4. Time series and scatter plot of sulfur (*3) and sulfate for a single site

### 6.4.2 Module A versus Module C data

Quality assurance for the A and C modules involves correlation plots of two species. The Module A measurements are color-coded in red, while the Module C measurements are color-coded in green. The laser absorption (LRNC) measurement on Module A is compared to light absorbing carbon (LAC) on Module C.

Figure 5 shows the time series and scatter plot of laser absorption (LRNC) and light absorbing carbon (LAC). The red line and axis correspond to LRNC on Module A and the green line and axis correspond to LAC. The yellow dots show the ratio of LRNC/LAC that is used to look for systematic biases in the two measurements. The ratio should be close to unity for all data points, although there is considerable scatter for these parameters. If all ratios are much greater than one or much less than one, underlying causes are sought. A possible cause of this is a systematic error in flow rate.

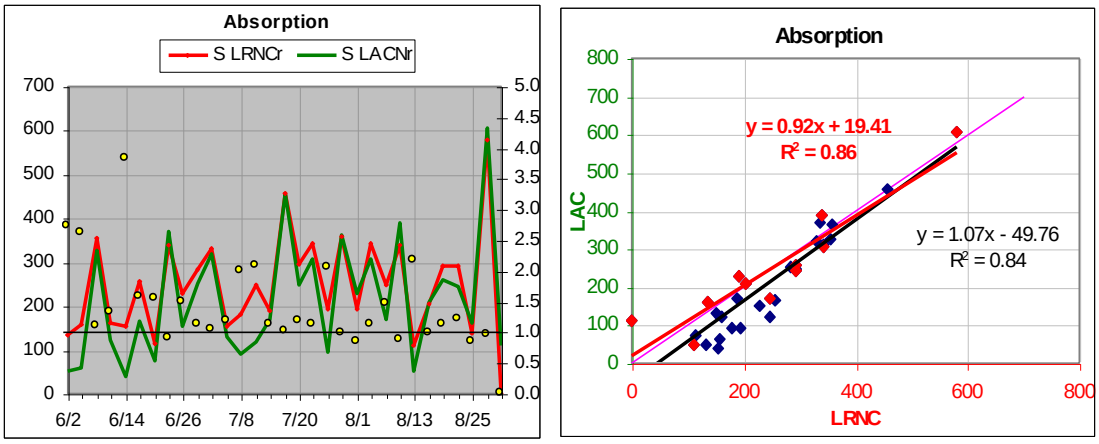



Figure 5. Time series and scatter plot of laser absorption (LRNC) and light absorbing carbon (LAC) for a single site

### 6.4.3 Module A versus Module D data

Quality assurance for the A and D modules consists of site-by-site comparisons of the $PM_{2.5}$ mass concentration and the $PM_{10}$ mass concentration. If any of the following cases is detected, the corresponding data will be flagged in a report for the data validation analyst.

- the mass concentration is negative;
- PM2.5 is larger than PM10 and the difference is greater than the root mean square of the two uncertainties. Because MF is a subset of MT this should not occur;
- PM10 is abnormally high. PM10 minus PM2.5 is greater than 43 times of the root mean square of the two uncertainties. The number 43 is set empirically.

Although the ratio of $PM_{2.5}$ mass to $PM_{10}$ mass is fairly consistent at most sites, the correlation plot is meant only to verify that no $PM_{2.5}$ mass values are larger than the corresponding $PM_{10}$ mass values.

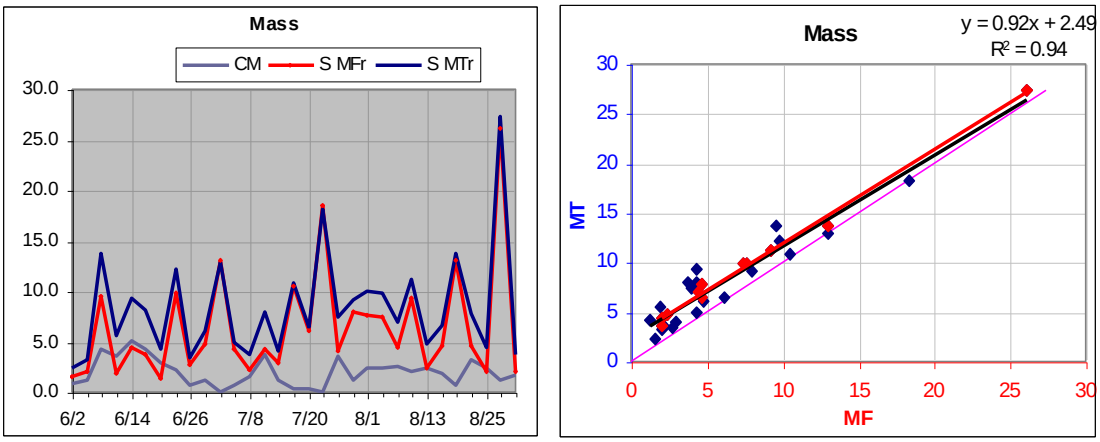



Figure 6. Time series and scatter plot of $PM_{10}$ mass and $PM_{2.5}$ mass for a single site. The difference between the two [coarse mass (CM)] is also shown with the gray line.

Figure 6 shows the measured $PM_{10}$ (MT) and $PM_{2.5}$ (MF) mass in a time series and scatter plot. All cases of MF>MT are investigated to determine whether a weighing error has occurred and to correct it if one is found.

## 6.5 RECONSTRUCTED MASS VERSUS MEASURED MASS (MF)

The reconstructed mass , RCMC and RCMN, is calculated by equation 351-40. The reconstructed mass is compared to the measured mass as a check of all measured species. If any of the following cases is detected, the corresponding data will be flagged in a report for the data validation analyst.

- RCMC is higher than two times of MF, and RCMC-MF is larger than 3 times of the root mean square of the two uncertainties. The number 3 is set empirically;
- MF is much higher than RCMN, and the difference is larger than 22 times of the root mean square of the two uncertainties. The number 22 is set empirically

Figure 7 shows the time-series and scatter plots for a site where nitrate is not high. The reconstructed mass accurately accounts for the measured mass. Both the time-series and scatter plot show excellent correlation and equivalent values. Figure 8 shows the same plot for a site where nitrate is a significant fraction of the measured mass. The RCMC accounts for only about 60% of the measured mass at this site. But RCMN, the reconstructed mass including nitrate, is very close to the measured mass.

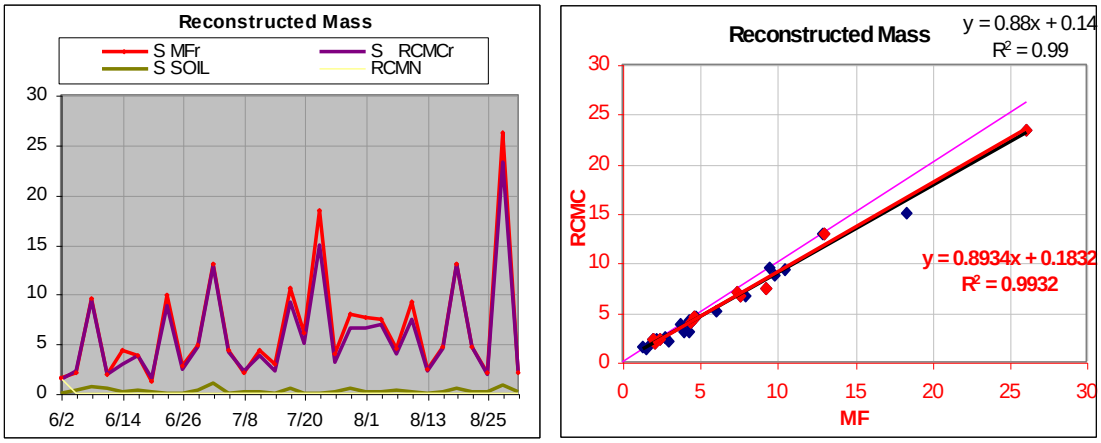



Figure 7. Time series and scatter plot of reconstructed mass (RCMC) and measured fine mass (MF). In this case there is excellent agreement.

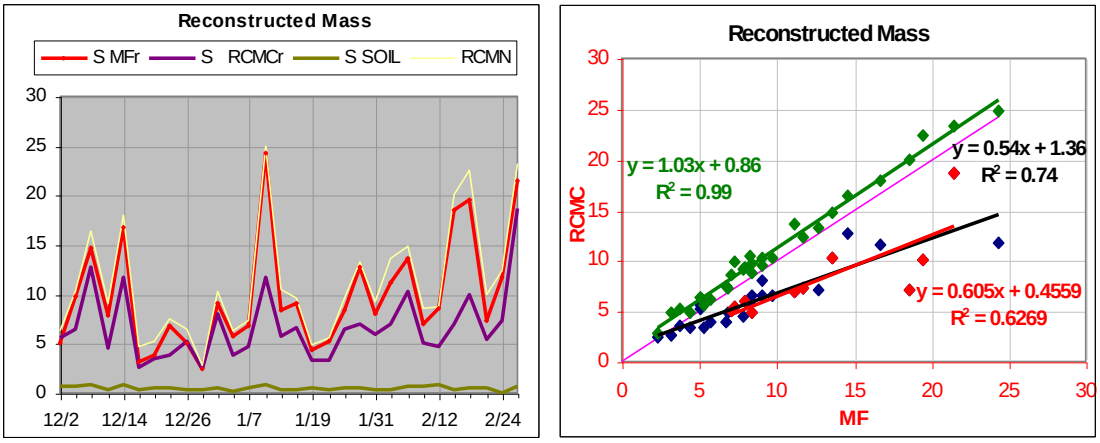



Figure 8. Time series and scatter plot of reconstructed mass (RCMC), reconstructed mass with nitrate (RCMN), and measured fine mass (MF) for a single site. In this case nitrate is a significant contributor to the fine mass.

## 6.6 LONG-TERM NETWORK-WIDE CHECKS

In addition to site-by-site 3-month data checks, long-term checks are also carried out for the whole network. These checks help reveal the long-term trends and seasonal patterns if any. Compared to the short-term checks, it is also able to detect more chronic and network-wide problems. The long-term checks include:

- Multi-years' time series plots for all species, showing 10% percentile, median, and 90% percentile. Figure 10 shows an example of PM2.5, one of the species.
- Multi-years' time series plots for (S*3)/$SO_4$, as shown in Figure 11.
- Multi-years' time series plots for RCMN/PM2.5, as shown in Figure 12.

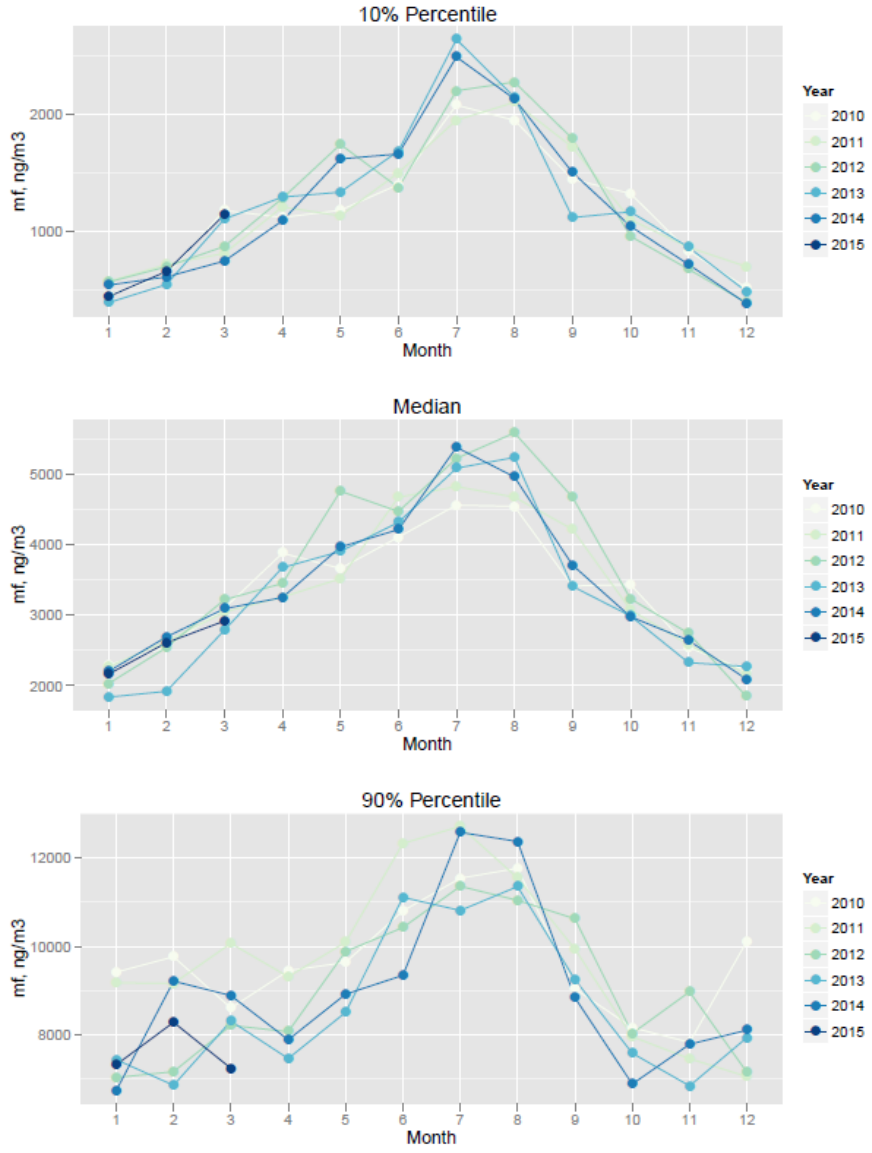



Figure 10. Time series plot of PM2.5 data for the whole network

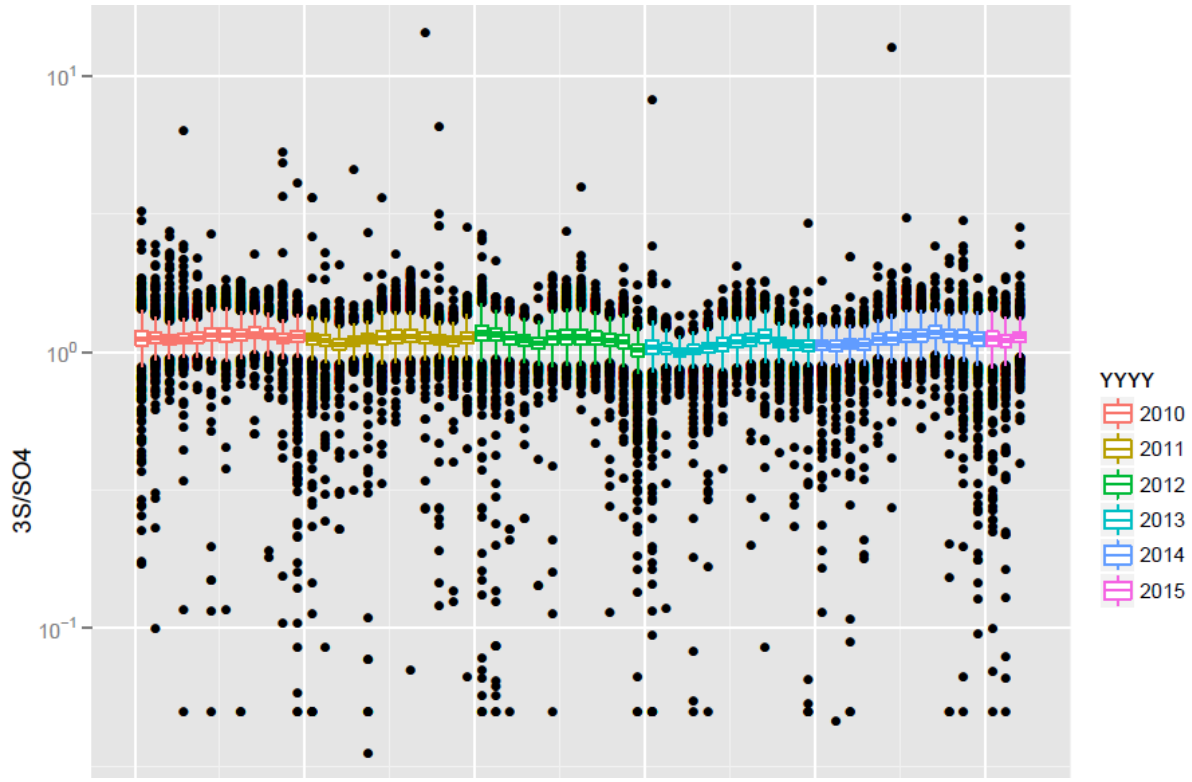



Figure 11. Time-series plot of sulfur (*3) / sulfate for the whole network

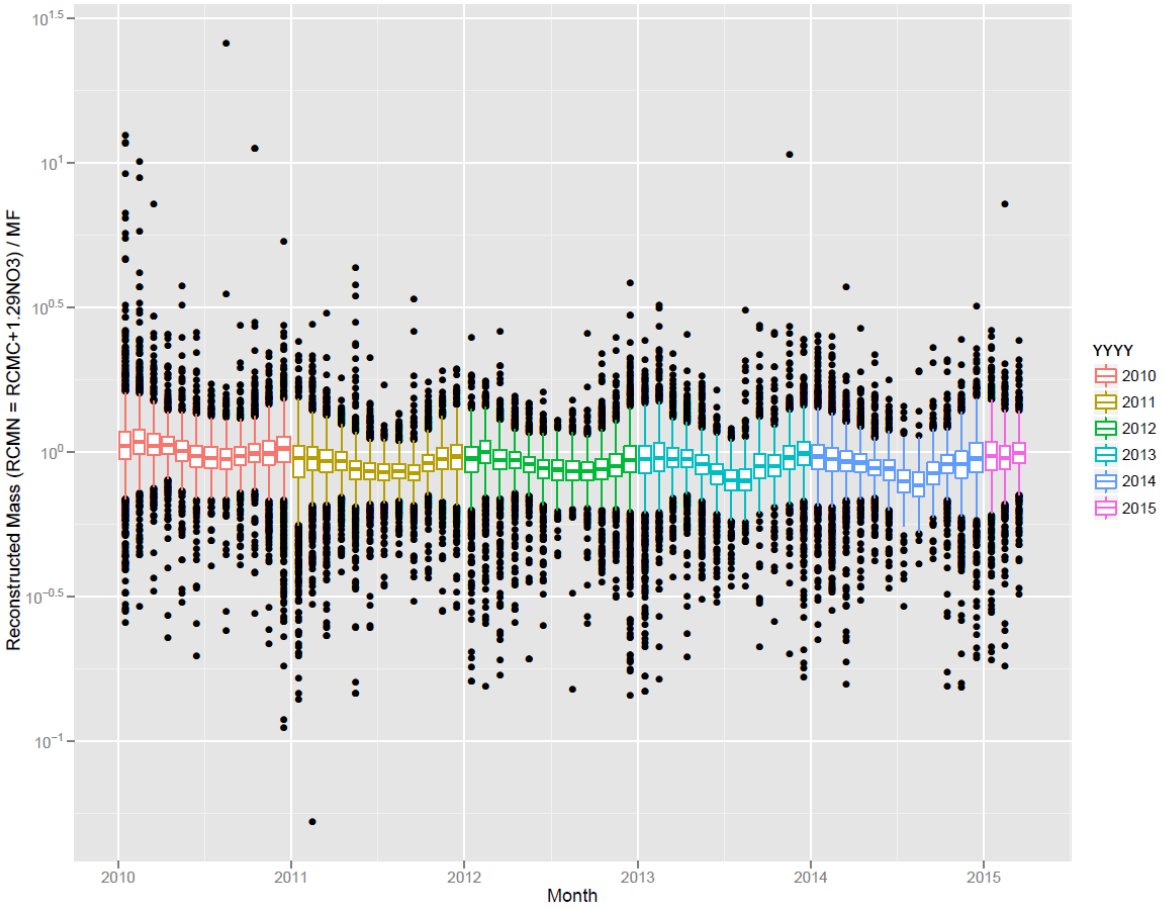



Figure 12. Time-series plot of RCMN/PM2.5 for the whole network

## 6.7 OTHER REVIEWS

There are some other checks throughout the data validation process:

- There should be no site with less than 10 or more than 11 records for the month.

- There should be no records with QD in the status field of the delivery file. If such cases remain in the data set, the reason is found and the status flag is changed. Depending on the reason, the status flag could be set to normal (NM) or to any one of terminal flags.

- If some statuses which are not very self-explanatory are contained in the delivery file, explanations for them must accompany the data transmission to CIRA, like TU (time uncertain) and DE (derived or estimated values).

If any records contain SA or QA in the status field, or any sites are in the HOLDS file, an explanation for them must accompany the data transmission to CIRA.

## 7. SUBMISSION TO CIRA

After all validations are done and the data are deemed acceptable, the data are ready to submit to CIRA. The data file is located in the U:\IMPROVE\TotalDBF folder on the Crocker Nuclear Laboratory computer. The naming convention is QTRtotMO.dbf, where QTR is the three letter code for the sampling quarter (e.g., A05 for the spring season of 2005) and MO is the two digit month (e.g., 03 for March). The data file is sent to the following people as an email attachment:

"Schichtel, Bret" Schichtel@CIRA.colostate.edu

“Debbie Miller” debbie_c_miller@nps.gov

"Copeland, Scott" copeland@cira.colostate.edu

"McClure, Shawn" McClure@cira.colostate.edu

## 8. REFERENCES

CNL (2002) IMPROVE Quality Assurance Project Plan (QAPP), Revision 0.0, Crocker Nuclear Laboratory, University of California, Davis, CA.

John, W. and Reischl, G.P. (1980) A Cyclone for Size-Selective Sampling of Ambient Air, J. Air Pollut. Control Assoc., 30 (8), 872-876.

## APPENDIX A. IMPROVE DATA DICTIONARY

# Logs file (C04logs.dbf)

| # | Parameter | Definition | Description | Flow db |
|---|---|---|---|---|
| 1 | Site | 5-character site name | | Yes |
| 2 | Week | Tuesday date of sampling week | | |
| 3 | Day | Corresponds to the solenoid valve number | | Yes |
| 4 | Samdat | Sample date | | Yes |
| 5 | Strtim | Start time for sample, currently hardwired to 00:00 | | |
| 6 | Tempcur | Logsheet temperature in degrees Celsius | | Yes |
| 7 | Agi | A logsheet maximum orifice pressure transducer reading | An indication of the maximum vacuum pulled by the pump; low values warn of pump failure. These values are collected each week, and same values are filled in for each sample in week. | |
| 8 | Bgi | B logsheet maximum orifice pressure transducer reading | | |
| 9 | Cgi | C logsheet maximum orifice pressure transducer reading | | |
| 10 | Dgi | D logsheet maximum orifice pressure transducer reading | | |
| 11 | Af1gi | A logsheet initial orifice pressure transducer reading | The **initial** readings from the pressure transducer located in front of the **critical orifice**. They are collected by the site operator weekly when cartridges are **loaded**. | Yes |
| 12 | Bf1gi | B logsheet initial orifice pressure transducer reading | | Yes |
| 13 | Cf1gi | C logsheet initial orifice pressure transducer reading | | Yes |
| 14 | Df1gi | D logsheet initial orifice pressure transducer reading | | Yes |
| 15 | Af1mi | A logsheet initial cyclone pressure transducer reading | The **initial** readings from the pressure transducer located at the **cyclone**. They are collected by the site operator weekly when cartridges are **loaded**. | Yes |
| 16 | Bf1mi | B logsheet initial cyclone pressure transducer reading | | Yes |
| 17 | Cf1mi | C logsheet initial cyclone pressure transducer reading | | Yes |
| 18 | Df1mi | D logsheet initial cyclone pressure transducer reading | | Yes |
| 19 | Af1gf | A logsheet final orifice pressure transducer reading | The **final** readings from the pressure transducer located in front of the critical orifice. They are collected by the site operator weekly when cartridges are **unloaded**. | Yes |
| 20 | Bf1gf | B logsheet final orifice pressure transducer reading | | Yes |
| 21 | Cf1gf | C logsheet final orifice pressure transducer reading | | Yes |

| # | Parameter | Definition | Description | Flow db |
|---|---|---|---|---|
| 22 | Df1gf | D logsheet final orifice pressure transducer reading | | Yes |
| 23 | Af1mf | A logsheet final cyclone pressure transducer reading | The **initial** readings from the pressure transducer located at the **cyclone**. They are collected by the site operator weekly when cartridges are **unloaded**. | Yes |
| 24 | Bf1mf | B logsheet final cyclone pressure transducer reading | | Yes |
| 25 | Cf1mf | C logsheet final cyclone pressure transducer reading | | Yes |
| 26 | Df1mf | D logsheet final cyclone pressure transducer reading | | Yes |
| 27 | Af1et | A logsheet elapsed time | The elapsed time values recorded by the site operator weekly when the sample cartridges are unloaded. | Yes |
| 28 | Bf1et | B logsheet elapsed time | | Yes |
| 29 | Cf1et | C logsheet elapsed time | | Yes |
| 30 | Df1et | D logsheet elapsed time | | Yes |
| 31 | Af1nm | A validation flag | Status flags for the samples from each module | Yes |
| 32 | Bf1nm | B validation flag | | Yes |
| 33 | Cf1nm | C validation flag | | Yes |
| 34 | Df1nm | D validation flag | | Yes |
| 35 | Name | Initials of person that checked in the box | | |
| 36 | Indate | Date the sample returned to the lab | | |
| 37 | Intime | Time the sample returned to the lab | | |
| 38 | Dbl | Initials of person that double checked the box | | |
| 39 | Area | A module filter area | A module area rarely changes | |
| 40 | Protocol | Sample collection timing (1 day in 3 or Wed/Sat) | All sites are now 1 in 3 except MALO | |
| 41 | Pstdone | Logic: Post-weight measurement collected | | |
| 42 | Predone | Logic: Pre-weight measurement collected | | |
| 43 | Position | Simply a count of the number of samples at each site in the quarter | Indicates position in the analysis tray | |
| 44 | Qtr | Seasonal quarter | | |
| 45 | SO2/ SO2site | Old logs logical/new logs character field, all blanks | | |
| 46 | Dblc | Logic: carbon after-filter collected | Same sites are always used | |
| 47 | Leakchked | Logic: cartridges leak checked | | |
| 48 | Prname | Pre-weight technician | This information is copied from the “weights” files. | |
| 49 | Predate | Pre-weight date | | |
| 50 | Pretime | Pre-weight time | | |
| 51 | Poname | Post-weight technician | | |

| # | Parameter | Definition | Description | Flow db |
|---|---|---|---|---|
| 52 | Fbchan | Module that had field blank | | |
| 53 | Fbinhouse | Logic: Field blank cassette in-house | Used to control flow of field blanks sites | |
| 54 | Comments | Operator logsheet comments | | |
| 55 | Flag | Message to balance technician | Appears when filters are weighed | |
| *56* | Balpstdone | Logical: post-weight measured | | |
| 57 | Sampler | Sampler version number | | Yes |
| 58 | So2site | Site name for $_{SO2}$ data (e.g.,INGAS) | | |
| 59 | Bdiam | B module filter diameter | Hasn't changed since 2000 | |
| 60 | Lkchkinit | Initials of person that performed leak check | | |
| 61 | Flshcode | Flashcard serial number | New compact flashcards don't have serial numbers | |
| 62 | Opinit | Site operator initials | Taken from logsheet | Yes |
| 63 | Usela | A flow measurement indicator* | | Yes |
| 64 | Uselb | B flow measurement indicator* | | Yes |
| 65 | Uselc | C flow measurement indicator* | | Yes |
| 66 | Useld | D flow measurement indicator* | | Yes |
| 67 | Loadate | Date sample cartridge loaded into sampler | | |
| 68 | Unldate | Date sample cartridge unloaded from sampler | | |
| 69 | Loadtim | Time sample cartridge loaded into sampler | | |
| 70 | Unldtim | Time sample cartridge unloaded from sampler | | |
| 71 | Uselt | temp measurement indicator | | Yes |

* These parameters indicate which flowrate measurement to use: T = use "mag" values recorded on logsheet, F = use flashcard "mag" data, V = use flashcard "vac" data, U = use "vac" values recorded on logsheet, or N = use nominal values in calibration file.

# Ions files (d04qtrions.dbf)

| # | Parameter | Description |
|---|---|---|
| 1 | Site | Sampler name |
| 2 | Samdat | Sample date |
| 3 | Strtim | Sample start time |
| 4 | Status | Either NM-normal, RP-replicate analysis, FB-field blank, FR-replicate field blank. NM records are routine filters. FB records are used to calculate artifact corrections. |
| 5 | Cl | Chloride ion filter density in ug/filter |
| 6 | $NO_2$ | Nitrite ion filter density in ug/filter |
| 7 | NO3 | Nitrate ion filter density in ug/filter |
| 8 | SO4 | Sulfate ion filter density in ug/filter |
| 9 | NH4 | Ammonium ion filter density in ug/filter |
| 10 | Comments | RTI lab comments about filter analysis |

# Laser files (B04laser.dbf)

| # | Parameter | Description |
|---|---|---|
| 1 | Site | Sampler name |
| 2 | Samdat | Sample date |
| 3 | Strtim | Sample start time |
| 4 | Status | Contains the exact validation flag in the logs file for the A module. |
| 5 | Chan | Indicates the filter module analyzed (values are often not filled in) |
| 6 | T1 | Transmitted intensity measured by the integrating plate |
| 7 | R1 | Reflected intensity measured by the integrating sphere |
| 8 | Inname1 | Name of technician doing the measurement (not used currently) |
| 9 | Indate1 | Date of measurement (not used currently) |
| 10 | Intime1 | Time of measurement (not used currently) |
| 11 | T2 | Repeat of transmitted intensity measured by the integrating plate |
| 12 | R2 | Repeat of reflected intensity measured by the integrating sphere |
| 13 | Inname2 | Name of technician doing the repeat measurement (not used currently) |
| 14 | Indate2 | Date of repeat measurement (not used currently) |
| 15 | Intime2 | Time of repeat measurement (not used currently) |

# Weights files (D04wts.dbf, note older files may contain other fields)

| # | Parameter | Description |
|---|---|---|
| 1 | Site | Sampler name |
| 2 | Samdat | Sample date |
| 3 | Strtim | Sample start time |
| 4 | QTR | Seasonal quarter |
| 5 | Chan | Indicates the filter module analyzed (e.g., A1 or D1) |
| 6 | Status | Either NM-normal, FB-field blank, XX-destroyed filter, NS-no sample, SW-swapped filter. Data are exported with this flag if the logs flag is non-terminal. |
| 7 | Prebalwt | Pre-sampling weight as recorded by the balance |
| 8 | Pstbalwt | Post-sampling weight as recorded by the balance |
| 9 | Prindate | Date when pre-sample weight was collected |
| 10 | Printime | Time when pre-sample weight was collected |
| 11 | Prbalance | Balance that was used to weigh the filter pre-sampling |
| 12 | Prname | Person that weighed the filter pre-sampling |
| 13 | Poindate | Date when post-sample weight was collected |
| 14 | Pointime | Time when post-sample weight was collected |
| 15 | Pobalance | Balance used to weigh the filter post-sampling |
| 16 | Poname | Person that weighed the filter post-sampling |
| 17 | RH | Relative humidity in the weigh room (recorded post-sampling) |
| 18 | Temp | Temperature in the weigh room (recorded post-sampling) |
| 19 | Avrh | Not currently used |

# Carbon files (D04car12.dbf)

| # | Parameter | Description |
|---|---|---|
| 1 | QID | Filter index, assigned by DRI |
| 2 | SITE | Sampler name |
| 3 | SAMDAT | Sample date |
| 4 | STRTIM | Sample start time |
| 5 | STATUS | Either CP-primary filter; FB-primary filter, field blank; PR-primary filter, replicate analysis; FR-primary filter, field blank, replicate analysis; CS-secondary filter; FS-secondary filter, field blank; SR-secondary filter, replicate analysis; or BR-secondary filter, field blank, replicate analysis. CP records are routine filters and CS records are used to calculate the artifact corrections. |
| 6 | OETF | DRI chemical analysis validation flags |
| 7 | OCTC | Total organic carbon filter loading in ug/filter |
| 8 | OCTU | Total organic carbon filter loading uncertainty in ug/filter |
| 9 | ECTC | Total elemental carbon filter loading in ug/filter |
| 10 | ECTU | Total elemental carbon filter loading uncertainty in ug/filter |
| 11 | EHTC | Elemental carbon evolved at temperature > 550$^{o}$C filter loading in ug/filter |
| 12 | EHTU | Elemental carbon evolved at temperature > 550$^{o}$C filter loading uncertainty in ug/filter |
| 13 | TCTC | Total carbon filter loading in ug/filter |
| 14 | TCTU | Total carbon filter loading uncertainty in ug/filter |
| 15 | O1TC | Organic carbon evolved in He atmosphere at 120$^{o}$C filter loading in ug/filter |
| 16 | O1TU | Organic carbon evolved in He atmosphere at 120$^{o}$C filter loading uncertainty in ug/filter |
| 17 | O2TC | Organic carbon evolved in He atmosphere at 250$^{o}$C filter loading in ug/filter |
| 18 | O2TU | Organic carbon evolved in He atmosphere at 250$^{o}$C filter loading uncertainty in ug/filter |
| 19 | O3TC | Organic carbon evolved in He atmosphere at 450$^{o}$C filter loading in ug/filter |
| 20 | O3TU | Organic carbon evolved in He atmosphere at 450$^{o}$C filter loading uncertainty in ug/filter |
| 21 | O4TC | Organic carbon evolved in He atmosphere at 550$^{o}$C filter loading in ug/filter |
| 22 | O4TU | Organic carbon evolved in He atmosphere at 550$^{o}$C filter loading uncertainty in ug/filter |
| 23 | OPTC | Pryrolyzed organic carbon filter loading in ug/filter |
| 24 | OPTU | Pryrolyzed organic carbon filter loading uncertainty in ug/filter |
| 25 | E1TC | Elemental carbon evolved in He/$O_2$ atmosphere at 550$^{o}$C filter loading in ug/filter |
| 26 | E1TU | Elemental carbon evolved in He/$O_2$ atmosphere at 550$^{o}$C filter loading uncertainty in ug/filter |
| 27 | E2TC | Elemental carbon evolved in He/$O_2$ atmosphere at 700$^{o}$C filter loading in ug/filter |
| 28 | E2TU | Elemental carbon evolved in He/$O_2$ atmosphere at 700$^{o}$C filter loading uncertainty in ug/filter |
| 29 | E3TC | Elemental carbon evolved in He/$O_2$ atmosphere at 800$^{o}$C filter loading in ug/filter |
| 30 | E3TU | Elemental carbon evolved in He/$O_2$ atmosphere at 800$^{o}$C filter loading uncertainty in ug/filter |
| 31 | Comment | DRI lab comments about filter analysis |

# XRF files (D04ele12.dbf, note older files also contain PIXE parameters)

| # | Parameter | Description |
|---|---|---|
| 1 | Site | Sampler name |
| 2 | Samdat | Sample date |
| 3 | Strtim | Sample start time |
| 4 | Pesstat | PESA status flag, all values are NM |
| 5 | Xrmstat | Molybdenum-anode XRF status flag, all values are NM |
| 6 | Xrcstat | Copper-anode XRF status flag, all values are NM |
| 7-9 | H, H_err, H_mdl | Hydrogen filter loading, uncertainty, and minimum detection limit from PESA in ng/cm$^2$ |
| 10-12 | S, S_err, S_mdl | Sulfur filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 13-15 | Cl, Cl_err, Cl_mdl | Chlorine filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 16-18 | K, K_err, K_mdl | Potassium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 19-21 | Ca, Ca_err, Ca_mdl | Calcium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 22-24 | Ba, Ba_err, Ba_mdl | Barium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 25-27 | Ti, Ti_err, Ti_mdl | Titanium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 28-30 | V, V_err, V_mdl | Vanadium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 31-33 | Cr, Cr_err, Cr_mdl | Chromium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 34-36 | Mn, Mn_err, Mn_mdl | Manganese filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 37-39 | Fe, Fe_err, Fe_mdl | Iron filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 40-42 | Co, Co_err, Co_mdl | Cobalt filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 43-45 | Ni, Ni_err, Ni_mdl | Nickel filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 46-48 | Cu, Cu_err, Cu_mdl | Copper filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 49-51 | Zn, Zn_err, Zn_mdl | Zinc filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 52-54 | Ga, Ga_err, Ga_mdl | Galium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 55-57 | Au, Au_err, Au_mdl | Gold filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |

| | | |
|---|---|---|
| 58-60 | Hg, Hg_err, Hg_mdl | Mercury filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 61-63 | As, As_err, As_mdl | Arsenic filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 64-66 | Pb, Pb_err, Pb_mdl | Lead filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 67-69 | Se, Se_err, Se_mdl | Selenium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 70-72 | Br, Br_err, Br_mdl | Bromine filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 73-75 | Rb, Rb_err, Rb_mdl | Rubidium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 76-78 | Sr, Sr_err, Sr_mdl | Mercury filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 79-81 | Y, Y_err, Y_mdl | Yttrium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 82-84 | Zr, Zr_err, Zr_mdl | Zirconium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ |
| 85-87 | Cd, Cd_err, Cd_mdl | Cadmium filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 88-90 | Ag, Ag_err, Ag_mdl | Silver filter loading, uncertainty, and minimum detection limit from molybdenum-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 91-93 | Yna, Yna_err, Yna_mdl | Sodium filter loading, uncertainty, and minimum detection limit from copper-anode XRF in ng/cm$^2$ |
| 94-96 | Ymg, Ymg_err, Ymg_mdl | Magnesium filter loading, uncertainty, and minimum detection limit from copper -anode XRF in ng/cm$^2$ |
| 97-99 | Yal, Yal_err, Yal_mdl | Aluminum filter loading, uncertainty, and minimum detection limit from copper -anode XRF in ng/cm$^2$ |
| 100-102 | Ysi, Ysi_err, Ysi_mdl | Silicon filter loading, uncertainty, and minimum detection limit from copper -anode XRF in ng/cm$^2$ |
| 103-105 | Yp, Yp_err, Yp_mdl | Phosphorous filter loading, uncertainty, and minimum detection limit from copper -anode XRF in ng/cm$^2$ |
| 106-108 | Ys, Ys_err, Ys_mdl | Sulfur filter loading, uncertainty, and minimum detection limit from copper -anode XRF in ng/cm$^2$ |
| 109-111 | Ycl, Ycl_err, Ycl_mdl | Chorine filter loading, uncertainty, and minimum detection limit from copper-anode XRF in ng/cm2 |
| 112-114 | Yk, Yk_err, Yk_mdl | Potassium filter loading, uncertainty, and minimum detection limit from copper-anode XRF in ng/cm2 |
| 115-117 | Yca, Yca_err, Yca_mdl | Calcium filter loading, uncertainty, and minimum detection limit from copper-anode XRF in ng/cm2 |
| 118-120 | Yba, Yba_err, Yba_mdl | Barium filter loading, uncertainty, and minimum detection limit from copper-anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 121-123 | Yti, Yti_err, Yti_mdl | Yttrium filter loading, uncertainty, and minimum detection limit from copper-anode XRF in ng/cm2 |

| | | |
|---|---|---|
| 124-126 | Yv, Yv_err, Yv_mdl | Vanadium filter loading, uncertainty, and minimum detection limit from copper-anode XRF in $^{ng/cm2}$ |
| 127-129 | Ycr, Ycr_err, Ycr_mdl | Chromium filter loading, uncertainty, and minimum detection limit from copper-anode XRF in ng/cm$^2$ |
| 130-132 | Ymn, Ymn_err, Ymn_mdl | Manganese filter loading, uncertainty, and minimum detection limit from copper-anode XRF in ng/cm$^2$ |
| 133-135 | Yfe, Yfe_err, Yfe_mdl | Iron filter loading, uncertainty, and minimum detection limit from copper-anode XRF in ng/cm$^2$ |
| 136-138 | Yco, Yco_err, Yco_mdl | Cobalt filter loading, uncertainty, and minimum detection limit from copper - anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 139-141 | Yni, Yni_err, Yni_mdl | Nickel filter loading, uncertainty, and minimum detection limit from copper - anode XRF in ng/cm$^2$ (not reported to CIRA) |
| 142 | Pesalt | PESA sample-specific detector live time (not reported to CIRA) |
| 143 | Pixelt | NOTE: This parameter should have been removed in D04 but wasn't so the columns are shifted incorrectly (not reported to CIRA) |
| 144 | Xrmlt | Molybdenum-anode XRF sample-specific detector live time (not reported to CIRA) |
| 145 | Xrclt | Copper-anode XRF sample-specific detector live time (not reported to CIRA) |

Arthist file (last modified 10/28/05) The values stored in this file are used to correct the ions and carbon data for sampling artifacts. The file contains records that summarize the artifacts for 3-month seasonal quarters and records that summarize the artifacts for individual months.

| # | Parameter | Description |
|---|---|---|
| 1 | Qtr | Seasonal quarter |
| 2 | Month | Integer month value |
| 3 | Cl | Median chloride ion field blank loading (ug/filter) |
| 4 | Dcl | Standard deviation of the chloride field blank loadings (ug/filter) |
| 5 | NO2 | Median nitrite ion field blank loading (ug/filter) |
| 6 | DNO2 | Standard deviation of the nitrite field blank loadings (ug/filter) |
| 7 | NO3 | Median nitrate ion median field blank loading (ug/filter) |
| 8 | DNO3 | Standard deviation of the nitrate field blank loadings (ug/filter) |
| 9 | SO4 | Median sulfate ion median field blank loading (ug/filter) |
| 10 | DSO4 | Standard deviation of the sulfate field blank loadings (ug/filter) |
| 11 | NH4 | Median ammonium ion field blank loading (ug/filter) |
| 12 | DNH4 | Standard deviation of the ammonium field blank loadings (ug/filter) |
| 13 | O1 | Median of the first OC fraction loadings on the secondary filters (ug/filter) |
| 14 | DO1 | Standard deviation of the first OC fraction loadings on the secondary filters (ug/filter) |
| 15 | O2 | Median of the second OC fraction loadings on the secondary filters (ug/filter) |
| 16 | DO2 | Standard deviation of the second OC fraction loadings on the secondary filters (ug/filter) |
| 17 | O3 | Median of the third OC fraction loadings on the secondary filters (ug/filter) |
| 18 | DO3 | Standard deviation of the third OC fraction loadings on the secondary filters (ug/filter) |
| 19 | O4 | Median of the fourth OC fraction loadings on the secondary filters (ug/filter) |
| 20 | DO4 | Standard deviation of the fourth OC fraction loadings on the secondary filters (ug/filter) |
| 21 | OP | Median of the first OC fraction loadings on the secondary filters (ug/filter) |
| 22 | DOP | Standard deviation of the first OC fraction loadings on the secondary filters (ug/filter) |
| 23 | E1 | Median of the first EC fraction loadings on the secondary filters (ug/filter) |
| 24 | DE1 | Standard deviation of the first EC fraction loadings on the secondary filters (ug/filter) |
| 25 | E2 | Median of the second EC fraction loadings on the secondary filters (ug/filter) |
| 26 | DE2 | Standard deviation of the second EC fraction loadings on the secondary filters (ug/filter) |
| 27 | E3 | Median of the third EC fraction loadings on the secondary filters (ug/filter) |
| 28 | DE3 | Standard deviation of the third EC fraction loadings on the secondary filters (ug/filter) |
| 29 | So2 | Median of the $SO_2$ loadings on the field blanks (ug/filter) |
| 30 | Dso2 | Standard deviation of the $SO_2$ loadings on the field blanks (ug/filter) |

# Lotnums file (last modified 11/8/05)

| # | Parameter | Description |
|---|---|---|
| 1 | Site | Name of the sampler that was being loaded when the lot number changed |
| 2 | Samdat | Date of the sample that was being loaded when the lot number changed |
| 3 | Strtim | Start time for the sample that was being loaded when the lot number changed |
| 4 | Lotnum | Filter lot number |
| 5 | Strtdate | Date that the filter lot number changed |
| 6 | Strttime | Time that the filter lot number changed |
| 7 | Comments | |

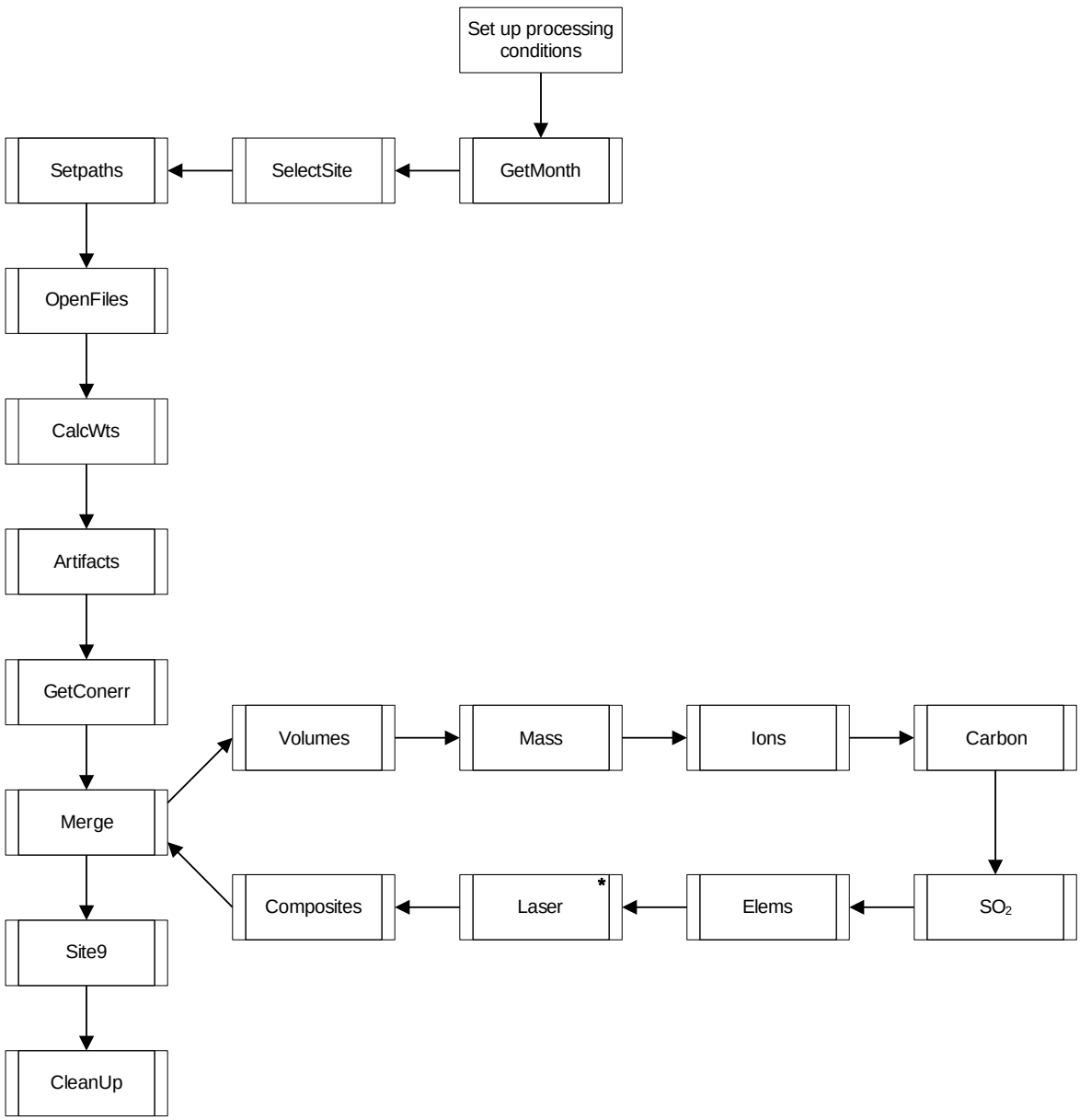
Conterr file (last modified 7/26/01) This file contains the assumed volume and analytical errors for the ions and carbon fractions (note: there are currently two records in this file). These errors are used to calculate the uncertainty in the reported concentrations.

| # | Parameter | Description |
|---|---|---|
| 1 | DATE | First date that these errors were assumed |
| 2 | MK | Not sure what this is, it is not used in Lowell's builddbf code |
| 3 | MFVOL | Assumed error (percent) in the volume measurements, applies to all module |
| 4 | O1 | Assumed analytical error (percent) in the first organic carbon fraction concentrations |
| 5 | O2 | Assumed analytical error (percent) in the second organic carbon fraction concentrations |
| 6 | O3 | Assumed analytical error (percent) in the third organic carbon fraction concentrations |
| 7 | O4 | Assumed analytical error (percent) in the fourth organic carbon fraction concentrations |
| 8 | OP | Assumed analytical error (percent) in the pyrolyzed carbon fraction concentrations |
| 9 | E1 | Assumed analytical error (percent) in the first elemental carbon fraction concentrations |
| 10 | E2 | Assumed analytical error (percent) in the second elemental carbon fraction concentrations |
| 11 | E3 | Assumed analytical error (percent) in the third elemental carbon fraction concentrations |
| 12 | CL | Assumed analytical error (percent) in chloride ion concentrations |
| 13 | NO2 | Assumed analytical error (percent) in nitrite ion concentrations |
| 14 | NO3 | Assumed analytical error (percent) in nitrate ion concentrations |
| 15 | SO4 | Assumed analytical error (percent) in sulfate ion concentrations |
| 16 | NH4 | Assumed analytical error (percent) in ammonium ion concentrations |
| 17 | SO2 | Assumed analytical error (percent) in sulfur dioxide concentrations |
| 18 | Clmdl | Chloride analytical detection limit (used if field blank median = 0) |
| 19 | NO2mdl | Nitrite analytical detection limit (used if field blank median = 0) |
| 20 | NO3mdl | Nitrate analytical detection limit (used if field blank median = 0) |
| 21 | SO4mdl | Sulfate analytical detection limit (used if field blank median = 0) |
| 22 | NH4mdl | Ammonium analytical detection limit (used if field blank median = 0) |

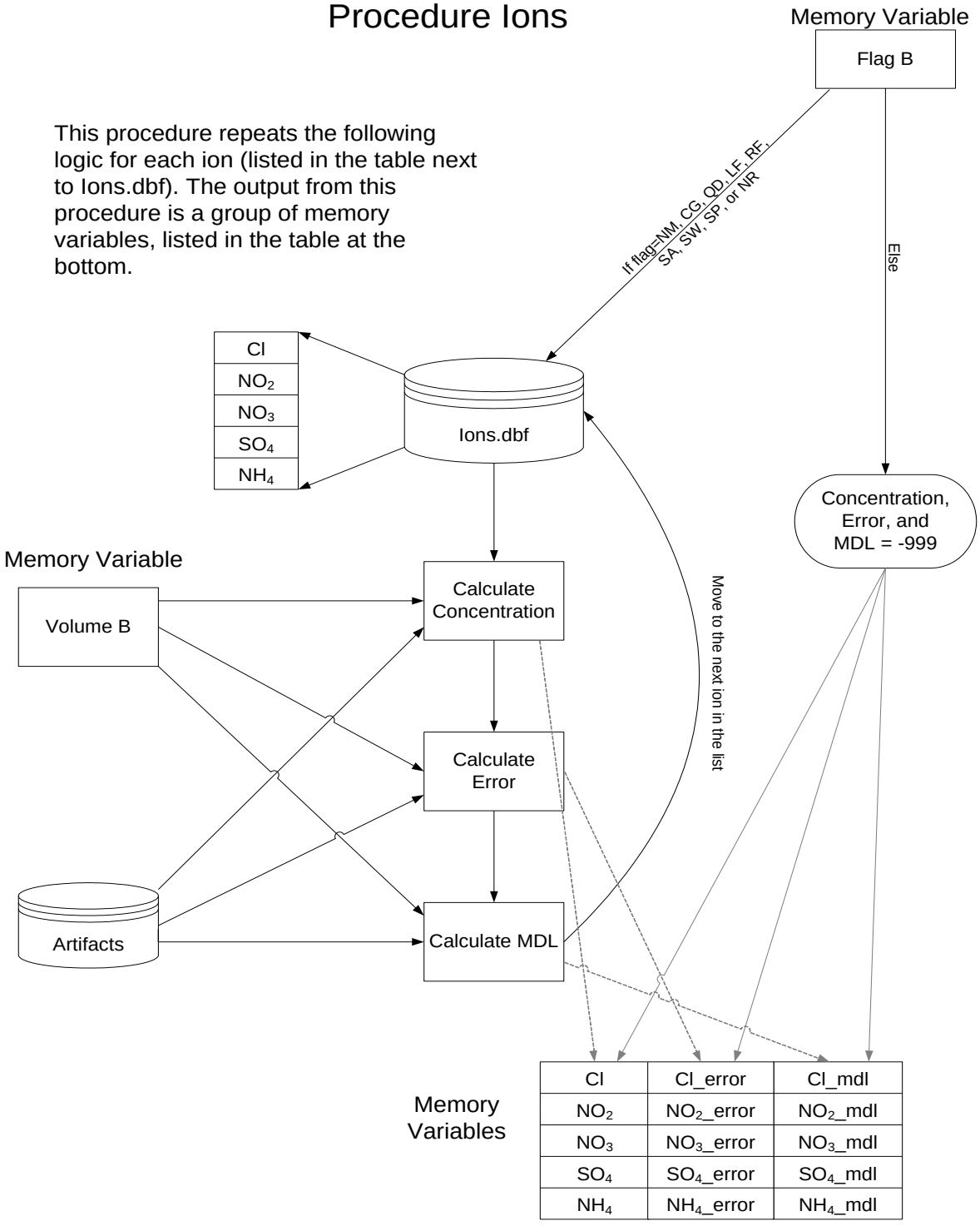
BalEq files: Each balance, excluding the Cahn 31 reference balance, used in the weigh room has a separate file (e.g., baleq31a.dbf). The equations are used to adjust the weight measured on a particular balance to the corresponding weight on the Cahn 31 balance.

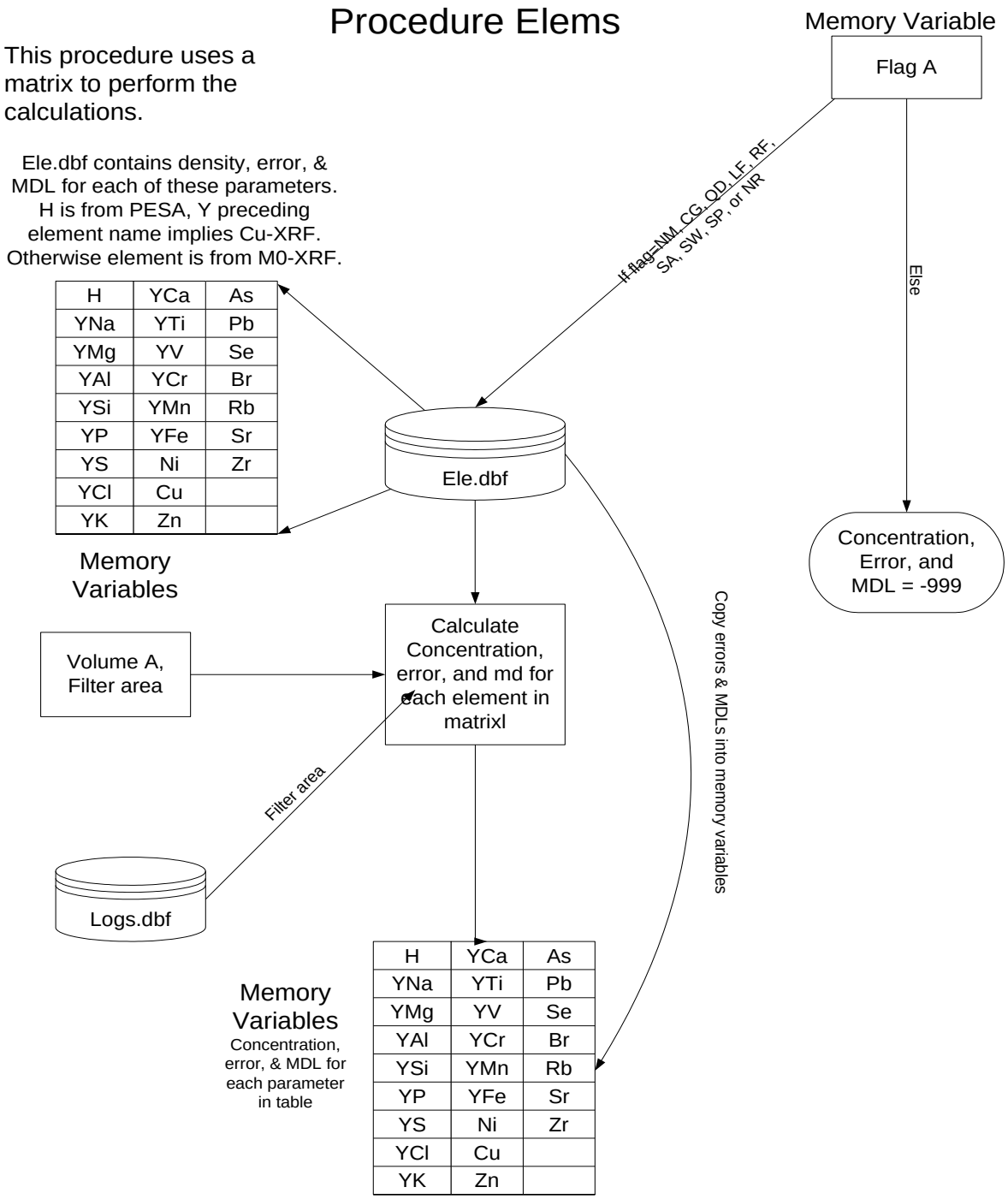
| # | Parameter | Description |
|---|---|---|
| 1 | Tareint | Balance intercept for regression to the Cahn 31 balance |
| 2 | Tareslp | Balance slope for the regression to the Cahn 31 balance |
| 3 | Begdat | Starting date for the regression equation |

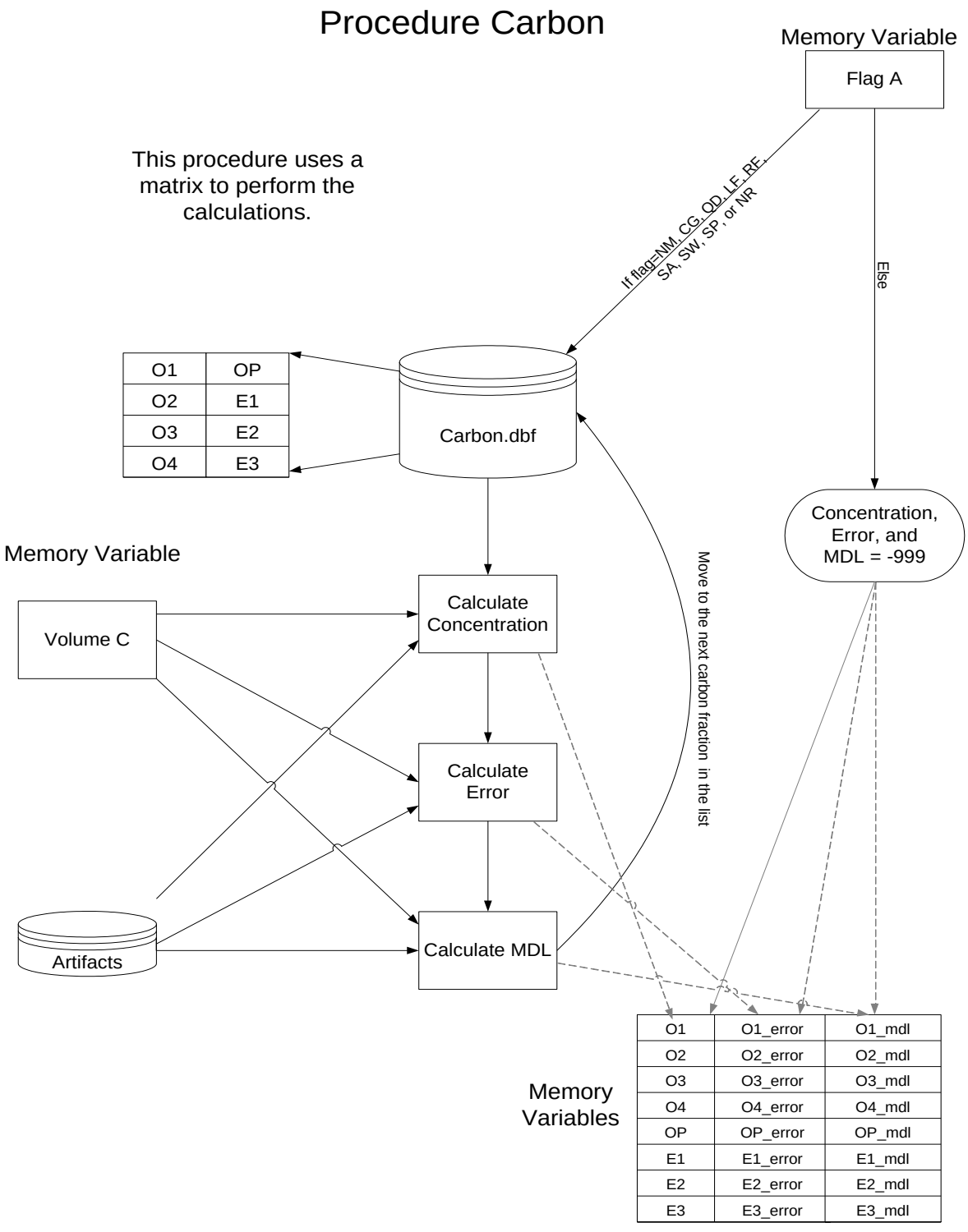
## APPENDIX B. BUILDDBF CODE DIAGRAMS

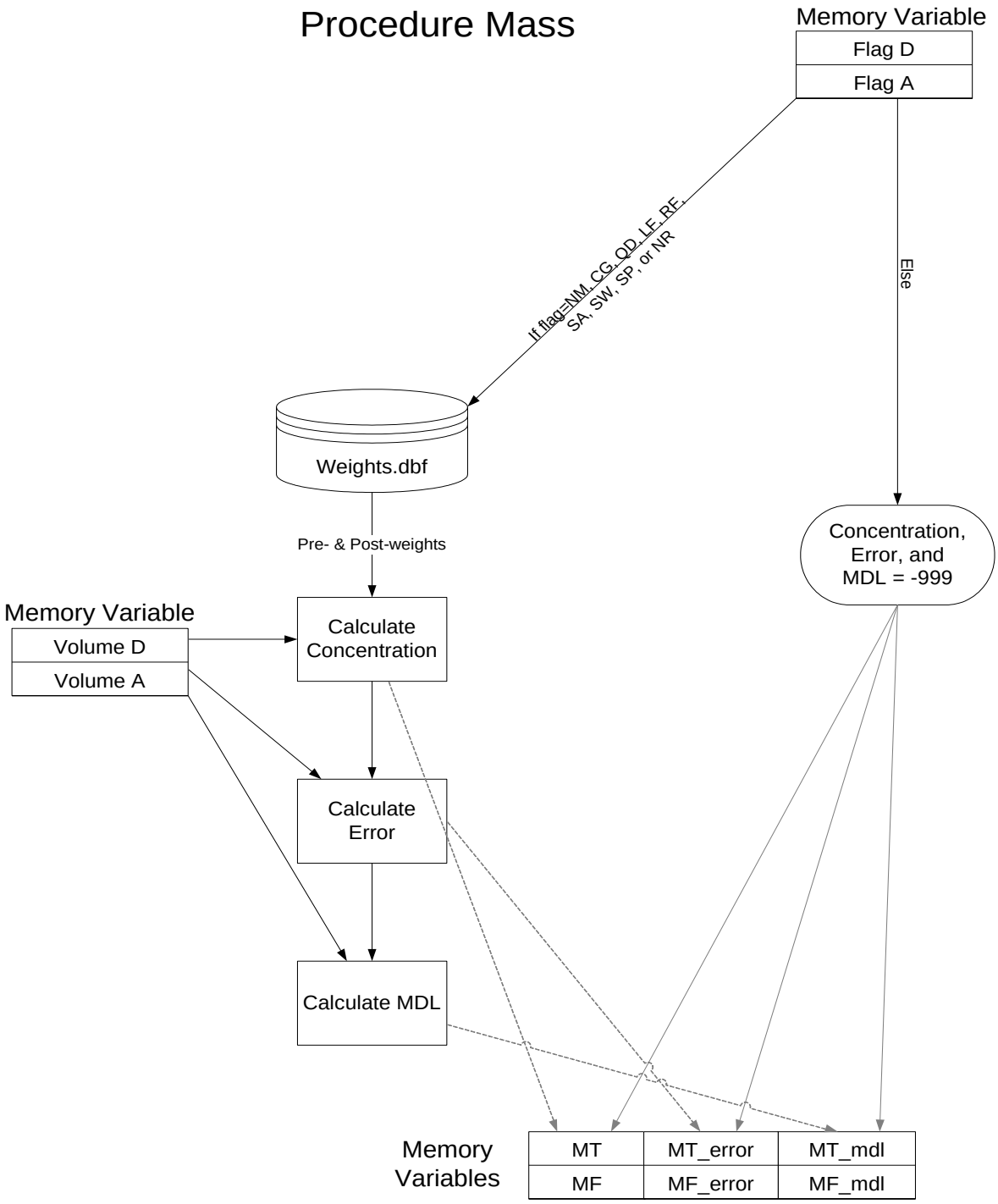


# Procedure Ions



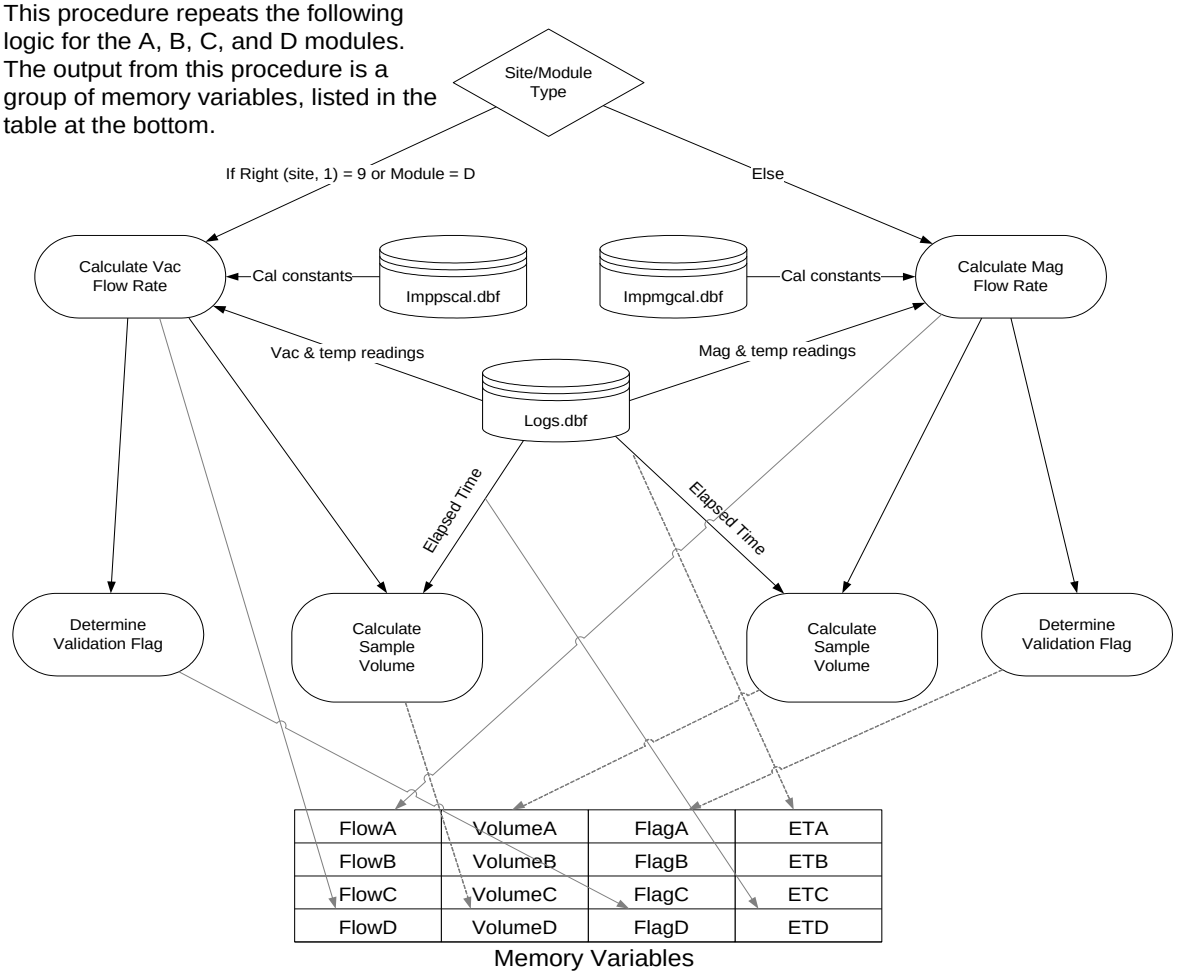

Procedure Elems
This procedure uses a matrix to perform the calculations.
Memory Variable
Flag A
If flag=NM, CG, QD, LF, RF, SA, SW, SP, or NR
Else
Ele.dbf contains density, error, & MDL for each of these parameters. H is from PESA, Y preceding element name implies Cu-XRF. Otherwise element is from M0-XRF.
H YCa As
YNa YTi Pb
YMg YV Se
YAl YCr Br
YSi YMn Rb
YP YFe Sr
YS Ni Zr
YCl Cu
YK Zn
Memory Variables
Ele.dbf
Concentration, Error, and MDL = -999
Volume A, Filter area
Calculate Concentration, error, and md for each element in matrixl
Copy errors & MDLs into memory variables
Filter area
Logs.dbf
Memory Variables
Concentration, error, & MDL for each parameter in table
H YCa As
YNa YTi Pb
YMg YV Se
YAl YCr Br
YSi YMn Rb
YP YFe Sr
YS Ni Zr
YCl Cu
YK Zn


Procedure Carbon
Memory Variable
Flag A
This procedure uses a matrix to perform the calculations.
If flag=NM, CG, QD, LF, RE, SA, SW, SP, or NR
Else
O1
OP
O2
E1
O3
E2
O4
E3
Carbon.dbf
Concentration, Error, and MDL = -999
Memory Variable
Volume C
Calculate Concentration
Calculate Error
Calculate MDL
Artifacts
Move to the next carbon fraction in the list
Memory Variables
O1 O1_error O1_mdl
O2 O2_error O2_mdl
O3 O3_error O3_mdl
O4 O4_error O4_mdl
OP OP_error OP_mdl
E1 E1_error E1_mdl
E2 E2_error E2_mdl
E3 E3_error E3_mdl


Procedure Mass
Memory Variable
Flag D
Flag A
If flag=NM, CG, QD, LE, RE, SA, SW, SP, or NR
Else
Weights.dbf
Pre- & Post-weights
Concentration, Error, and MDL = -999
Memory Variable
Volume D
Volume A
Calculate Concentration
Calculate Error
Calculate MDL
Memory Variables
MT
MT_error
MT_mdl
MF
MF_error
MF_mdl

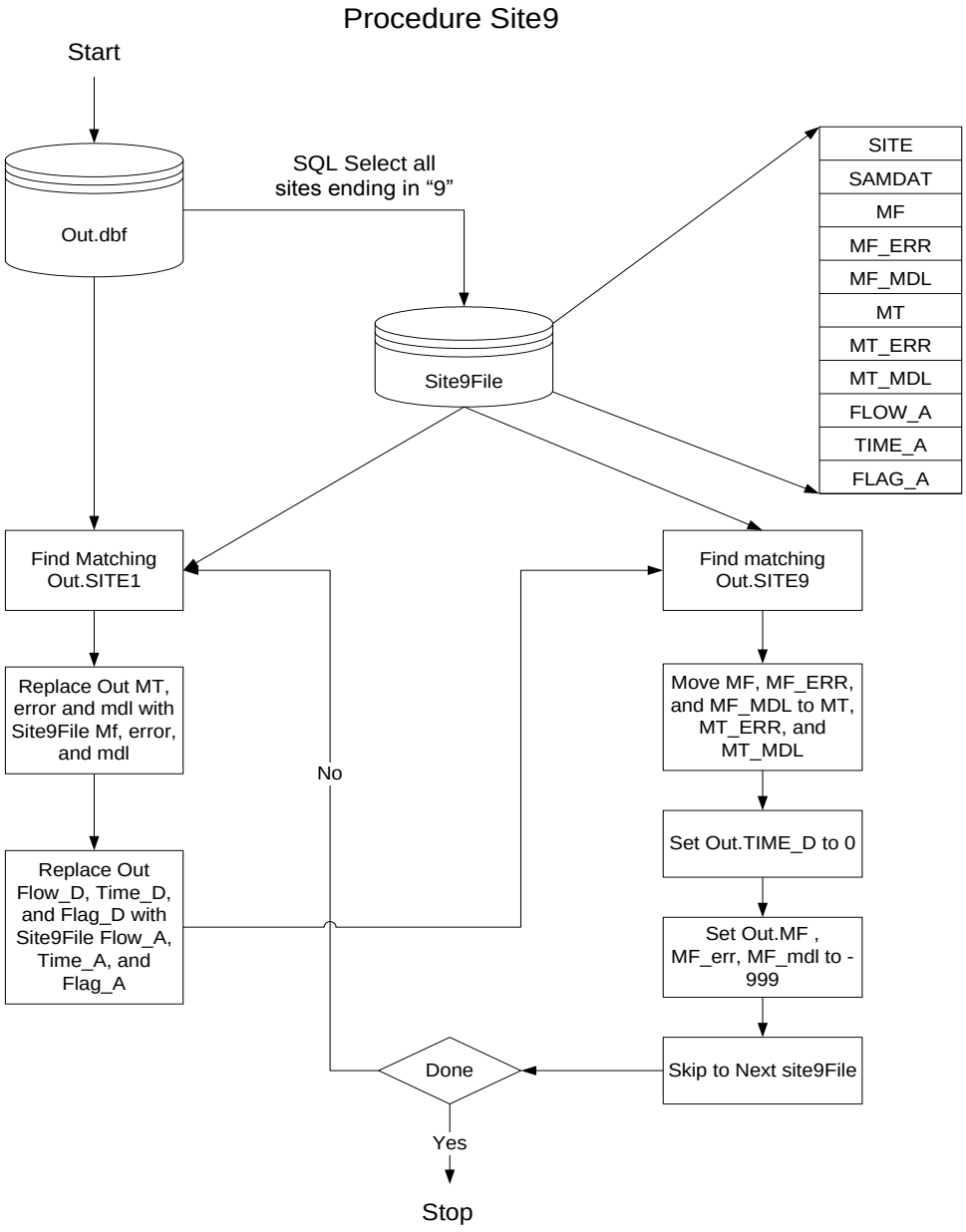
# Procedure Volumes

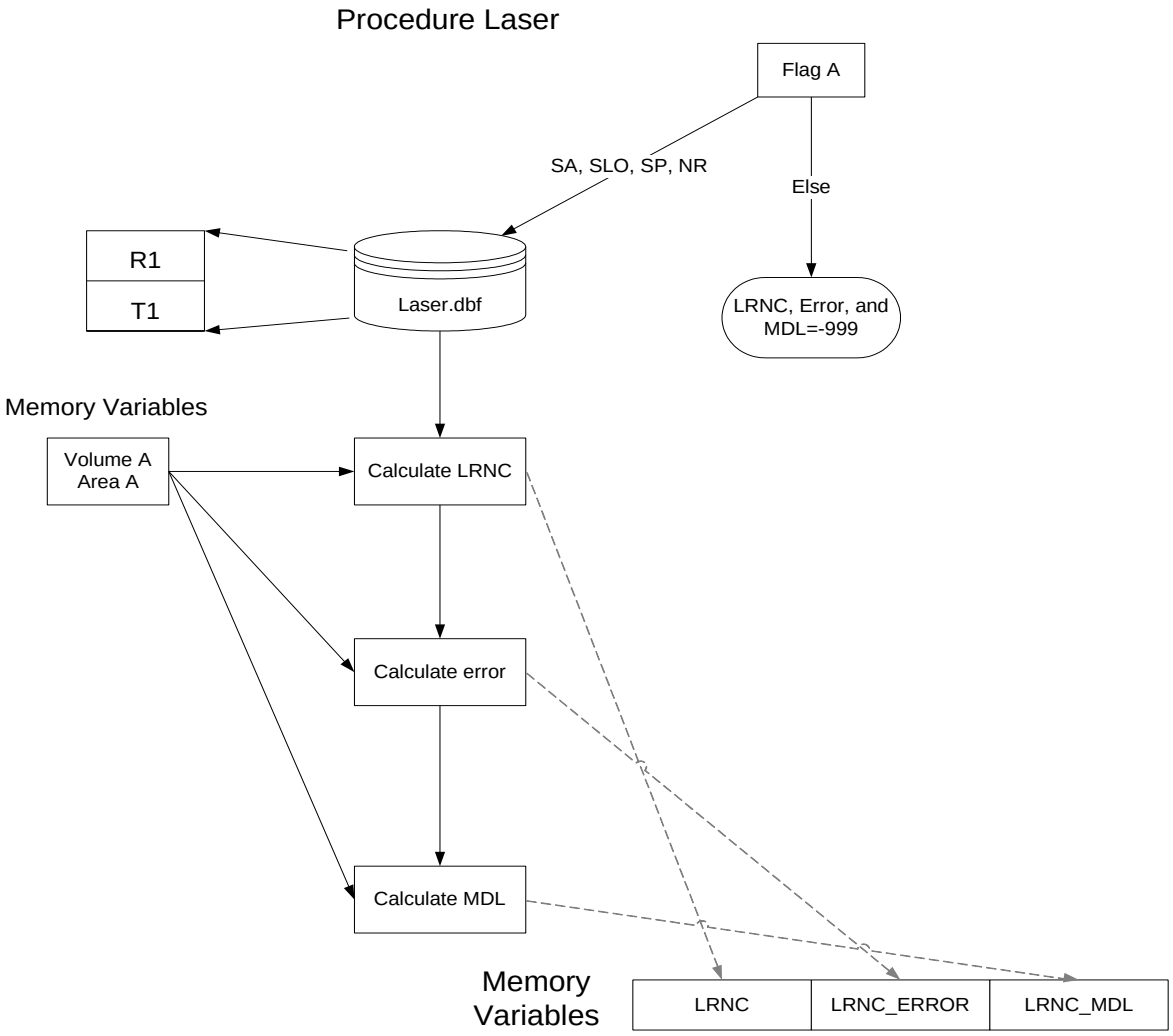
This procedure repeats the following logic for the A, B, C, and D modules. The output from this procedure is a group of memory variables, listed in the table at the bottom.




| | | | |
|---|---|---|---|
| FlowA | VolumeA | FlagA | ETA |
| FlowB | VolumeB | FlagB | ETB |
| FlowC | VolumeC | FlagC | ETC |
| FlowD | VolumeD | FlagD | ETD |

Memory Variables

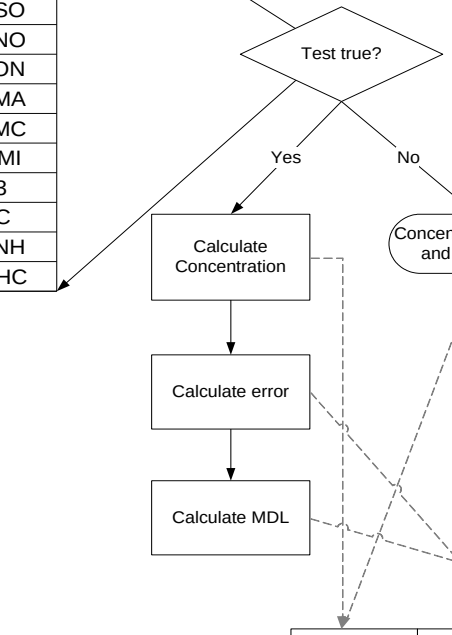

Procedure Site9
Start
Out.dbf
SQL Select all sites ending in "9"
Site9File
SITE
SAMDAT
MF
MF_ERR
MF_MDL
MT
MT_ERR
MT_MDL
FLOW_A
TIME_A
FLAG_A
Find Matching Out.SITE1
Replace Out MT, error and mdl with Site9File Mf, error, and mdl
Replace Out Flow_D, Time_D, and Flag_D with Site9File Flow_A, Time_A, and Flag_A
No
Find matching Out.SITE9
Move MF, MF_ERR, and MF_MDL to MT, MT_ERR, and MT_MDL
Set Out.TIME_D to 0
Set Out.MF , MF_err, MF_mdl to -999
Skip to Next site9File
Done
Yes
Stop


Procedure Laser
Flag A
SA, SLO, SP, NR
Else
R1
T1
Laser.dbf
LRNC, Error, and MDL=-999
Memory Variables
Volume A
Area A
Calculate LRNC
Calculate error
Calculate MDL
Memory Variables
LRNC
LRNC_ERROR
LRNC_MDL

## Procedure Composites

The following tests control calculation of the corresponding composite variable

| | |
|---|---|
| H>0 and S>S_mdl | OMH |
| O1>0 or O1_err>0 | OMCN |
| E1>0 or E1_err>0 | LACN |
| Si_mdl>0 and Fe_mdl>0 | SOIL |
| S>0 | NHSO |
| NO3>0 | NHNO |
| Fe>0 and K>0 | KNON |
| LRNC>0 | RCMA |
| OMC_err>0 and LACN_err>0 | RCMC |
| SO4_err>0 and LRCN_mdl>0 | RCMI |
| S>0 | S3 |
| MF>0 | MC |
| SO4>0 and NO3>0 | RCNH |
| OMH_err>0 and NO3_err>0 | OMHC |




Memory Variables

| | | |
|---|---|---|
| OMH | OMH_error | OMH_mdl |
| OMCN | OMCN_error | OMCN_mdl |
| LACN | LACN_error | LACN_mdl |
| SOIL | SOIL_error | SOIL_mdl |
| NHSO | NHSO_error | NHSO_mdl |
| NHNO | NHNO_error | NHNO_mdl |
| KNON | KNON_error | KNON_mdl |
| RCMA | RCMA_error | RCMA_mdl |
| RCMC | RCMC_error | RCMC_mdl |
| RCMI | RCMI_error | RCMI_mdl |
| S3 | S3_error | S3_mdl |
| MC | MC_error | MC_mdl |
| RCNH | RCNH_error | RCNH_mdl |
| OMHC | OMHC_error | OMHC_mdl |

## APPENDIX C. BUILDDBF CODE

# Table of Contents

## C.1. BuildDBF

```
* Program BUILDdbf
* Create the IMPROVE monthly database
*
************************************************************************
*
* Modified 11/17/2005 to add analytical mdl for Cl, NO2, NO3, SO4, and NH4
* to conterr.dbf and use them if field blanks stdev is zero.
*
* Modified 1/4/2006 by Lowell to remove code used to build 2000-2004 data
* sequentially. The code is commented out with *&& at the beginning of
* each line if there's any reason to reinstate it later.
************************************************************************

PARAMETERS mSwap
PUBLIC mseason, mmonth, mUser, mCalled
PUBLIC mdisk, mrootpath, mlogs, mlogpath
PUBLIC validstat, NMLFRF, BailOut
PUBLIC ntimes, nindex, nindex2
*&&PUBLIC bldMonth(12), bldSeason(21)
PUBLIC mdlcl, mdlno2, mdlno3, mdlso4, mdlnh4
mCalled = mSwap

validstat = "'NM','CG','QD','LF','RF', 'SA', 'SW', 'SP', 'NR'"
NMLFRF = "'NM','LF','RF', 'NR'"
mUSER = GETENV('USERNAME')

*&&bldMonth(1) = "01"
*&&bldMonth(2) = "02"
*&&bldMonth(3) = "03"
*&&bldMonth(4) = "04"
*&&bldMonth(5) = "05"
*&&bldMonth(6) = "06"
*&&bldMonth(7) = "07"
*&&bldMonth(8) = "08"
*&&bldMonth(9) = "09"
*&&bldMonth(10) = "10"
*&&bldMonth(11) = "11"
*&&bldMonth(12) = "12"

*&&bldSeason( 1) = "D99"
*&&bldSeason( 2) = "A00"
*&&bldSeason( 3) = "B00"
*&&bldSeason( 4) = "C00"
*&&bldSeason( 5) = "D00"
*&&bldSeason( 6) = "A01"
*&&bldSeason( 7) = "B01"
*&&bldSeason( 8) = "C01"
*&&bldSeason( 9) = "D01"
*&&bldSeason(10) = "A02"
*&&bldSeason(11) = "B02"
*&&bldSeason(12) = "C02"
*&&bldSeason(13) = "D02"
*&&bldSeason(14) = "A03"
*&&bldSeason(15) = "B03"
*&&bldSeason(16) = "C03"
*&&bldSeason(17) = "D03"
```

```
*&&bldSeason(18) = "A04"
*&&bldSeason(19) = "B04"
*&&bldSeason(20) = "C04"
*&&bldSeason(21) = "D04"

SET TALK OFF
SET SAFETY OFF

ON ERROR DO errhand WITH ;
   ERROR( ), MESSAGE( ), MESSAGE(1), PROGRAM( ), LINENO( )

CLEAR
DO WHILE .T.

*IF DIRECTORY("M:\")
*  mdisk="m:\"
   IF DIRECTORY("U:\")
      mdisk="u:\"
   ELSE
      mdisk="c:\"
   ENDIF
   mrootpath = mdisk + "improve\"
   mlogpath  = mrootpath + "logs\"
   STORE SYS(5)+SYS(2003) TO mdefdrv
   IF DIRECTORY("M:\zdefault\foxpro")
      SET DEFAULT TO M:\zdefault\FOXPRO
   ELSE
      MKDIR M:\zdefault\FOXPRO
      SET DEFAULT TO M:\zdefault\FOXPRO
   ENDIF

   SET PATH TO M:\IMPROVE\PROGRAMS

   IF NOT mCalled
      CLOSE DATABASES ALL
   ENDIF
   BailOut = .F.

*&&WAIT WINDOW AT 10,40 "Press 'A' to process 2000-2004" + CHR(13) + CHR(10) +
   "Any other key for a single month" TO m1st5
*&&IF INLIST (m1st5, "A", "a")
*&&    numMonths = 60
*&&    ProcessAll = .T.
*&&    mseason = bldSeason(1)
*&&    mmonth = bldMonth(1)
*&&    mQtr = LEFT(mseason,1)
*&&ELSE
       numMonths = 1
       ProcessAll = .F.
       DO GetMonth
*&&ENDIF

   mlogs = mlogpath + mseason + "logs.dbf"
   DO SelectSite
   bldsite = msite
   FOR nTimes = 1 TO numMonths
      CLOSE DATABASES ALL
*&&    IF ProcessAll
```

```
*&&           nIndex = INT(nTimes/3)+1
*&&           mSeason = bldSeason(nIndex)
*&&           nIndex2 = nTimes - INT((nTimes-1)/12)*&&12
*&&           mMonth = bldMonth(nIndex2)
*&&           mQtr = LEFT(mseason,1)
*&&           msite = bldsite
*&&? nTimes, nIndex2, mSeason, mMonth
*&&wait
*&&    ELSE
*&&    ENDIF
       DO SetPaths
       DO OpenFiles
       DO CalcWts
       SELECT wts
       COPY TO mPathTemp + mseason + "weights.dbf" FOX2X

** Allow chance to bail out
       IF BailOut
             CANCEL
       ENDIF
*   WAIT WINDOW AT 10,40 "Press 'C' to continue" + CHR(13) + CHR(10) + "Any other
    key to stop" TO mcont
*   IF NOT INLIST (mcont, "C", "c")
*      CANCEL
*   ENDIF

*********************************************
*         Main Program                      *
*********************************************
       SET TALK OFF
       DO Artifacts              && Get the artifact information
       DO getconerr              && Get the "standard" uncertainty data
*ON ERROR Do Cleanup

       SET TALK OFF
       SET VIEW OFF
       DO Merge                        && Calculate and merge the data from the
    various databases

* Process PM10 speciation samples
       DO SITE9                        && Merge the PM10 mass data into the
    corresponding SITE1 sites

* Moved SiteX processing to Cleanup

* DO QACheck
       DO CleanUp                      && Clean up loose ends and delete
    temporary files

   ENDFOR
ENDDO
CANCEL

*******************************
PROCEDURE getconerr

PUBLIC mmfvol, mcocl, mcono2, mcono3, mcoso4, mconh4, mcoo1, mcoo2, mcoo3, mcoo4,
   mcoop, mcoe1, mcoe2, mcoe3, mcoso2
```

```
ON ERROR DO COERERR
USE mPATHSUPP + 'CONTERR.DBF' IN 0 ALIAS err
SELECT err
GO BOTTOM
ON ERROR
mmfvol = err.MFVOL
mcocl  = err.CL
mcono2 = err.NO2
mcono3 = err.NO3
mcoso4 = err.SO4
mconh4 = err.NH4
mcoo1  = err.O1
mcoo2  = err.O2
mcoo3  = err.O3
mcoo4  = err.O4
mcoop  = err.OP
mcoe1  = err.E1
mcoe2  = err.E2
mcoe3  = err.E3
mcoso2 = err.SO2
mdlcl = err.CLmdl
mdlno2 = err.NO2mdl
mdlno3 = err.NO3mdl
mdlso4 = err.SO4mdl
mdlnh4 = err.NH4mdl
USE
RETURN
*********************************
PROCEDURE COERERR
WAIT WINDOW mPATHSUPP + 'CONTERR.DBF is already open' TIMEOUT 1
IF LASTKEY() = 23
   DEACTIVATE WINDOW ALL
   CLOSE DATABASES
   SET COLOR SET TO                          && Set the color back to default
   QUIT
ELSE
   RETRY                  &&
ENDIF
RETURN
************************************************
PROCEDURE MGCALERR
WAIT WINDOW mPATHCAL+ 'IMPMGCAL.DBF is already open' TIMEOUT 1
IF LASTKEY() = 23
   DEACTIVATE WINDOW ALL
   CLOSE DATABASES
   SET COLOR SET TO                          && Set the color back to default
   QUIT
ELSE
   RETRY                  &&
ENDIF
*********************************
PROCEDURE PSCALERR
WAIT WINDOW mPATHCAL+ 'IMPPSCAL.DBF is already open' TIMEOUT 1
IF LASTKEY() = 23
   DEACTIVATE WINDOW ALL
   CLOSE DATABASES
   SET COLOR SET TO                          && Set the color back to default
   QUIT
```

```
ELSE
   RETRY                    &&
ENDIF
*********************************
```

## C.2. GetMonth

```
* This procedure displays a window to select a month and year to build
* the IMPROVE database.
*
* Parameters returned:
*  mMonth:   Character (width 2) e.g. "12" for December
*  mQTR:           Character (width 1) e.g. "B" for summer season
*  mSeason:  Character (width 3) e.b. "B03" for summer 2003
*

PROCEDURE getmonth

**CLEAR

PUBLIC mMonth, mQtr, mSeason, aMonth, mYear
PUBLIC mPMonth, mYearMonth
STORE "00" to mMonth
STORE "000" to mSeason
DIMENSION gaMonth(12), gaYear(20), cQtr(12)
STORE "0000" TO mYear

cQtr(12) = "D"
cQtr( 1) = "D"
cQtr( 2) = "D"
cQtr( 3) = "A"
cQtr( 4) = "A"
cQtr( 5) = "A"
cQtr( 6) = "B"
cQtr( 7) = "B"
cQtr( 8) = "B"
cQtr( 9) = "C"
cQtr(10) = "C"
cQtr(11) = "C"
FOR gnCount = 1 to 12  && Fill the month array
   STORE cmonth(date(year(date()),gncount,1)) TO gaMonth(gnCount)
NEXT
FOR gnCount = 1 to 20  && Fill the year array
   STORE str(1987+gncount,4,0) TO gaYear(gnCount)
NEXT

frmMyForm = CREATEOBJECT('Form')  && Create a Form
frmMyForm.Caption = "Build data for month"
frmMyForm.Closable = .f.  && Disable the Control menu box
frmMyForm.Move(150,10,550,400)  && Move the form
frmMyForm.AddObject('ListBox1','lstMyListBox')  && Add ListBox control
frmMyForm.AddObject('ListBox2','2ndMyListBox')  && Add ListBox control
frmMyForm.AddObject('cmbCommand1','cmdMyCmdBtn')  && Add "Continue" Command
   button
frmMyForm.AddObject('cmbCommand2','QuitBtn')  && Add "Quit" Command button
frmMyForm.AddObject('MyLabel', 'Caution')
*frmMyForm.AddObject('Label1', 'SiteLabel')
*frmMyForm.AddObject('mSite', 'SiteBox')

frmMyForm.ListBox1.RowSourceType = 5  && Specifies an array
frmMyForm.ListBox1.RowSource = 'gaMonth' && Array containing listbox items
frmMyForm.ListBox2.RowSourceType = 5  && Specifies an array
```

```
frmMyForm.ListBox2.RowSource = 'gaYear' && Array containing listbox items

*frmMyForm.cmbCommand1.Visible =.T.  && "Continue" Command button visible
frmMyForm.cmbCommand2.Visible =.T.  && "Quit" Command button visible
frmMyForm.ListBox1.Visible =.T.  && "List Box visible
frmMyForm.MyLabel.Visible = .T.
*frmMyForm.ListBox2.Visible =.F.  && "List Box not visible

frmMyForm.SHOW  && Display the form
frmMyForm.ListBox2.Visible =.F.  && "List Box not visible
READ EVENTS         && Start event processing


DEFINE CLASS Caution AS Label
   Caption = "   Be sure the following files are up to date" ;
   + CHR(13) + CHR(10) + "            -  Elements" ;
   + CHR(13) + CHR(10) + "            -  Ions" ;
   + CHR(13) + CHR(10) + "            -  Carbon" ;
   + CHR(13) + CHR(10) + "            -  Laser"
   Left = 270
   Top = 20
   Height = 80
   Width = 240
   BorderStyle = 1
   BackStyle = 1
   FontBold = .T.
   BackColor = RGB(128, 255, 255)
   ForeColor = RGB(128, 0, 0)
ENDDEFINE

DEFINE CLASS cmdMyCmdBtn AS CommandButton  && Create Command button
   Caption = '\<Continue'  && Caption on the Command button
   Cancel = .T.  && Default Cancel Command button (Esc)
   Left = 10  && Command button column
   Top = 310  && Command button row
   Height = 25  && Command button height

   PROCEDURE Click
     IF mMonth = "00" OR mSeason = "000"
**         CLEAR
      ? 'Select MONTH and YEAR'
      Wait
**            CLEAR
      frmMyForm.cmbCommand1.Visible =.T.  && "Continue" Command button visible
      frmMyForm.cmbCommand2.Visible =.T.  && "Quit" Command button visible
      frmMyForm.ListBox1.Visible =.T.  && "List Box visible
      frmMyForm.ListBox2.Visible =.F.  && "List Box visible
      frmMyForm.SHOW
     ELSE
      CLEAR EVENTS  && Stop event processing, close Form
*            CLEAR  && Clear main Visual FoxPro window
      RELEASE gaMonth, gaYear, cQtr
     ENDIF
   WAIT CLEAR
ENDDEFINE

DEFINE CLASS QuitBtn AS CommandButton  && Create Command button
   Caption = '\<Quit'  && Caption on the Command button
```

```
   Cancel = .T.  && Default Cancel Command button (Esc)
   Left = 10  && Command button column
   Top = 260  && Command button row
   Height = 25  && Command button height

   PROCEDURE Click
      WAIT CLEAR
    SET SAFETY ON
    POP KEY ALL
    IF INLIST(mUser, "ashbaugh", "sengupta")
       IF mCalled
             RETURN TO master
       ENDIF
       CANCEL
    ENDIF
    QUIT
    ENDPROC
ENDDEFINE

DEFINE CLASS lstMyListBox AS ListBox  && Create ListBox control
   Left = 10  && List Box column
   Top = 25  && List Box row
   MultiSelect = .F.  && Don't allow selecting more than 1 item
   Height = 210

PROCEDURE Click
   ACTIVATE SCREEN
**   CLEAR
   FOR nCnt = 1 TO ThisForm.ListBox1.ListCount
      IF ThisForm.ListBox1.Selected(nCnt)  && Is item selected?
         aMonth = gaMonth(nCnt)
         mMonth = IIF(nCnt<10,"0"+str(nCnt,1,0),str(nCnt,2,0))
         mYearMonth = mYear + mMonth
         mQtr = cQtr(nCnt)
         mPMonth = IIF(nCnt=1,"12", IIF(nCnt<11,"0"+str(nCnt-1,1,0),str(nCnt-
   1,2,0)))
        frmMyForm.ListBox2.Visible =.T.  && "List Box visible
      ENDIF
   ENDFOR
ENDDEFINE

DEFINE CLASS 2ndMyListBox AS ListBox  && Create ListBox control
   Left = 140                    && List Box column
   Top = 25               && List Box row
   MultiSelect = .F.      && Don't allow selecting more than 1 item
   Height = 355

PROCEDURE Click
   ACTIVATE SCREEN
**   CLEAR
   FOR mCnt = 1 TO ThisForm.ListBox2.ListCount
      IF ThisForm.ListBox2.Selected(mCnt)  && Is item selected?
         ? aMonth+" "+GaYear(mCnt)
         STORE GaYear(mCnt) TO mYear
         mYearMonth = mYear + mMonth
         mSeason = mQtr + IIF(val(mMonth)>2,;
         right(ThisForm.ListBox2.List(mCnt),2),;
         right(ThisForm.ListBox2.List(mCnt-1),2))
```

```
         frmMyForm.cmbCommand1.Visible =.T.  && "Continue" Command button visible
      ENDIF
   ENDFOR
ENDDEFINE
```

## C.3. SelectSite

```
PROCEDURE SelectSite

*********************************************************
* This procedure opens a list to select a site name
* to process for output data
*
* Returns msite
*
*********************************************************

PUBLIC mSite

USE &mlogs ALIAS logs
SELECT logs
GO TOP
*mSite = logs.site
SELECT DISTINCT Logs.site;
 FROM logs;
 ORDER BY Logs.site;
 INTO TABLE Sites
INSERT INTO Sites (site) values ("  ALL")
INDEX ON site TAG site
GO TOP
SELECT logs
USE

frmInput = CREATEOBJECT('Form')
frmInput.closable = .F.
frmInput.movable = .T.
frmInput.BorderStyle = 3
frmInput.move(100,10,400,200)
frmInput.Caption = "Select site"
frmInput.Name = "Form1"
frmInput.AddObject('Label1', 'SiteLabel')
frmInput.AddObject('mSite', 'SiteBox')
*frmInput.AddObject('Label2', 'SeasonLabel')
*frmInput.AddObject('mSeason', 'SeasonBox')
frmInput.AddObject('Command1', 'ContinueBtn')
frmInput.AddObject('QuitBtn', 'QuitBtn1')
frmInput.Label1.Visible = .T.
frmInput.mSite.Visible = .T.
*frmInput.Label2.Visible = .T.
*frmInput.mSeason.Visible = .T.
frmInput.Command1.Visible = .T.
frmInput.QuitBtn.Visible = .T.

frmInput.show
READ EVENTS
RETURN

* Object definitions for display form follow
DEFINE CLASS SiteLabel AS Label
   AutoSize = .F.
*  FontBold = .T.
   FontSize = 9
```

```
    Alignment = 1
    Caption = "Site Name:"+chr(13)+"('ALL' for report)"
    Height = 40
    Left = 35
    Top = 24
    Width = 93
    Name = "Label1"
ENDDEFINE

DEFINE CLASS SiteBox AS ListBox
*   FontBold = .T.
    FontSize = 9
    Value = sites.Site
    ControlSource = sites.site
    Top = 10
    Left = 144
    Width = 75
    Height = 110
    MaxLength = 5
    SpecialEffect = 0
    ColumnCount = 1
    Name = "mSite"
    SelStart = 1
    SelLength = 5
    SelectOnEntry = .T.
    RowSourceType = 3
    RowSource = "select site from sites into cursor site ORDER BY site"
    DisplayValue = 1
    NumberOfElements = 180
    InputMask = "!!!!!"
    ReadOnly = .F.
    IncrementalSearch = .T.
    PROCEDURE VALID
       m.msite = site.site
       CLEAR EVENTS
       thisform.release
       WAIT CLEAR
    ENDPROC
ENDDEFINE

DEFINE CLASS ContinueBtn as CommandButton
    Top = 24
    Left = 240
    Height = 25
    Width = 121
*   FontBold = .T.
    FontSize = 10
    Cancel = .F.
    Caption = "\<Continue"
    Default = .T.
    TerminateRead = .F.
    Name = "Command1"

    PROCEDURE Click
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
       m.msite = site.site
       IF SELECT("Flash")>0
              SELECT Flash
```

```
            USE
      ENDIF
      CLEAR EVENTS
      thisform.release
      WAIT CLEAR
   ENDPROC
ENDDEFINE

DEFINE CLASS QuitBtn1 as CommandButton
   Top = 85
   Left = 240
   Height = 25
   Width = 121
*  FontBold = .T.
   FontSize = 10
   Cancel = .F.
   Caption = "\<Quit"
   TerminateRead = .F.
   Name = "QuitBtn"

   PROCEDURE Click
*     IF SELECT("Flash")>0
*           SELECT Flash
*           USE
*     ENDIF
*     ON ERROR
*     SET DEFAULT TO &DefaultDir
      BailOut = .T.
      CLEAR EVENTS
      thisform.release
      WAIT CLEAR
*     Cancel
   ENDPROC
ENDDEFINE
```

## C.4. SetPaths

```
PROCEDURE setpaths
* Define data paths and file names

PUBLIC mweights, mcarbon, mions, mlaser, mele &&, mlogs, mlogpath
PUBLIC mso2, mmag, mvac, mout, mconterr, mart, mouttemp, msites
PUBLIC mpcarbon, mpions, moutfinl, mfinl, mspcl, mfinlxls
PUBLIC mwtspath, mcarpath, mionpath, mlaspath,;
       melepath, mso2path, mcalpath, moutpath, mpathsupp, ;
       mPathTemp, mNewWtTemp, mNewWt, mFlash, mFlowFlags

* 11/4/2003 - may have corrected the problem noted here.
* The Temporary directory mPathTemp may cause program failure
* if there is not an M: drive. The following code will create
* mPathTemp if it does not exist on the M: drive, but will do
* nothing if the M: drive does not exist. Then references to
* mPathTemp will fail.

IF DIRECTORY("M:\")
    mPathTemp = "m:\improve\Temp\"
    IF NOT DIRECTORY("&mPathTemp")
        RUN MD &mPathTemp
    ENDIF
    IF NOT DIRECTORY("m:\IMPROVE\PROGRAMS")
        RUN MD "m:\IMPROVE\PROGRAMS"
    ENDIF
    SET PATH TO "m:\IMPROVE\PROGRAMS", mdisk + "IMPROVE\PROGRAMS"
ELSE
    SET PATH TO mdisk + "IMPROVE\PROGRAMS"
    IF NOT DIRECTORY(mdisk + "improve\Temp\")
        tdisk = &mdisk + "m:\improve\Temp\"
        RUN MD &tdisk
    ENDIF
    mPathTemp = mdisk + "improve\Temp\"
ENDIF
mrootpath = mdisk + "improve\"
*SET DEFAULT TO mrootpath + "programs\"
SET DEFAULT TO "m:\improve\programs\"

mlogpath  = mrootpath + "logs\"
mwtspath  = mrootpath + "weights\"
mcarpath  = mrootpath + "carbon\"
mionpath  = mrootpath + "ions\"
mlaspath  = mrootpath + "laser\"
melepath  = mrootpath + "pixexrf\"
mso2path  = mrootpath + "so2\"
mcalpath  = mrootpath + "sitecal\"
moutpath  = mrootpath + "totalDBF\"
mPATHSUPP = mrootpath + "Support\"
mFlashPath= mrootpath + "FlashDBF\Reports\"
*mQAPath   = mrootpath + "QAPlots\QA Data\"
mQAPath   = mpathtemp

*Do GetMonth
*mlogs = mlogpath + mseason + "logs.dbf"
*DO SelectSite
```

```
mlogs = mlogpath + mseason + "logs.dbf"
mweights = mwtspath + mseason + "wts.dbf"
mcarbon = mcarpath + mseason + "car" + ".dbf"
mions = mionpath + mseason + "ions" + ".dbf"
mlaser = mlaspath + mseason + "laser.dbf"
mele = melepath + mseason + "ele" + ".dbf"
mso2 = mso2path + mseason + "so2.dbf"
mmag = mcalpath + "impmgcal.dbf"
mvac = mcalpath + "imppscal.dbf"
mFlash = mFlashPath + mseason + "flows.dbf"
IF mSite = "  ALL"
   mout = mQAPath + mseason + "QA" + mmonth + ".dbf"
   mfinl = moutpath + mseason + "tot" + mmonth + ".dbf"
   mspcl = moutpath + mseason + "spc" + mmonth + ".dbf"
ELSE
   mout = mQAPath + mSite + mseason + "QA" + mmonth + ".dbf"
   mfinl = mQAPath + mSite + mseason + mmonth + ".dbf"
   mspcl = mQAPath + mSite + "spc" + mseason + mmonth + ".dbf"
ENDIF
*mfinlxls = mPathTemp + mseason + "tot" + mmonth + ".xls"
mconterr = mpathsupp + "conterr.dbf"
mart = mpathsupp + "arthist.dbf"
mouttemp = mPathTemp + "outtemp.dbf"
moutfinl = mPathTemp + "FinalTot.dbf"
msites = mcalpath + "sitefile.dbf"
mFlowFlags = mFlashPath + "Flow_Flags_All.dbf"
return
```

## C.5. OpenFiles

```
PROCEDURE openfiles

* Open all databases, set indexes, and set relations

CLOSE DATABASES ALL
mDefPath = SYS(5)+SYS(2003)
SET DEFAULT TO &mPathTemp

*Delete temporary files if they exist
IF FILE('tlogs.dbf')
   DELETE FILE tlogs.dbf
ENDIF
IF FILE('tcarbon.dbf')
   DELETE FILE tcarbon.dbf
ENDIF
IF FILE('tions.dbf')
   DELETE FILE tions.dbf
ENDIF
IF FILE('tlaser.dbf')
   DELETE FILE tlaser.dbf
ENDIF
IF FILE('tele.dbf')
   DELETE FILE tele.dbf
ENDIF
IF FILE('tso2.dbf')
   DELETE FILE tso2.dbf
ENDIF
IF FILE('tmag.dbf')
   DELETE FILE tmag.dbf
ENDIF
IF FILE('tvac.dbf')
   DELETE FILE tvac.dbf
ENDIF
IF FILE('twts.dbf')
   DELETE FILE twts.dbf
ENDIF
IF FILE('tsites.dbf')
   DELETE FILE tsites.dbf
ENDIF

*Copy data to temporary files
USE &mlogs
* Select only the current month
   COPY TO tlogs.dbf FOR MONTH(samdat) = VAL(mmonth)
USE &mweights
   COPY ALL TO twts
USE &mcarbon
* Select only the current month for artifact calculation
* Modified 7/7/05 by Lowell to copy all months. A filter
* will be set in Artifacts to use the correct time period.
   COPY all TO tcarbon && FOR MONTH(samdat) = VAL(mmonth)
USE &mions
* Select only the current month for artifact calculation
* Modified 7/7/05 by Lowell to copy all months. A filter
* will be set in Artifacts to use the correct time period.
```

```
   COPY all TO tions && FOR MONTH(samdat) = VAL(mmonth)
USE &mlaser
   COPY ALL TO tlaser
USE &mele
   COPY ALL TO tele
USE &mso2
   COPY ALL TO tso2
USE &mmag
   COPY ALL TO tmag
USE &mvac
   COPY ALL TO tvac
USE &msites
   COPY ALL TO tsites
USE
IF FILE('&mout')
   IF FILE('tout.dbf')
      DELETE FILE tout.dbf
      DELETE FILE tfinl.dbf
   ENDIF
   CLOSE DATABASES ALL
   DELETE FILE &mout
   DELETE FILE &mfinl
   DELETE FILE &mspcl
*  DELETE FILE &mNewWt
*  CREATE &mNewWt FROM &mNewWtTemp
*  COPY TO tNewWt.dbf FOX2X
*  USE
   CREATE &mout FROM &mouttemp
*  IF VAL(mYearMonth) > 200412
*     ALTER TABLE add COLUMN opt N(9,1)
*  ENDIF
   COPY TO tout.dbf FOX2X
   USE
   CREATE mspcl FROM &moutfinl
*  IF VAL(mYearMonth) > 200412
*     ALTER TABLE add COLUMN opt N(9,1)
*  ENDIF
   COPY TO &mspcl FOX2X
   CREATE mfinl FROM &moutfinl
*  IF VAL(mYearMonth) > 200412
*     ALTER TABLE add COLUMN opt N(9,1)
*  ENDIF
   COPY TO &mfinl FOX2X
   COPY TO tfinl.dbf FOX2X
   USE
ELSE
*  CREATE &mNewWt FROM &mNewWtTemp
*  COPY TO tNewWt.dbf FOX2X
*  USE
   CREATE &mout FROM &mouttemp
   COPY TO tout.dbf FOX2X
   USE
   CREATE mspcl FROM &moutfinl
   COPY TO &mspcl FOX2X
   CREATE mfinl FROM &moutfinl
   COPY TO &mfinl FOX2X
   COPY TO tfinl.dbf FOX2X
   USE
```

```
ENDIF
*COPY FILE &mconterr TO terr.dbf

*Open temporary files and assign alias names
USE tlogs IN 0 ALIAS logs
USE twts IN 0 ALIAS wts
USE tcarbon IN 0 ALIAS carbon
USE tions IN 0 ALIAS ions
USE tlaser IN 0 ALIAS laser
USE tele IN 0 ALIAS elements
USE tso2 IN 0 ALIAS so2
USE tmag IN 0 ALIAS mag
USE tvac IN 0 ALIAS vac
USE tsites IN 0 ALIAS sites
*SELECT DISTINCT Logs.site;
* FROM logs;
* ORDER BY Logs.site;
* INTO CURSOR Sites

USE tout IN 0 ALIAS out
    SELECT out
    DELETE ALL
    PACK
USE tfinl IN 0 ALIAS finl
    SELECT finl
    DELETE all
    PACK
*USE tNewWt IN 0 ALIAS NewWt
*   SELECT NewWt
*   DELETE all
*   PACK
*USE terr IN 0 ALIAS err

USE m:\improve\programs\nh4sites IN 0 ALIAS nh4sites
SELECT nh4sites
INDEX ON site TAG site

* Set indexes
SELECT logs
INDEX ON trim(site)+ dtoc(samdat)+ strtim TAG sitdatim
SELECT wts
INDEX ON TRIM(site)+ dtoc(samdat)+ strtim TAG sitdatim
SELECT carbon
INDEX ON trim(site)+dtoc(samdat)+strtim TAG sitdatim
INDEX ON O1tc tag O1
INDEX ON O2tc tag O2
INDEX ON O3tc tag O3
INDEX ON O4tc tag O4
INDEX ON OPtc tag OP
INDEX ON E1tc tag E1
INDEX ON E2tc tag E2
INDEX ON E3tc tag E3
SET ORDER TO sitdatim
SELECT ions
INDEX ON trim(site)+dtoc(samdat)+strtim TAG sitdatim
INDEX ON cl tag CL
INDEX ON NO2 tag NO2
INDEX ON NO3 tag NO3
```

```
INDEX ON SO4 tag SO4
INDEX ON NH4 tag NH4
SET ORDER TO sitdatim
SELECT laser
INDEX ON trim(site)+dtoc(samdat)+strtim TAG sitdatim
SELECT elements
INDEX ON trim(site)+dtoc(samdat)+strtim TAG sitdatim
SELECT so2
INDEX ON trim(site)+dtoc(samdat)+strtim TAG sitdatim
INDEX ON so4 TAG so4
SELECT mag
INDEX ON sitecode TAG site
SELECT vac
INDEX ON sitecode TAG site
SELECT sites
INDEX ON site TAG site
SELECT logs

* Relate databases as needed
SET RELATION TO logs.site+ DTOC(logs.samdat)+ logs.strtim INTO carbon ADDITIVE
SET RELATION TO logs.site+ DTOC(logs.samdat)+ logs.strtim INTO ions ADDITIVE
SET RELATION TO logs.site+ DTOC(logs.samdat)+ logs.strtim INTO elements ADDITIVE
SET RELATION TO Logs.so2site+DTOC(Logs.samdat)+Logs.strtim INTO So2 ADDITIVE
SET RELATION TO logs.site+ DTOC(logs.samdat)+ logs.strtim INTO laser ADDITIVE
SET RELATION TO logs.site INTO mag ADDITIVE
SET RELATION TO logs.site INTO vac ADDITIVE
SET RELATION TO logs.site INTO Sites ADDITIVE
SET RELATION TO site INTO Nh4sites ADDITIVE
IF logs.samdat>={9/1/2004}
   USE &mFlash IN 0 ALIAS flash
   SELECT flash
   INDEX ON LEFT(site,4) + DTOC(date) + "0000" TAG site4date
   INDEX ON site + DTOC(date) + "0000" TAG sitedate
   SET ORDER TO sitedate
   SELECT logs
   SET RELATION TO logs.site + DTOC(logs.samdat) INTO flash additive
*
* This section was moved to the VOLUMES routine so as to set the relationship
* depending on the site name. SITEX files have to use site4date. All others
* use sitedate.
*
*  SET RELATION TO LEFT(logs.site,4) + DTOC(logs.samdat) INTO flash additive
ENDIF

* Open the flow flags file and relate it to logs for processing in Volumes
USE &mFlowFlags IN 0 ALIAS FlowFlags
SELECT FlowFlags
INDEX ON site+DTOC(date) TAG sitedate
SET ORDER TO SITEDATE   && SITE+DTOC(DATE)
SELECT logs
SET RELATION TO logs.site+dtoc(logs.samdat) INTO FlowFlags ADDITIVE

SET DEFAULT TO &mDefPath
RETURN
```

## C.6. CalcWts

```
PROCEDURE CalcWts

* Recalculates prewt, postwt, and diff in the WTS file for selected quarter

PUBLIC mPrewght, mPstwght

mDefPath = SYS(5)+SYS(2003)
SET DEFAULT TO &mPathTemp

*Delete temporary files if they exist
IF FILE('tbal25.dbf')
   DELETE FILE tbal25.dbf
ENDIF
IF FILE('tbal30.dbf')
   DELETE FILE tbal30.dbf
ENDIF
IF FILE('tbal30a.dbf')
   DELETE FILE tbal30a.dbf
ENDIF
IF FILE('tbal31a.dbf')
   DELETE FILE tbal31a.dbf
ENDIF

USE "u:\improve\support\baleq25.dbf" IN 0 Alias bal
SELECT bal
   COPY ALL TO tbal25
USE "u:\improve\support\baleq30.dbf"
   COPY ALL TO tbal30
USE "u:\improve\support\baleq30a.dbf"
   COPY ALL TO tbal30a
USE "u:\improve\support\baleq31a.dbf"
   COPY ALL TO tbal31a
USE

USE tbal25 IN 0 ALIAS bal25
USE tbal30 IN 0 ALIAS bal30
USE tbal30a IN 0 ALIAS bal30a
USE tbal31a IN 0 ALIAS bal31a

SELECT wts

lPrewght = .F.
FOR n = 1 TO FCOUNT("wts")
   IF FIELD(n) = "PREWGHT"
      lPrewght = .T.
   ENDIF
ENDFOR

IF NOT lPrewght
   ALTER TABLE wts ADD COLUMN Prewght N(6,3)
   ALTER TABLE wts ADD COLUMN Postwght N(6,3)
   ALTER TABLE wts ADD COLUMN Diff N(6,3)
   REPLACE ALL Prewght WITH Prebalwt
   REPLACE ALL Postwght WITH Pstbalwt
   REPLACE ALL Diff WITH Postwght-Prewght
```

```
ENDIF

GO TOP
DO WHILE NOT EOF('wts')
   DO GETPREWT
   DO GETPSTWT
   IF  (wts.prewght <> 0 .and. (wts.prewght <> mPrewght)) .or. ;
       (wts.postwght <> 0 .and. (wts.postwght <> mPstwght)) .or. ;
       wts.diff <> mPstwght - mPrewght .and. ;
       wts.postwght<>0
       REPLACE wts.prewght WITH mPrewght
       REPLACE wts.postwght WITH mPstwght
       REPLACE wts.diff WITH mPstwght - mPrewght
   ENDIF
   skip in wts
ENDDO

* Clean up files
SELECT bal25
USE
SELECT bal30
USE
SELECT bal30a
USE
SELECT bal31a
USE
DELETE FILE tbal25.dbf
DELETE FILE tbal30.dbf
DELETE FILE tbal30a.dbf
DELETE FILE tbal31a.dbf

RETURN

************************************************
Procedure GETPREWT
   SELECT wts
   PUBLIC mprecaldate
   mPRINDATE = wts.prindate
   mPRINTIME = wts.printime
   SET DELETED ON
   IF FIELD(1,"wts") = "SITE"
      STORE "Prebalwt" to Fprebalwt    && Select the balance prewt regardless of
   field name
   ELSE
      STORE FIELD(8,"wts") to Fprebalwt
   ENDIF
   mprebalwt = &Fprebalwt
*  IF mseason="B02"
*     mprebalwt = wts.cahn25wt
*  ELSE
*     mprebalwt = wts.prebalwt
*  ENDIF
   Do Case
   Case wts.prbalance = '31' .or. mprebalwt = 0 .or. wts.SAMDAT < {^1996-03-01}
      && Use the PREWGHT for all before A96
      mPREWGHT = wts.prewght
                          && This is because of the 20 mg addition stuff on the
   25
```

```
      mprecaldate = wts.prindate
   Case wts.prbalance = '25'
      SELECT bal25
      Locate For BEGDAT > mPRINDATE
      If Found()
            Skip - 1
      Else
            Goto Bottom
      Endif
      mTAREINT  = tareint
      mTARESLP = tareslp
      mPREWGHT=round(mTAREINT+(mprebalwt*mTARESLP),3)
      mprecaldate = begdat
   Case wts.prbalance = '30'
      Sele bal30
      Locate For BEGDAT > mPRINDATE
      If Found()
            Skip - 1
      Else
            Goto Bottom
      Endif
      mTAREINT  = TAREINT
      mTARESLP = TARESLP
      mPREWGHT=round(mTAREINT+(mprebalwt*mTARESLP),3)
      mprecaldate = begdat
   Case wts.prbalance = '3A'
      Sele bal30a
      Locate For BEGDAT > mPRINDATE
      If Found()
            Skip - 1
      Else
            Goto Bottom
      Endif
      mTAREINT  = TAREINT
      mTARESLP = TARESLP
      mPREWGHT=round(mTAREINT+(mprebalwt*mTARESLP),3)
      mprecaldate = begdat
   Case wts.prbalance = '1A'
      Sele bal31a
      Locate For BEGDAT > mPRINDATE
      If Found()
            Skip - 1
      Else
            Goto Bottom
      Endif
      mTAREINT  = TAREINT
      mTARESLP = TARESLP
      mPREWGHT=round(mTAREINT+(mprebalwt*mTARESLP),3)
      mprecaldate = begdat
   OTHERWISE
      mPREWGHT=mprebalwt
      mprecaldate = begdat
   Endcase
   SELECT wts
Return
************************************************
Procedure GETPSTWT
   SELECT wts
```

```
PUBLIC mpstcaldate
mPOINDATE = wts.poindate
mPOINTIME = wts.pointime
Set Dele on
IF FIELD(1,"wts") = "SITE"
   STORE "Pstbalwt" to Fpstbalwt    && Select the balance pstwt regardless of
field name
ELSE
   STORE FIELD(10,"wts") to Fpstbalwt
ENDIF
mpstbalwt = &Fpstbalwt
Do Case
Case wts.pobalance = '25'
   SELECT bal25
   Locate For BEGDAT > mPoINDATE
   If Found()
         Skip - 1
   Else
         Goto Bottom
   Endif
   mTAREINT  = tareint
   mTARESLP = tareslp
   mPstwght =ROUND(mTAREINT+(mpstbalwt*mTARESLP),3)
   mpstcaldate = begdat
Case wts.pobalance = '30'
   Sele bal30
   Locate For BEGDAT > mPOINDATE
   If Found()
         Skip - 1
   Else
         Goto Bottom
   Endif
   mTAREINT  = TAREINT
   mTARESLP  = TARESLP
   mPstwght =ROUND(mTAREINT+(mpstbalwt*mTARESLP),3)
   mpstcaldate = begdat
Case wts.pobalance = '3A'
   Sele bal30a
   Locate For BEGDAT > mPOINDATE
   If Found()
         Skip - 1
   Else
         Goto Bottom
   Endif
   mTAREINT  = TAREINT
   mTARESLP  = TARESLP
   mPstwght =ROUND(mTAREINT+(mpstbalwt*mTARESLP),3)
   mpstcaldate = begdat
Case wts.pobalance = '1A'
   Sele bal31a
   Locate For BEGDAT > mPOINDATE
   If Found()
         Skip - 1
   Else
         Goto Bottom
   Endif
   mTAREINT  = TAREINT
   mTARESLP  = TARESLP
```

```
      mPstwght =ROUND(mTAREINT+(mpstbalwt*mTARESLP),3)
      mpstcaldate = begdat
   Otherwise                                          &&POBALANCE = 31 and
   POBALANCE = '  '
      mPstwght = wts.postwght                 && This is because of the 20 mg
   addition stuff on the 25
      mpstcaldate = wts.poindate
   Endcase
Return
```

## C.7. Artifacts

```
PROCEDURE artifacts
* Calculate ions artifacts

************************************************************************
* Code added 7/7/2005 by Lowell to calculate quarterly artifacts
* if a month prior to June 2002 (B02) is selected. This allows use
* of the correct quarterly artifacts for all dates prior to B02.
*
* Modified 9/23/2005 by Lowell to calculate separate artifacts in B00
* for 25mm and 37mm filters. Applies only to B00 quarter.
************************************************************************

RELEASE mCLStd, mNO2Std, mNO3Std, mSO4Std, mNH4Std
RELEASE mCLArt, mNO2Art, mNO3Art, mSO4Art, mNH4Art
RELEASE mO1Std, mO2Std, mO3Std, mO4Std, mOPStd, mE1Std, mE2Std, mE3Std
RELEASE mO1Art, mO2Art, mO3Art, mO4Art, mOPArt, mE1Art, mE2Art, mE3Art
RELEASE mO1BStd, mO2BStd, mO3BStd, mO4BStd, mOPBStd, mE1BStd, mE2BStd, mE3BStd
RELEASE mCLoStd,  mNO2oStd, mNO3oStd, mSO4oStd, mNH4oStd    &&Previous month
RELEASE mCLoArt,  mNO2oArt, mNO3oArt, mSO4oArt, mNH4oArt    &&Previous month
RELEASE mCLStd25, mNO2Std25, mNO3Std25, mSO4Std25, mNH4Std25
RELEASE mCLArt25, mNO2Art25, mNO3Art25, mSO4Art25, mNH4Art25
RELEASE mCLStd37, mNO2Std37, mNO3Std37, mSO4Std37, mNH4Std37
RELEASE mCLArt37, mNO2Art37, mNO3Art37, mSO4Art37, mNH4Art37
* RELEASE mO1oStd,  mO2oStd,  mO3oStd,  mO4oStd,  mOPoStd,  mE1oStd,  mE2oStd,
   mE3oStd   &&Previous month
* RELEASE mO1oArt,  mO2oArt,  mO3oArt,  mO4oArt,  mOPoArt,  mE1oArt,  mE2oArt,
   mE3oArt   &&Previous month

PUBLIC mCLStd,  mNO2Std, mNO3Std, mSO4Std, mNH4Std
PUBLIC mCLArt,  mNO2Art, mNO3Art, mSO4Art, mNH4Art
PUBLIC mO1Std,  mO2Std,  mO3Std,  mO4Std,  mOPStd,  mE1Std,  mE2Std,  mE3Std
PUBLIC mO1Art,  mO2Art,  mO3Art,  mO4Art,  mOPArt,  mE1Art,  mE2Art,  mE3Art
PUBLIC mO1BStd, mO2BStd, mO3BStd, mO4BStd, mOPBStd, mE1BStd, mE2BStd, mE3BStd
PUBLIC mCLoStd,  mNO2oStd, mNO3oStd, mSO4oStd, mNH4oStd           &&Previous
   month
PUBLIC mCLoArt,  mNO2oArt, mNO3oArt, mSO4oArt, mNH4oArt           &&Previous
   month
PUBLIC mCLStd25, mNO2Std25, mNO3Std25, mSO4Std25, mNH4Std25
PUBLIC mCLArt25, mNO2Art25, mNO3Art25, mSO4Art25, mNH4Art25
PUBLIC mCLStd37, mNO2Std37, mNO3Std37, mSO4Std37, mNH4Std37
PUBLIC mCLArt37, mNO2Art37, mNO3Art37, mSO4Art37, mNH4Art37
* PUBLIC mO1oStd,  mO2oStd,  mO3oStd,  mO4oStd,  mOPoStd,  mE1oStd,  mE2oStd,
   mE3oStd   &&Previous month
* PUBLIC mO1oArt,  mO2oArt,  mO3oArt,  mO4oArt,  mOPoArt,  mE1oArt,  mE2oArt,
   mE3oArt   &&Previous month

*IF logs.samdat<{^2002-06-01}    && Get quarterly artifact information from
   ARTHIST file*
*  USE &mart IN 0 ALIAS art
*  SELE art
*  GO TOP
*  NewQtr = .F.
*  LOCATE FOR art.qtr=UPPER(mseason)
*  IF EOF("art")
*     WAIT WINDOW AT 10,40 "&mseason not found in ARTHIST.DBF"
```

```
*   ENDIF
*   mCLArt = art.cl
*   mNO2Art = art.no2
*   mNO3Art = art.no3
*   mSO4Art = art.so4
*   mNH4Art = art.nh4
*   mCLStd = art.dcl
*   mNO2Std = art.dno2
*   mNO3Std = art.dno3
*   mSO4Std = art.dso4
*   mNH4Std = art.dnh4
*   mO1Art = art.o1
*   mO2Art = art.o2
*   mO3Art = art.o3
*   mO4Art = art.o4
*   mOPArt = art.op
*   mE1Art = art.e1
*   mE2Art = art.e2
*   mE3Art = art.e3
*   mO1Std = art.do1
*   mO2Std = art.do2
*   mO3Std = art.do3
*   mO4Std = art.do4
*   mOPStd = art.dop
*   mE1Std = art.de1
*   mE2Std = art.de2
*   mE3Std = art.de3

SELECT ions
IF logs.samdat<{^2002-06-01} && Calculate quarterly artifacts
    SET FILTER TO STATUS="FB" AND .NOT. DELETED()
ELSE   && Calculate artifact for a single month
    SET FILTER TO MONTH(samdat) = VAL(mmonth) AND STATUS="FB" AND .NOT. DELETED()
ENDIF

NumArt=1
IF mSeason="B00"    && B00 uses 25mm and 37mm filters. Calculate separate
    artifacts
    NumArt = 2
    SET FILTER TO STATUS="FB" AND .NOT. DELETED() AND bdiam<>"37"  && Calc 25mm
    artifact first
ENDIF

FOR Nart = 1 TO NumArt
    IF SYS(103) != 'ON'
        mTALK = .T.
    ELSE
        mTALK = .F.
    ENDIF
    SET TALK OFF
    COUNT TO ioncount

*Calculate standard deviations of Field Blanks
    CALCULATE STD(cl) TO mCLStd
    CALCULATE STD(no2) TO mNO2Std
    CALCULATE STD(no3) TO mNO3Std
    CALCULATE STD(SO4) TO mSO4Std
*CALCULATE Std(NH4) TO mNH4Std
```

```
   CALCULATE STD(nh4) TO mNH4Std FOR nh4>=0


* Calculate median values of Field Blanks
* Chloride
   SET ORDER TO cl
   GO TOP
   IF MOD(ioncount,2) <> 0
      SKIP (ioncount-1)/2
      mCLArt = cl
   ELSE
      SKIP ioncount/2-1
      mCLArt = cl
      SKIP
      mCLArt = (mCLArt + cl)/2
   ENDIF

* Nitrite
   SET ORDER TO no2
   GO TOP
   IF MOD(ioncount,2) <> 0
      SKIP (ioncount-1)/2
      mNO2Art = no2
   ELSE
      SKIP ioncount/2-1
      mNO2Art = no2
      SKIP
      mNO2Art = (mNO2Art + no2)/2
   ENDIF

* Nitrate
   SET ORDER TO no3
   GO TOP
   IF MOD(ioncount,2) <> 0
      SKIP (ioncount-1)/2
      mNO3Art = no3
   ELSE
      SKIP ioncount/2-1
      mNO3Art = no3
      SKIP
      mNO3Art = (mNO3Art + no3)/2
   ENDIF

* Sulfate
   SET ORDER TO SO4
   GO TOP
   IF MOD(ioncount,2) <> 0
      SKIP (ioncount-1)/2
      mSO4Art = SO4
   ELSE
      SKIP ioncount/2-1
      mSO4Art = SO4
      SKIP
      mSO4Art = (mSO4Art + SO4)/2
   ENDIF

* Ammonium
   SET ORDER TO nh4
```

```
   SET FILTER TO STATUS="FB" AND .NOT. DELETED() AND nh4 >= 0
   IF logs.samdat<{^2002-06-01} && Calculate quarterly artifacts
      SET FILTER TO STATUS="FB" AND .NOT. DELETED() AND nh4 >= 0
   ELSE      && Calculate artifact for a single month
      SET FILTER TO MONTH(samdat) = VAL(mmonth) AND STATUS="FB" AND .NOT.
   DELETED() AND nh4 >= 0
   ENDIF
   COUNT TO nh4count
   GO TOP
   IF MOD(nh4count,2) <> 0
      SKIP (nh4count-1)/2
*  mNH4Art = NH4
      mNH4Art = nh4
   ELSE
      SKIP nh4count/2-1
*  mNH4Art = NH4
      mNH4Art = nh4
      SKIP
*  mNH4Art = (mNH4Art + nh4)/2
      mNH4Art = (mNH4Art + nh4)/2
   ENDIF
   IF mSeason="B00"
      DO CASE
            CASE Nart=1               && Store 25 mm artifact data and
   calculate 37mm artifact
                  mCLStd25  = mCLStd
                  mNO2Std25 = mNO2Std
                  mNO3Std25 = mNO3Std
                  mSO4Std25 = mSO4Std
                  mNH4Std25 = mNH4Std
                  mCLArt25  = mCLArt
                  mNO2Art25 = mNO2Art
                  mNO3Art25 = mNO3Art
                  mSO4Art25 = mSO4Art
                  mNH4Art25 = mNH4Art
                  SET FILTER TO STATUS="FB" AND .NOT. DELETED() AND bdiam="37"
      && Calc 37mm artifact first
            CASE Nart=2               && Store 37 mm artifact data
                  mCLStd37  = mCLStd
                  mNO2Std37 = mNO2Std
                  mNO3Std37 = mNO3Std
                  mSO4Std37 = mSO4Std
                  mNH4Std37 = mNH4Std
                  mCLArt37  = mCLArt
                  mNO2Art37 = mNO2Art
                  mNO3Art37 = mNO3Art
                  mSO4Art37 = mSO4Art
                  mNH4Art37 = mNH4Art
      ENDCASE
   ENDIF
ENDFOR
SET FILTER TO
SET ORDER TO sitdatim

* Calculate SO2 artifacts
SELECT so2
SET FILTER TO STATUS="FB" AND .NOT. DELETED()
COUNT TO so2count
```

```
CALCULATE STD(SO4) TO mso2Std

SET ORDER TO SO4
GO TOP
IF MOD(so2count,2) <> 0
   SKIP (so2count-1)/2
   mSO2Art = SO4
ELSE
   IF so2count>0
      SKIP MAX(0,so2count/2-1)
      mSO2Art = SO4
      SKIP
      mSO2Art = (mSO2Art + SO4)/2
   ELSE
*This is for the case of no FB
      mSO2Art = -999
   ENDIF
ENDIF

SET FILTER TO
SET ORDER TO sitdatim

* Calculate organic artifacts using Secondary Filters
SELECT carbon&& Carbon data file is already selected for a single month
IF logs.samdat<{^2002-06-01} && Calculate quarterly artifacts
   SET FILTER TO STATUS="CS" AND .NOT. DELETED()
ELSE   && Calculate artifact for a single month
   SET FILTER TO MONTH(samdat) = VAL(mmonth) AND STATUS="CS" AND .NOT. DELETED()
ENDIF

COUNT TO carcount

* Calculate standard deviations of Secondary Filters
CALCULATE STD(O1TC) TO mO1Std
CALCULATE STD(O2TC) TO mO2Std
CALCULATE STD(O3TC) TO mO3Std
CALCULATE STD(O4TC) TO mO4Std
CALCULATE STD(OPTC) TO mOPStd
CALCULATE STD(E1TC) TO mE1Std
CALCULATE STD(E2TC) TO mE2Std
CALCULATE STD(E3TC) TO mE3Std

* Calculate median values of Secondary Filters
SET ORDER TO o1
GO TOP
IF MOD(carcount,2) <> 0
   SKIP (carcount-1)/2
   mO1Art = O1TC
ELSE
   SKIP carcount/2-1
   mO1Art = O1TC
   SKIP
   mO1Art = (mO1Art + O1TC)/2
ENDIF

SET ORDER TO o2
GO TOP
IF MOD(carcount,2) <> 0
```

```
    SKIP (carcount-1)/2
    mO2Art = O2TC
ELSE
    SKIP carcount/2-1
    mO2Art = O2TC
    SKIP
    mO2Art = (mO2Art + O2TC)/2
ENDIF

SET ORDER TO o3
GO TOP
IF MOD(carcount,2) <> 0
    SKIP (carcount-1)/2
    mO3Art = O3TC
ELSE
    SKIP carcount/2-1
    mO3Art = O3TC
    SKIP
    mO3Art = (mO3Art + O3TC)/2
ENDIF

SET ORDER TO o4
GO TOP
IF MOD(carcount,2) <> 0
    SKIP (carcount-1)/2
    mO4Art = O4TC
ELSE
    SKIP carcount/2-1
    mO4Art = O4TC
    SKIP
    mO4Art = (mO4Art + O4TC)/2
ENDIF

SET ORDER TO op
GO TOP
IF MOD(carcount,2) <> 0
    SKIP (carcount-1)/2
    mOPArt = OPTC
ELSE
    SKIP carcount/2-1
    mOPArt = OPTC
    SKIP
    mOPArt = (mOPArt + OPTC)/2
ENDIF

SET ORDER TO e1
GO TOP
IF MOD(carcount,2) <> 0
    SKIP (carcount-1)/2
    mE1Art = E1TC
ELSE
    SKIP carcount/2-1
    mE1Art = E1TC
    SKIP
    mE1Art = (mE1Art + E1TC)/2
ENDIF

SET ORDER TO e2
```

```
GO TOP
IF MOD(carcount,2) <> 0
   SKIP (carcount-1)/2
   mE2Art = E2TC
ELSE
   SKIP carcount/2-1
   mE2Art = E2TC
   SKIP
   mE2Art = (mE2Art + E2TC)/2
ENDIF

SET ORDER TO e3
GO TOP
IF MOD(carcount,2) <> 0
   SKIP (carcount-1)/2
   mE3Art = E3TC
ELSE
   SKIP carcount/2-1
   mE3Art = E3TC
   SKIP
   mE3Art = (mE3Art + E3TC)/2
ENDIF

IF logs.samdat<{^2002-06-01} && Calculate quarterly artifacts
   SET FILTER TO STATUS="FB" AND .NOT. DELETED()
ELSE   && Calculate artifact for a single month
   SET FILTER TO MONTH(samdat) = VAL(mmonth) AND STATUS="FB" AND .NOT. DELETED()
ENDIF

* Calculate standard deviations of Field Blanks
CALCULATE STD(O1TC) TO mO1BStd
CALCULATE STD(O2TC) TO mO2BStd
CALCULATE STD(O3TC) TO mO3BStd
CALCULATE STD(O4TC) TO mO4BStd
CALCULATE STD(OPTC) TO mOPBStd
CALCULATE STD(E1TC) TO mE1BStd
CALCULATE STD(E2TC) TO mE2BStd
CALCULATE STD(E3TC) TO mE3BStd

SET FILTER TO STATUS="CP" AND .NOT. DELETED()
SET ORDER TO sitdatim

IF mTALK
   SET TALK ON
ENDIF

USE &mart IN 0 ALIAS art
SELECT art
GO TOP
NewQtr = .F.
LOCATE FOR art.qtr=UPPER(mSeason)
IF EOF("art")
   NewQtr = .T.
ENDIF
LOCATE FOR art.qtr=UPPER(mSeason) AND art.MONTH=VAL(mmonth)
IF EOF("art")
   APPEND BLANK
   GO BOTTOM
```

```
ENDIF
REPLACE art.qtr WITH UPPER(mSeason)
REPLACE art.MONTH WITH VAL(mmonth)
REPLACE art.cl WITH mCLArt
REPLACE art.no2 WITH mNO2Art
REPLACE art.no3 WITH mNO3Art
REPLACE art.SO4 WITH mSO4Art
REPLACE art.nh4 WITH mNH4Art
REPLACE art.so2 WITH mSO2Art
REPLACE art.o1 WITH mO1Art
REPLACE art.o2 WITH mO2Art
REPLACE art.o3 WITH mO3Art
REPLACE art.o4 WITH mO4Art
REPLACE art.op WITH mOPArt
REPLACE art.e1 WITH mE1Art
REPLACE art.e2 WITH mE2Art
REPLACE art.e3 WITH mE3Art
REPLACE art.dcl WITH mCLStd
REPLACE art.dno2 WITH mNO2Std
REPLACE art.dno3 WITH mNO3Std
REPLACE art.dso4 WITH mSO4Std
REPLACE art.dnh4 WITH mNH4Std
REPLACE art.dSO2 WITH mso2Std
REPLACE art.do1 WITH mO1Std
REPLACE art.do2 WITH mO2Std
REPLACE art.do3 WITH mO3Std
REPLACE art.do4 WITH mO4Std
REPLACE art.dop WITH mOPStd
REPLACE art.de1 WITH mE1Std
REPLACE art.de2 WITH mE2Std
REPLACE art.de3 WITH mE3Std

IF mSeason="B00"    &&Store 25mm artifact
   LOCATE FOR art.qtr=UPPER(mSeason) AND art.MONTH=VAL(mmonth+"2")
   IF EOF("art")
      APPEND BLANK
      GO BOTTOM
   ENDIF
   REPLACE art.qtr WITH UPPER(mSeason)
   REPLACE art.MONTH WITH VAL(mmonth+"2")
   REPLACE art.cl WITH mCLArt25
   REPLACE art.no2 WITH mNO2Art25
   REPLACE art.no3 WITH mNO3Art25
   REPLACE art.SO4 WITH mSO4Art25
   REPLACE art.nh4 WITH mNH4Art25
   REPLACE art.so2 WITH mSO2Art
   REPLACE art.o1 WITH mO1Art
   REPLACE art.o2 WITH mO2Art
   REPLACE art.o3 WITH mO3Art
   REPLACE art.o4 WITH mO4Art
   REPLACE art.op WITH mOPArt
   REPLACE art.e1 WITH mE1Art
   REPLACE art.e2 WITH mE2Art
   REPLACE art.e3 WITH mE3Art
   REPLACE art.dcl WITH mCLStd25
   REPLACE art.dno2 WITH mNO2Std25
   REPLACE art.dno3 WITH mNO3Std25
   REPLACE art.dso4 WITH mSO4Std25
```

```
   REPLACE art.dnh4 WITH mNH4Std25
   REPLACE art.dSO2 WITH mso2Std
   REPLACE art.do1 WITH mO1Std
   REPLACE art.do2 WITH mO2Std
   REPLACE art.do3 WITH mO3Std
   REPLACE art.do4 WITH mO4Std
   REPLACE art.dop WITH mOPStd
   REPLACE art.de1 WITH mE1Std
   REPLACE art.de2 WITH mE2Std
   REPLACE art.de3 WITH mE3Std
ENDIF
* Retrieve December 2003 artifacts to use on January 1 & 4, 2004
* for sites that used older nylon filters on those two dates.
IF UPPER(mSeason)="D03" AND VAL(mmonth)=1
   LOCATE FOR art.qtr="D03" AND art.MONTH=12
   IF EOF("art")
      WAIT WINDOW AT 10,40 "No artifacts found for December 2003"
   ENDIF
   mCLoStd = art.dcl
   mNO2oStd = art.dno2
   mNO3oStd = art.dno3
   mSO4oStd = art.dso4
   mNH4oStd = art.dnh4
   mCLoArt = art.cl
   mNO2oArt = art.no2
   mNO3oArt = art.no3
   mSO4oArt = art.SO4
   mNH4oArt = art.nh4
*  mO1oStd = art.dO1             &&The December 2003 carbon artifacts are not
   needed for January 2004
*  mO2oStd = art.dO2
*  mO3oStd = art.dO3
*  mO4oStd = art.dO4
*  mOPoStd = art.dOP
*  mE1oStd = art.dE1
*  mE2oStd = art.dE2
*  mE3oStd = art.dE3
*  mO1oArt = art.O1
*  mO2oArt = art.O2
*  mO3oArt = art.O3
*  mO4oArt = art.O4
*  mOPoArt = art.OP
*  mE1oArt = art.E1
*  mE2oArt = art.E2
*  mE3oArt = art.E3
ENDIF

SELECT art
USE          && Close Artifacts file
SELECT ions
SET FILTER TO LEFT(STATUS,1)<>"F" AND LEFT(STATUS,1)<>"R"

RETURN
```

## C.8. Merge

```
PROCEDURE merge
************************************************************
*
* Merge the data from weights, XRF, laser, ions, and carbon into the output
   database
* Updated August 30, 2004 to add LRNC to the end of the record.
*
* Updated August 4, 2005 to remove DAVI2, MALO1, and MALO2 from processing
*
************************************************************

DIMENSION outdata(184)
STORE -999 TO outdata

*DO SelectSite

SELECT logs
GO TOP
IF mSite="  ALL"
   SET FILTER TO
   wsite = logs.site
ELSE
   SET FILTER TO site = mSite
   GO TOP
   wsite = mSite
ENDIF

mkeytest=0
DO WHILE NOT EOF('logs')

*  DO WHILE EOF('sites') OR INLIST(logs.site, "BLNK1 ", "DAVI1 ", "DAVIS ",
   "HANCS ", "INGAS ")
*  DO WHILE INLIST(logs.site, "BLNK1", "DAVI1", "DAVIS", "HANCS", "INGAS",
   "DAVI2", "MALO1", "MALO2")
   DO WHILE INLIST(logs.site, "BLNK1", "DAVI1", "DAVIS", "HANCS", "INGAS", ;
             "DAVI2", "FARM1", "FARM2", "FARM3", "FARM4", "FARM5", "FARM6")
      SKIP IN logs
   ENDDO && sites

* Display name of site being processed
   IF wsite <> logs.site
      wsite = logs.site
      mkeytest = LASTKEY()
      WAIT WINDOW AT 10,40 wsite NOWAIT
   ENDIF

   SELECT out
   APPEND BLANK
   SCATTER TO outdata

   DO volumes
   DO MASS
   DO ions
   DO carbon
   DO SO2
```

```
    DO elems
    DO laser
    DO composites

* Create output record
    STORE logs.site TO outdata(1)
    outdata(2) = logs.samdat
    outdata(3) = logs.strtim
    outdata(4) = mflowa
    outdata(5) = mflowb
    outdata(6) = mflowc
    outdata(7) = mflowd
    outdata(8) = meta
    outdata(9) = metb
    outdata(10) = metc
    outdata(11) = metd
    outdata(12) = mflaga
    outdata(13) = mflagb
    outdata(14) = mflagc
    outdata(15) = mflagd

    outdata(16) = mmf
    outdata(17) = mmf_err
    outdata(18) = mmf_mdl
    outdata(19) = mmt
    outdata(20) = mmt_err
    outdata(21) = mmt_mdl

    outdata(22) = mCL
    outdata(23) = mCl_Err
    outdata(24) = mCl_MDL
    outdata(25) = mNO2
    outdata(26) = mNO2_Err
    outdata(27) = mNO2_MDL
    outdata(28) = mNO3
    outdata(29) = mNO3_Err
    outdata(30) = mNO3_MDL
    outdata(31) = mSO4
    outdata(32) = mSO4_Err
    outdata(33) = mSO4_MDL
    outdata(34) = mNH4
    outdata(35) = mNH4_Err
    outdata(36) = mNH4_MDL

    outdata(37) = mO1
    outdata(38) = mO1_ERR
    outdata(39) = mO1_MDL
    outdata(40) = mO2
    outdata(41) = mO2_ERR
    outdata(42) = mO2_MDL
    outdata(43) = mO3
    outdata(44) = mO3_ERR
    outdata(45) = mO3_MDL
    outdata(46) = mO4
    outdata(47) = mO4_ERR
    outdata(48) = mO4_MDL
    outdata(49) = mOP
    outdata(50) = mOP_ERR
```

```
outdata(51) = mOP_MDL
outdata(52) = mE1
outdata(53) = mE1_ERR
outdata(54) = mE1_MDL
outdata(55) = mE2
outdata(56) = mE2_ERR
outdata(57) = mE2_MDL
outdata(58) = mE3
outdata(59) = mE3_ERR
outdata(60) = mE3_MDL

outdata(61) = mSO2
outdata(62) = mSO2_err
outdata(63) = mSO2_mdl

FOR N = 1 TO 75
   outdata(63+N) = elements(N)
ENDFOR

outdata(139) = mlrnc
outdata(140) = mlrnc_err
outdata(141) = mlrnc_mdl
outdata(142) = momh
outdata(143) = momh_err
outdata(144) = momh_mdl
outdata(145) = momcn
outdata(146) = momcn_err
outdata(147) = momcn_mdl
outdata(148) = mlacn
outdata(149) = mlacn_err
outdata(150) = mlacn_mdl

outdata(151) = msoil
outdata(152) = msoil_err
outdata(153) = msoil_mdl
outdata(154) = mnhso
outdata(155) = mnhso_err
outdata(156) = mnhso_mdl
outdata(157) = mnhno
outdata(158) = mnhno_err
outdata(159) = mnhno_mdl
outdata(160) = mknon
outdata(161) = mknon_err
outdata(162) = mknon_mdl
outdata(163) = mrcma
outdata(164) = mrcma_err
outdata(165) = mrcma_mdl
outdata(166) = mrcmc
outdata(167) = mrcmc_err
outdata(168) = mrcmc_mdl
outdata(169) = mrcmi
outdata(170) = mrcmi_err
outdata(171) = mrcmi_mdl
outdata(172) = ms3
outdata(173) = ms3_err
outdata(174) = ms3_mdl
outdata(175) = momhc
outdata(176) = momhc_err
```

```
   outdata(177) = momhc_mdl
   outdata(178) = mrcnh
   outdata(179) = mrcnh_err
   outdata(180) = mrcnh_mdl
   outdata(181) = logs.comments
   IF VAL(mYearMonth) > 200412
      outdata(182) = mOPT
      outdata(183) = mOPT_err
      outdata(184) = mOPT_mdl
   ENDIF
   SELECT out
   GATHER FROM outdata

   SELECT logs

   SKIP
ENDDO && logs
RETURN
```

## C.9. Volumes

```
**********************************************************************
*
* Modified 8/19/2003 to correct error in processing status flags
* The problem occurred if FlagA was "NM", "QD", "LF", or "RF" and
* FlagB, FlagC, or FlagD was not. The correct FlagB, C, or D would
* be overwritten, usually with "RF" because the flow rate was 0
* The error was corrected for 12/2002 data.
*
* Modified 1/20/2005 to set flags to PO if ET<18 hours. This should be
* dealt with more comprehensively when we examine flags.
*
* Modified 7/6/2005 by Lowell to use flashcard flow measurements
* starting with C04. The code uses a file of mean flow transducer
* measurements created separately to replace the flow values in logs.
* It does not use the flashcard ET information, but retains the ET
* from logs. The code also finds the flashcard data from Channel E
* to use in the correct Module X channel.
*
* Modified 7/11/2005 by Lowell to add ability to use Vac flow rates. If
* usela, uselb, or uselc are set to "V", the flow for that module will
* be calculated using the Vac readings
*
* Modified 8/3/2005 by Lowell to correct coding error. The error resulted
* in assigning an incorrect TempC for calculating flow rate on the A
* channel (rarely on the B or C). The TempC variable was assigned before
* repositioning the pointer to the correct spot in the calibration file.
* It is now assigned correctly after filtering the file and positioning
* the record pointer at the bottom.
*
* Modified 8/9/2005 by Lowell to correct error in handling temperature.
* The error occured when useld<>"T". The program would then replace
* logs.tempcur with flash.TempC. The code should have tested uselt, not
* useld.
*
* Modified 8/10/2005 by Lowell to correct another error associated with
* incorporating FC data into logs. The SITEX relation between LOGS and
* FLASH must use only the first four characters of the site name. All
* other names should use all five characters, particularly SITE9 and SITE5
*
* Modified 9/05/05 to calculate D module flow rate using MAG for Version I
* sampler. Looks in LOGS file for version to decide.
*
* Modified 9/14/05 to correct error in linking to MAG and VAC when using
* "N" flags. Had to add "sitecode=logs.site" to filter condition.
*
* Modified 10/10/05 to add "AND NOT DELETED()" to filter condition on
* all calibration files. Calibrations may stay in the cal files marked
* for deletion, but now they are not used.
*
* Modified 10/12/2005 by Lowell to remove date dependence of temperature
* correction on flow calculation.
*
* Modified 10/12/2005 by Lowell to insert A, B, and C flow flags from
* Nicole's file into temporary logs file for processing. NOTE: THIS WILL
* NEED TO BE ADDRESSED IN FUTURE DATA DELIVERIES
```

```
*
* Modified 10/13/2005 by Lowell to replace code to create my flow flags
* prior to using Nicole's flow flags. Also reset limits to match Nicole's
* flow limits. There were some quarters with no flow flags in Nicole's file.
*
* Modified 10/14/2005 by Nicole to correct modifications on 10/13.
*
* Modified 12/6/2005 by Lowell to add 0.00001 to the mag value applied to
* the LOG10 calculation. When the Mag values are zero, this sets a non-zero
* lower limit that still results in a zero flow. It also does not affect
* the actual flow rate in any noticeable way.
*
* Modifed 12/6/2005 to add " AND NOT EOF('flash')" to the CASE statement
* when replacing logs.mag readings with flash readings. This allows the
* logs file to be the default in case there is no flash data.
*********************************************************************

PROCEDURE volumes

PUBLIC mFLOWA, mFLOWB, mFLOWC, mFLOWD
PUBLIC mETA,   mETB,   mETC,   mETD
PUBLIC mVOLA,  mVOLB,  mVOLC,  mVOLD
PUBLIC mAreaA, mAreaB, mAreaC, mAreaD
PUBLIC mCONVA, mCONVB, mCONVC, mCONVD
PUBLIC mFlagA, mFlagB, mFlagC, mFlagD
PUBLIC mBDiam, mInlet

* Set flag to "PO" if ET<18
IF logs.af1et < 18 AND logs.af1nm ="NM"
   REPLACE logs.af1nm WITH "PO"
ENDIF
IF logs.bf1et < 18 AND logs.bf1nm ="NM"
   REPLACE logs.bf1nm WITH "PO"
ENDIF
IF logs.cf1et < 18 AND logs.cf1nm ="NM"
   REPLACE logs.cf1nm WITH "PO"
ENDIF
IF logs.df1et < 18 AND logs.df1nm ="NM"
   REPLACE logs.df1nm WITH "PO"
ENDIF

*********************************************************************
* If 1/1/2005 or later, use ET and flow information from the        *
* Flashcard Database program                                        *
*********************************************************************


*********************************************************************
* If C04 or later, replace log flow readings with flashcard averages *
*    But don't make the replacement if the logs flag is set         *
*********************************************************************
*IF logs.site="SAFO1"
*  SUSPEND
*ENDIF
IF logs.samdat>{9/1/2004}
   IF RIGHT(logs.site,1)="X"     && Insert Channel E flash data into X-mod
   channel
      SELECT flash
```

```
	SET ORDER TO site4date
	SELECT logs
	SET RELATION OFF INTO flash
	SET RELATION TO LEFT(logs.site,4) + DTOC(logs.samdat) INTO flash ADDITIVE
	xmod = sites.config
	IF xmod="A"
		DO CASE
			CASE UPPER(logs.usela)="N"
				SELECT mag
				SET FILTER TO sitecode=logs.site AND channel="A1" AND
DATE<=logs.samdat AND NOT DELETED()
				GO BOTTOM
				REPLACE logs.af1mi WITH mag.nom_flow
				REPLACE logs.af1mf WITH mag.nom_flow
				SELECT vac
				SET FILTER TO sitecode=logs.site AND channel="A1" AND
DATE<=logs.samdat AND NOT DELETED()
				GO BOTTOM
				REPLACE logs.af1gi WITH vac.nom_flow
				REPLACE logs.af1gf WITH vac.nom_flow
			CASE INLIST(UPPER(logs.usela),"F", " ", "V") AND NOT
EOF('flash')
				REPLACE logs.af1mi WITH flash.emagrsd
				REPLACE logs.af1mf WITH flash.emagrsd
				REPLACE logs.af1gi WITH flash.evacrsd
				REPLACE logs.af1gf WITH flash.evacrsd
		ENDCASE
	ENDIF
	IF xmod="B"
		DO CASE
			CASE UPPER(logs.uselb)="N"
				SELECT mag
				SET FILTER TO sitecode=logs.site AND channel="B1" AND
DATE<=logs.samdat AND NOT DELETED()
				GO BOTTOM
				REPLACE logs.bf1mi WITH mag.nom_flow
				REPLACE logs.bf1mf WITH mag.nom_flow
				SELECT vac
				SET FILTER TO sitecode=logs.site AND channel="B1" AND
DATE<=logs.samdat AND NOT DELETED()
				GO BOTTOM
				REPLACE logs.bf1gi WITH vac.nom_flow
				REPLACE logs.bf1gf WITH vac.nom_flow
			CASE INLIST(UPPER(logs.uselb),"F", " ", "V") AND NOT
EOF('flash')
				REPLACE logs.bf1mi WITH flash.emagrsd
				REPLACE logs.bf1mf WITH flash.emagrsd
				REPLACE logs.bf1gi WITH flash.evacrsd
				REPLACE logs.bf1gf WITH flash.evacrsd
		ENDCASE
	ENDIF
	IF xmod="C"
		DO CASE
			CASE UPPER(logs.uselc)="N"
				SELECT mag
				SET FILTER TO sitecode=logs.site AND channel="C1" AND
DATE<=logs.samdat AND NOT DELETED()
				GO BOTTOM
```

```
                        REPLACE logs.cf1mi WITH mag.nom_flow
                        REPLACE logs.cf1mf WITH mag.nom_flow
                        SELECT vac
                        SET FILTER TO sitecode=logs.site AND channel="C1" AND
DATE<=logs.samdat AND NOT DELETED()
                        GO BOTTOM
                        REPLACE logs.cf1gi WITH vac.nom_flow
                        REPLACE logs.cf1gf WITH vac.nom_flow
                 CASE INLIST(UPPER(logs.uselc),"F", " ", "V") AND NOT
EOF('flash')
                        REPLACE logs.cf1mi WITH flash.emagrsd
                        REPLACE logs.cf1mf WITH flash.emagrsd
                        REPLACE logs.cf1gi WITH flash.evacrsd
                        REPLACE logs.cf1gf WITH flash.evacrsd
          ENDCASE
   ENDIF
   IF xmod="D"
          DO CASE
                 CASE UPPER(logs.useld)="N"
                        SELECT vac
                        SET FILTER TO sitecode=logs.site AND channel="D1" AND
DATE<=logs.samdat AND NOT DELETED()
                        GO BOTTOM
                        REPLACE logs.df1gi WITH vac.nom_flow
                        REPLACE logs.df1gf WITH vac.nom_flow
                 CASE INLIST(UPPER(logs.useld),"F", " ", "V") AND NOT
EOF('flash')
                        REPLACE logs.df1gi WITH flash.evacrsd
                        REPLACE logs.df1gf WITH flash.evacrsd
          ENDCASE
   ENDIF
   DO CASE
          CASE UPPER(logs.uselt)="N"
                 SELECT mag
                 SET FILTER TO sitecode=logs.site AND channel="A1" AND
DATE<=logs.samdat AND NOT DELETED()
                 GO BOTTOM
                 REPLACE logs.tempcur WITH mag.tempc
          CASE UPPER(logs.uselt)<>"T"
                 REPLACE logs.tempcur WITH flash.tempc
   ENDCASE
ELSE               && Not an X-mod, so insert all flash data into logs
   SELECT flash
   SET ORDER TO sitedate
   SELECT logs
   SET RELATION OFF INTO flash
   SET RELATION TO logs.site + DTOC(logs.samdat) INTO flash ADDITIVE
   DO CASE
          CASE UPPER(logs.usela)="N"
                 SELECT mag
                 SET FILTER TO sitecode=logs.site AND channel="A1" AND
DATE<=logs.samdat AND NOT DELETED()
                 GO BOTTOM
                 REPLACE logs.af1mi WITH mag.nom_flow
                 REPLACE logs.af1mf WITH mag.nom_flow
                 SELECT vac
                 SET FILTER TO sitecode=logs.site AND channel="A1" AND
DATE<=logs.samdat AND NOT DELETED()
```

```
                  GO BOTTOM
                  REPLACE logs.af1gi WITH vac.nom_flow
                  REPLACE logs.af1gf WITH vac.nom_flow
            CASE INLIST(UPPER(logs.usela),"F", " ", "V") AND NOT EOF('flash')
                  REPLACE logs.af1mi WITH flash.amagrsd
                  REPLACE logs.af1mf WITH flash.amagrsd
                  REPLACE logs.af1gi WITH flash.avacrsd
                  REPLACE logs.af1gf WITH flash.avacrsd
      ENDCASE
      DO CASE
            CASE UPPER(logs.uselb)="N"
                  SELECT mag
                  SET FILTER TO sitecode=logs.site AND channel="B1" AND
   DATE<=logs.samdat AND NOT DELETED()
                  GO BOTTOM
                  REPLACE logs.bf1mi WITH mag.nom_flow
                  REPLACE logs.bf1mf WITH mag.nom_flow
                  SELECT vac
                  SET FILTER TO sitecode=logs.site AND channel="B1" AND
   DATE<=logs.samdat AND NOT DELETED()
                  GO BOTTOM
                  REPLACE logs.bf1gi WITH vac.nom_flow
                  REPLACE logs.bf1gf WITH vac.nom_flow
            CASE INLIST(UPPER(logs.uselb),"F", " ", "V") AND NOT EOF('flash')
                  REPLACE logs.bf1mi WITH flash.bmagrsd
                  REPLACE logs.bf1mf WITH flash.bmagrsd
                  REPLACE logs.bf1gi WITH flash.bvacrsd
                  REPLACE logs.bf1gf WITH flash.bvacrsd
      ENDCASE
      DO CASE
            CASE UPPER(logs.uselc)="N"
                  SELECT mag
                  SET FILTER TO sitecode=logs.site AND channel="C1" AND
   DATE<=logs.samdat AND NOT DELETED()
*                 SELECT logs
*                 SELECT mag
                  GO BOTTOM
                  REPLACE logs.cf1mi WITH mag.nom_flow
                  REPLACE logs.cf1mf WITH mag.nom_flow
                  SELECT vac
                  SET FILTER TO sitecode=logs.site AND channel="C1" AND
   DATE<=logs.samdat AND NOT DELETED()
*                 SELECT logs
*                 SELECT vac
                  GO BOTTOM
                  REPLACE logs.cf1gi WITH vac.nom_flow
                  REPLACE logs.cf1gf WITH vac.nom_flow
            CASE INLIST(UPPER(logs.uselc),"F", " ", "V") AND NOT EOF('flash')
                  REPLACE logs.cf1mi WITH flash.cmagrsd
                  REPLACE logs.cf1mf WITH flash.cmagrsd
                  REPLACE logs.cf1gi WITH flash.cvacrsd
                  REPLACE logs.cf1gf WITH flash.cvacrsd
      ENDCASE
      DO CASE
            CASE UPPER(logs.useld)="N"
                  SELECT vac
                  SET FILTER TO sitecode=logs.site AND channel="D1" AND
   DATE<=logs.samdat AND NOT DELETED()
```

```
                    GO BOTTOM
                    REPLACE logs.df1gi WITH vac.nom_flow
                    REPLACE logs.df1gf WITH vac.nom_flow
             CASE INLIST(UPPER(logs.useld),"F", " ") AND NOT EOF('flash')
                    REPLACE logs.df1gi WITH flash.dvacrsd
                    REPLACE logs.df1gf WITH flash.dvacrsd
      ENDCASE
      DO CASE
             CASE UPPER(logs.uselt)="N"
                    SELECT mag
                    SET FILTER TO sitecode=logs.site AND channel="A1" AND
   DATE<=logs.samdat AND NOT DELETED()
                    GO BOTTOM
                    REPLACE logs.tempcur WITH mag.tempc
             CASE UPPER(logs.uselt)<>"T"
                    REPLACE logs.tempcur WITH flash.tempc
      ENDCASE
   ENDIF
ENDIF
*
* Done with replacing logs flows with flashcard flows. Now to calculate actual
   flows
*

*Module A ************************************************
IF RIGHT(logs.site,1)="9"
   SELECT vac
   SET FILTER TO sitecode=logs.site AND channel="A1" AND DATE <= logs.samdat AND
   NOT DELETED()
   GO BOTTOM
*  mTempc = IIF(logs.samdat>={^2004-01-01}, 293., vac.tempc+273.)
   mTempc = 293.    && Changed 12/12/2005 to properly calculate flow rates
   mFLOWA = IIF(INLIST(logs.af1nm, &ValidStat),;
      ROUND((vac.A_Davis+vac.B_Davis*(logs.af1gi+logs.af1gf)/2+0.00001)*;
      vac.Elevfact*;
      SQRT((logs.tempcur+273.)/(mTempc)),1),0)
   mETA = logs.af1et
   mAreaA = 3.53
*
* For SITE9, set a flow flag based on calculated flow
*
   IF INLIST(logs.af1nm, &NMLFRF)
      DO CASE
             CASE   vac.inlet = 'WED' .AND.;
                           (     BETWEEN(mFLOWA,15.0,17.0)   .OR. ;
                          BETWEEN(mFLOWA,21.0,23.0) ).AND. ;
                          .NOT. INLIST(logs.site,'BLNK1')
                    mFlagA = 'LF'
             CASE   vac.inlet = 'WED'  .AND. ;
                           (     mFLOWA < 15.0   .OR.  ;
                          mFLOWA > 23.0) .AND. ;
                          .NOT. INLIST(logs.site,'BLNK1')
                    mFlagA = 'RF'
             CASE   vac.inlet <> 'WED' .AND.;
                           (     BETWEEN(mFLOWA ,13.0,15.0)   .OR. ;
                          BETWEEN(mFLOWA ,19.0,21.0) ).AND. ;
                          .NOT. INLIST(logs.site,'BLNK1')
                    mFlagA = 'LF'
```

```
            CASE   vac.inlet <> 'WED'  .AND. ;
                         (     mFLOWA < 13.0   .OR.  ;
                        mFLOWA > 21.0) .AND. ;
                        .NOT. INLIST(logs.site,'BLNK1')
                   mFlagA = 'RF'
            OTHERWISE
                   mFlagA = logs.af1nm
      ENDCASE
   ELSE
      mFlagA = logs.af1nm
   ENDIF

   mVOLA = IIF(INLIST(logs.af1nm, &ValidStat),;
      mFLOWA*mETA*60/1000,0)
   mCONVA = IIF(INLIST(logs.af1nm, &ValidStat),;
      mVOLA/mAreaA,3)
   mInlet = vac.inlet
ELSE   && Not a Site 9
   SELECT mag       && Calculate mag flow rate
   SET FILTER TO sitecode=logs.site AND channel="A1" AND DATE <= logs.samdat AND
   NOT DELETED()
   GO BOTTOM
*  mTempc = IIF(logs.samdat>={^2004-01-01}, 293., mag.tempc+273.)
   mTempc = 293.    && Changed 12/12/2005 to properly calculate flow rates
   mFLOWA = IIF(INLIST(logs.af1nm, &ValidStat),;

      ROUND(10^(mag.A_Davis+mag.B_Davis*LOG10((logs.af1mi+logs.af1mf)/2+0.00001)
   )*;
      mag.Elevfact*;
      SQRT((logs.tempcur+273.)/(mTempc)),1),0)
   IF logs.samdat>{9/1/2004}
      IF logs.usela = "V" && Calculate vac flow rate
            SELECT vac
            SET FILTER TO sitecode=logs.site AND channel="A1" AND DATE <=
   logs.samdat AND NOT DELETED()
            GO BOTTOM
            mFLOWA = IIF(INLIST(logs.af1nm, &ValidStat),;

      ROUND((vac.A_Davis+vac.B_Davis*(logs.af1gi+logs.af1gf)/2+0.00001)*;
                  vac.Elevfact*;
                  SQRT((logs.tempcur+273.)/(mTempc)),1),0)
      ENDIF
   ENDIF
   mETA = logs.af1et
   mAreaA = logs.area
*  IF INLIST(logs.af1nm, &ValidStat)
   IF INLIST(logs.af1nm, &NMLFRF)
      DO CASE
            CASE mFLOWA < 15           && Added by Nicole 10/14/05
                  mFlagA = 'CL'
            CASE mFLOWA < 18           && Added by Nicole 10/14/05
                  mFlagA = 'CG'
            CASE (BETWEEN(mFLOWA,19.0,21.3) .OR. BETWEEN(mFLOWA,24.3,27.0));
                        .AND. .NOT. INLIST(logs.site,'BLNK1')
                  mFlagA = 'LF'
            CASE (mFLOWA < 19.0 .OR. mFLOWA > 27.0);
                        .AND. .NOT. INLIST(logs.site,'BLNK1')
                  mFlagA = 'RF'
```

```
            OTHERWISE
                  mFlagA = logs.af1nm
      ENDCASE
   ELSE
      mFlagA = logs.af1nm
   ENDIF

* Apply flow flags from Nicole's file for years 2000-2004
   SELECT logs
   IF BETWEEN(logs.samdat, {1/1/2000}, {12/31/2004})
      IF NOT EOF("FlowFlags")
            DO CASE
                  CASE mFlagA = "CG" AND FlowFlags.a_flag = "CL"
                        mFlagA = FlowFlags.a_flag
                  CASE INLIST(mFlagA,"NM", "QD", "UN", "SW", "SP", "AA", "LF",
   "RF", "NR");
                                    AND FlowFlags.a_flag <> "NM"
                              mFlagA = FlowFlags.a_flag
            ENDCASE
      ENDIF
   ENDIF
*  mFlagA = logs.af1nm           &&deleted by Nicole 10/14/05

   mVOLA = IIF(INLIST(logs.af1nm, &ValidStat),;
      mFLOWA*mETA*60/1000,0)
   mCONVA = IIF(INLIST(logs.af1nm, &ValidStat),;
      mVOLA/mAreaA,3)
ENDIF
*Module B ************************************************
IF RIGHT(logs.site,1)="9"
   SELECT vac
   SET FILTER TO sitecode=logs.site AND channel="B1" AND DATE <= logs.samdat AND
   NOT DELETED()
   GO BOTTOM
*  mTempc = IIF(logs.samdat>={^2004-01-01}, 293., vac.tempc+273.)
   mTempc = 293.    && Changed 12/12/2005 to properly calculate flow rates
   mFLOWB = IIF(INLIST(logs.bf1nm, &ValidStat),;
      ROUND((vac.A_Davis+vac.B_Davis*(logs.bf1gi+logs.bf1gf)/2+0.00001)*;
      vac.Elevfact*;
      SQRT((logs.tempcur+273.)/(mTempc)),1),0)
   mETB = logs.bf1et
   mAreaB = 3.53
*  IF INLIST(logs.af1nm, &ValidStat)
   IF INLIST(logs.bf1nm, &NMLFRF)
      DO CASE
            CASE   vac.inlet = 'WED' .AND.;
                        (     BETWEEN(mFLOWB,15.0,17.0)   .OR. ;
                       BETWEEN(mFLOWB,21.0,23.0) ).AND. ;
                       .NOT. INLIST(logs.site,'BLNK1')
                  mFlagB = 'LF'
            CASE   vac.inlet = 'WED'  .AND. ;
                        (     mFLOWB < 15.0   .OR.  ;
                       mFLOWB > 23.0) .AND. ;
                       .NOT. INLIST(logs.site,'BLNK1')
                  mFlagB = 'RF'
            CASE   vac.inlet <> 'WED' .AND.;
                        (     BETWEEN(mFLOWB ,13.0,15.0)   .OR. ;
                       BETWEEN(mFLOWB ,19.0,21.0) ).AND. ;
```

```
                        .NOT. INLIST(logs.site,'BLNK1')
                  mFlagB = 'LF'
            CASE  vac.inlet <> 'WED'  .AND. ;
                        (     mFLOWB < 13.0   .OR.  ;
                        mFLOWB > 21.0) .AND. ;
                        .NOT. INLIST(logs.site,'BLNK1')
                  mFlagB = 'RF'
            OTHERWISE
                  mFlagB = logs.bf1nm
      ENDCASE
   ELSE
      mFlagB = logs.bf1nm
   ENDIF

   mVOLB = IIF(INLIST(logs.bf1nm, &ValidStat),;
      mFLOWB*mETB*60/1000,0)
****** What is mCONVB used for?
   mCONVB = IIF(INLIST(logs.bf1nm, &ValidStat),;
      mVOLB/mAreaB,3)
   mInlet = vac.inlet
ELSE
   SELECT mag       && Calculate mag flow rate
   SET FILTER TO sitecode=logs.site AND channel="B1" AND DATE <= logs.samdat AND
   NOT DELETED()
   GO BOTTOM
*  mTempc = IIF(logs.samdat>={^2004-01-01}, 293., mag.tempc+273.)
   mTempc = 293.    && Changed 12/12/2005 to properly calculate flow rates
   mFLOWB = IIF(INLIST(logs.bf1nm, &ValidStat),;

      ROUND(10^(mag.A_Davis+mag.B_Davis*LOG10((logs.bf1mi+logs.bf1mf)/2+0.00001)
   )*;
      mag.Elevfact*;
      SQRT((logs.tempcur+273.)/(mTempc)),1),0)
   IF logs.samdat>{9/1/2004}
      IF logs.uselb = "V" && Calculate vac flow rate
            SELECT vac
            SET FILTER TO sitecode=logs.site AND channel="B1" AND DATE <=
   logs.samdat AND NOT DELETED()
            GO BOTTOM
            mFLOWB = IIF(INLIST(logs.bf1nm, &ValidStat),;

      ROUND((vac.A_Davis+vac.B_Davis*(logs.bf1gi+logs.bf1gf)/2+0.00001)*;
                  vac.Elevfact*;
                  SQRT((logs.tempcur+273.)/(mTempc)),1),0)
      ENDIF
   ENDIF
   mETB = logs.bf1et
*  mAreaB = 3.53
   mAreaB = 6.15    && 37mm diameter filter - 28mm diameter deposit
   mBDiam = IIF(logs.samdat<{10/1/1999}, "25", MAX("25", logs.bdiam))
*  IF INLIST(logs.bf1nm, &ValidStat)
   IF INLIST(logs.bf1nm, &NMLFRF)
      DO CASE
            CASE mFLOWB < 15          && Added by Nicole 10/14/05
                  mFlagB = 'CL'
            CASE mFLOWB < 18          && Added by Nicole 10/14/05
                  mFlagB = 'CG'
            CASE (BETWEEN(mFLOWB,19.0,21.3) .OR. BETWEEN(mFLOWB,24.3,27.0));
```

```
                        .AND. .NOT. INLIST(logs.site,'BLNK1')
                mFlagB = 'LF'
            CASE (mFLOWB < 19.0 .OR. mFLOWB > 27.0);
                        .AND. .NOT. INLIST(logs.site,'BLNK1')
                mFlagB = 'RF'
            OTHERWISE
                mFlagB = logs.bf1nm
      ENDCASE
   ELSE
      mFlagB = logs.bf1nm
   ENDIF

* Apply flow flags from Nicole's file for years 2000-2004
   SELECT logs
   IF BETWEEN(logs.samdat, {1/1/2000}, {12/31/2004})
      IF NOT EOF("FlowFlags")
            DO CASE
                CASE mFlagB = "CG" AND FlowFlags.b_flag = "CL"
                      mFlagB = FlowFlags.b_flag
                CASE INLIST(mFlagB,"NM", "QD", "UN", "SW", "SP", "AA", "LF",
   "RF", "NR");
                                AND FlowFlags.b_flag <> "NM"
                        mFlagB = FlowFlags.b_flag
            ENDCASE
      ENDIF
   ENDIF
*  mFlagB = logs.bf1nm           &&deleted by Nicole 10/14/05

   mVOLB = IIF(INLIST(logs.bf1nm, &ValidStat),;
      mFLOWB*mETB*60/1000,0)
   mCONVB = IIF(INLIST(logs.bf1nm, &ValidStat),;
      mVOLB/mAreaB,3)
ENDIF
*Module C ************************************************
IF RIGHT(logs.site,1)="9"
   SELECT vac
   SET FILTER TO sitecode=logs.site AND channel="C1" AND DATE <= logs.samdat AND
   NOT DELETED()
   GO BOTTOM
*  mTempc = IIF(logs.samdat>={^2004-01-01}, 293., vac.tempc+273.)
   mTempc = 293.    && Changed 12/12/2005 to properly calculate flow rates
   mFLOWC = IIF(INLIST(logs.cf1nm, &ValidStat),;
      ROUND((vac.A_Davis+vac.B_Davis*(logs.cf1gi+logs.cf1gf)/2+0.00001)*;
      vac.Elevfact*;
      SQRT((logs.tempcur+273.)/(mTempc)),1),0)
   mETC = logs.cf1et
   mAreaC = 3.53
*  IF INLIST(logs.af1nm, &ValidStat)
   IF INLIST(logs.cf1nm, &NMLFRF)
      DO CASE
            CASE   vac.inlet = 'WED' .AND.;
                        (     BETWEEN(mFLOWC,15.0,17.0)   .OR. ;
                        BETWEEN(mFLOWC,21.0,23.0) ).AND. ;
                        .NOT. INLIST(logs.site,'BLNK1')
                mFlagC = 'LF'
            CASE   vac.inlet = 'WED'  .AND. ;
                        (     mFLOWC < 15.0   .OR.  ;
                        mFLOWC > 23.0) .AND. ;
```

```
                        .NOT. INLIST(logs.site,'BLNK1')
                  mFlagC = 'RF'
            CASE  vac.inlet <> 'WED' .AND.;
                        (     BETWEEN(mFLOWC ,13.0,15.0)   .OR. ;
                        BETWEEN(mFLOWC ,19.0,21.0) ).AND. ;
                        .NOT. INLIST(logs.site,'BLNK1')
                  mFlagC = 'LF'
            CASE  vac.inlet <> 'WED'  .AND. ;
                        (     mFLOWC < 13.0   .OR.  ;
                        mFLOWC > 21.0) .AND. ;
                        .NOT. INLIST(logs.site,'BLNK1')
                  mFlagC = 'RF'
            OTHERWISE
                  mFlagC = logs.bf1nm
      ENDCASE
   ELSE
      mFlagC = logs.bf1nm
   ENDIF

   mVOLC = IIF(INLIST(logs.cf1nm, &ValidStat),;
      mFLOWC*mETC*60/1000,0)
   mCONVC = IIF(INLIST(logs.cf1nm, &ValidStat),;
      mVOLC/mAreaC,3)
   mInlet = vac.inlet
ELSE
   SELECT mag       && Calculate mag flow rate
   SET FILTER TO sitecode=logs.site AND channel="C1" AND DATE <= logs.samdat AND
   NOT DELETED()
   GO BOTTOM
*  mTempc = IIF(logs.samdat>={^2004-01-01}, 293., mag.tempc+273.)
   mTempc = 293.    && Changed 12/12/2005 to properly calculate flow rates
   mFLOWC = IIF(INLIST(logs.cf1nm, &ValidStat),;

      ROUND(10^(mag.A_Davis+mag.B_Davis*LOG10((logs.cf1mi+logs.cf1mf)/2+0.00001)
   )*;
      mag.Elevfact*;
      SQRT((logs.tempcur+273.)/(mTempc)),1),0)
   IF logs.samdat>{9/1/2004}
      IF logs.uselc = "V" && Calculate vac flow rate
            SELECT vac
            SET FILTER TO sitecode=logs.site AND channel="C1" AND DATE <=
   logs.samdat AND NOT DELETED()
            GO BOTTOM
            mFLOWC = IIF(INLIST(logs.cf1nm, &ValidStat),;

      ROUND((vac.A_Davis+vac.B_Davis*(logs.cf1gi+logs.cf1gf)/2+0.00001)*;
                  vac.Elevfact*;
                  SQRT((logs.tempcur+273.)/(mTempc)),1),0)
      ENDIF
   ENDIF
   mETC = logs.cf1et
   mAreaC = 3.53
*           IF INLIST(logs.af1nm, &ValidStat)
*                 IF INLIST(logs.af1nm,'NM','QD','LF','RF') AND
   INLIST(logs.cf1nm,'NM','CG','LF','RF')
   IF INLIST(logs.cf1nm, &NMLFRF)
      DO CASE
            CASE mFLOWC < 15          && Added by Nicole 10/14/05
```

```
                mFlagC = 'CL'
            CASE mFLOWC < 18          && Added by Nicole 10/14/05
                mFlagC = 'CG'
            CASE (BETWEEN(mFLOWC,19.0,21.3) .OR. BETWEEN(mFLOWC,24.3,27.0));
                    .AND. .NOT. INLIST(logs.site,'BLNK1')
                mFlagC = 'LF'
            CASE (mFLOWC < 19.0 .OR. mFLOWC > 27.0);
                    .AND. .NOT. INLIST(logs.site,'BLNK1')
                mFlagC = 'RF'
            OTHERWISE
                mFlagC = logs.cf1nm
      ENDCASE
   ELSE
      mFlagC = logs.cf1nm
   ENDIF

* Apply flow flags from Nicole's file for years 2000-2004
   SELECT logs
   IF BETWEEN(logs.samdat, {1/1/2000}, {12/31/2004})
      IF NOT EOF("FlowFlags")
            DO CASE
                CASE mFlagC = "CG" AND FlowFlags.c_flag = "CL"
                      mFlagC = FlowFlags.c_flag
                CASE INLIST(mFlagC,"NM", "QD", "UN", "SW", "SP", "AA", "LF",
   "RF", "NR");
                                AND FlowFlags.c_flag <> "NM"
                      mFlagC = FlowFlags.c_flag
            ENDCASE
      ENDIF
   ENDIF
*  mFlagC = logs.cf1nm           &&deleted by Nicole 10/14/05

   mVOLC = IIF(INLIST(logs.cf1nm, &ValidStat),;
      mFLOWC*mETC*60/1000,0)
   mCONVC = IIF(INLIST(logs.cf1nm, &ValidStat),;
      mVOLC/mAreaC,3)
ENDIF
* Module D ************************************************
IF logs.sampler="VER2"
   SELECT vac
   SET FILTER TO sitecode=logs.site AND channel="D1" AND DATE <= logs.samdat AND
   NOT DELETED()
   GO BOTTOM
*  mTempc = IIF(logs.samdat>={^2004-01-01}, 293., vac.tempc+273.)
   mTempc = 293.    && Changed 12/12/2005 to properly calculate flow rates
   mFLOWD = IIF(INLIST(logs.df1nm, &ValidStat),;
      ROUND((vac.A_Davis+vac.B_Davis*(logs.df1gi+logs.df1gf)/2)*;
      vac.Elevfact*;
      SQRT((logs.tempcur+273.)/(mTempc)),1),0)
ELSE   && VER1 sampler
   SELECT mag       && Calculate mag flow rate
   SET FILTER TO sitecode=logs.site AND channel="D1" AND DATE <= logs.samdat AND
   NOT DELETED()
   GO BOTTOM
   mTempc = mag.tempc+273
   mFLOWD = IIF(INLIST(logs.df1nm, &ValidStat),;
```

```
       ROUND(10^(mag.A_Davis+mag.B_Davis*LOG10((logs.df1mi+logs.df1mf)/2+0.00001)
   )*;
       mag.Elevfact*;
       SQRT((logs.tempcur+273.)/(mTempc)),1),0)
ENDIF
mETD = logs.df1et
mAreaD = 3.53
*IF INLIST(logs.bf1nm, &ValidStat)
*IF INLIST(logs.bf1nm,'NM','QD','LF','RF') AND
   INLIST(logs.df1nm,'NM','CG','LF','RF')
IF INLIST(logs.df1nm, &NMLFRF)
   DO CASE
      CASE   vac.inlet = 'WED' .AND.;
                    (      BETWEEN(mFLOWD,15.0,17.0)    .OR. ;
                   BETWEEN(mFLOWD,21.0,23.0) ).AND. ;
                   .NOT. INLIST(logs.site,'BLNK1')
             mFlagD = 'LF'
      CASE   vac.inlet = 'WED'  .AND. ;
                    (      mFLOWD < 15.0   .OR.  ;
                   mFLOWD > 23.0) .AND. ;
                   .NOT. INLIST(logs.site,'BLNK1')
             mFlagD = 'RF'
      CASE   vac.inlet <> 'WED' .AND.;
                    (      BETWEEN(mFLOWD,13.0,15.0)    .OR. ;
                   BETWEEN(mFLOWD,19.0,21.0) ).AND. ;
                   .NOT. INLIST(logs.site,'BLNK1')
             mFlagD = 'LF'
      CASE   vac.inlet <> 'WED'  .AND. ;
                    (      mFLOWD < 13.0   .OR.  ;
                   mFLOWD > 21.0) .AND. ;
                   .NOT. INLIST(logs.site,'BLNK1')
             mFlagD = 'RF'
      OTHERWISE
             mFlagD = logs.df1nm
   ENDCASE
ELSE
   mFlagD = logs.df1nm
ENDIF

mVOLD = IIF(INLIST(logs.df1nm, &ValidStat),;
   mFLOWD*mETD*60/1000,0)
mCONVD = IIF(INLIST(logs.df1nm, &ValidStat),;
   mVOLD/mAreaD,3)
mInlet = vac.inlet
RETURN
```

## C.10. Mass

```
PROCEDURE mass

************************************************************************
* Calculate mass concentration, err, and mdl
*
* Modified 9/22/05 by Lowell to exclude FB records from calculation.
* The LOCATE command stops at the first record that matches the criteria.
* If the FB record precedes the NM record, the mass was being calculated
* from the FB record. Now it selects the correct record
*
************************************************************************

PUBLIC mMF, mMF_err, mMF_mdl, mMT, mMT_err, mMT_mdl

SELECT wts

****************** PM10 mass ******************
LOCATE FOR wts.site=logs.site AND wts.samdat=logs.samdat AND
   wts.strtim=logs.strtim AND wts.chan="D1" AND wts.status<>"FB"
If INLIST(mflagd, &ValidStat)
   IF .NOT. EOF('wts') .AND. wts.postwght <> 0 .AND. mvold <>0 .AND. not
   inlist(wts.status,"UN","XX")
      mMT = 1000*(wts.postwght - wts.prewght)*1000/mvold
      mMT_err = 1000*SQRT((5/mvold)^2 + (mMT/1000*mmfvol)^2)
      mMT_mdl = 1000*10/mvold
   ELSE
      mMT = -999
      mMT_err = -999
      mMT_mdl = -999
   ENDIF
   IF inlist(wts.status,"SW","UN","XX")
      mflagd = wts.status
   ENDIF
ELSE
   mMT = -999
   mMT_err = -999
   mMT_mdl = -999
ENDIF

****************** Fine mass ******************
LOCATE FOR wts.site=logs.site AND wts.samdat=logs.samdat AND
   wts.strtim=logs.strtim AND wts.chan="A1" AND wts.status<>"FB"
If INLIST(mflaga, &ValidStat)
   IF .NOT. EOF('wts') .AND. wts.postwght <> 0 .AND. mvola <>0 .AND. not
   inlist(wts.status,"UN","XX")
      mMF = 1000*(wts.postwght - wts.prewght)*1000/mvola
      mMF_err = 1000*SQRT((5/mvola)^2 + (mMF/1000*mmfvol)^2)
      mMF_mdl = 1000*10/mvola
   ELSE
      mMF = -999
      mMF_err = -999
      mMF_mdl = -999
   ENDIF
   IF inlist(wts.status,"SW","UN","XX")
      mflaga = wts.status
```

```
    ENDIF
ELSE
    mMF = -999
    mMF_err = -999
    mMF_mdl = -999
ENDIF

RETURN
```

## C.11. Ions

```
PROCEDURE ions
* Calculate ions concentrations
*
************************************************************************
*
* Modified 11/17/2005 to add analytical mdl for Cl, NO2, NO3, SO4, and NH4
* to conterr.dbf and use them if field blanks stdev is zero.
*
************************************************************************

PUBLIC mCl,  mCl_Err,  mCl_MDL
PUBLIC mNO2, mNO2_Err, mNO2_MDL
PUBLIC mNO3, mNO3_Err, mNO3_MDL
PUBLIC mSO4, mSO4_Err, mSO4_MDL
PUBLIC mNH4, mNH4_Err, mNH4_MDL

IF mSeason="B00"
   DO CASE
      CASE logs.bdiam="37"
            mCLStd  = mCLStd37
            mNO2Std = mNO2Std37
            mNO3Std = mNO3Std37
            mSO4Std = mSO4Std37
            mNH4Std = mNH4Std37
            mCLArt  = mCLArt37
            mNO2Art = mNO2Art37
            mNO3Art = mNO3Art37
            mSO4Art = mSO4Art37
            mNH4Art = mNH4Art37
      OTHERWISE
            mCLStd  = mCLStd25
            mNO2Std = mNO2Std25
            mNO3Std = mNO3Std25
            mSO4Std = mSO4Std25
            mNH4Std = mNH4Std25
            mCLArt  = mCLArt25
            mNO2Art = mNO2Art25
            mNO3Art = mNO3Art25
            mSO4Art = mSO4Art25
            mNH4Art = mNH4Art25
   ENDCASE
ENDIF
lCLStd = mCLStd
lNO2Std = mNO2Std
lNO3Std = mNO3Std
lSO4Std = mSO4Std
lNH4Std = mNH4Std
lCLArt = mCLArt
lNO2Art = mNO2Art
lNO3Art = mNO3Art
lSO4Art = mSO4Art
lNH4Art = mNH4Art
* Test for use of old nylon filter lot on 1/1/04 or 1/4/04 for selected sites
IF INLIST(samdat, {^2004-01-01}, {^2004-01-04})
```

```
   IF INLIST(site, "ADPI1", "AREN1", "BAND1", "BIBE1", "BIBEX", "BLIS1",
   "BOAP1", "BRCA1",;
             "BRET1", "BRID1", "BRID9", "BRMA1", "CABA1", "CABI1", "CACO1",
   "CANY1",;
             "CAPI1", "CEBL1", "CHAS1", "CHER1", "CHIC1", "CHIR1", "CLPE1",
   "COHI1") .OR. ;
             INLIST(site,"CORI1", "CRLA1", "DENA1", "DETR1", "DEVA1", "DOME1",
   "ELDO1", "ELLI1",;
             "FLAT1", "FOPE1", "GICL1", "GRBA1", "GRSA1", "GUMO1", "HALE1",
   "HAVO1",;
             "HEGL1", "KAIS1", "KALM1", "LASU1", "MAVI1", "MEVE1", "MEVEX",
   "MKGO1") .OR. ;
             INLIST(site,"MOHO1", "MONT1", "MORA1", "MORA9", "NOAB1", "NOCH1",
   "OLTO1", "ORPI1",;
             "PASA1", "PEFO1", "PMRF1", "PMRFX", "PORE1", "QUCI1", "QURE1",
   "QUREX",;
             "REDW1", "SACR1", "SAFO1", "SAFOX", "SAMA1", "SAPE1", "SAWE1",
   "SAWT1") .OR. ;
             INLIST(site,"SEQU1", "SEQU9", "SIAN1", "SIKE1", "SNPA1", "SYCA1",
   "TALL1", "THBA1",;
             "THSI1", "TONT1", "TRIN1", "VILA1", "WARI1", "WEMI1", "WHPA1",
   "WHRI1",;
             "WIMO1", "YELL1", "YOSE1", "ZION1")
      lCLStd = mCLoStd
      lNO2Std = mNO2oStd
      lNO3Std = mNO3oStd
      lSO4Std = mSO4oStd
      lNH4Std = mNH4oStd
      lCLArt = mCLoArt
      lNO2Art = mNO2oArt
      lNO3Art = mNO3oArt
      lSO4Art = mSO4oArt
      lNH4Art = mNH4oArt
   ELSE
      lCLStd = mCLStd
      lNO2Std = mNO2Std
      lNO3Std = mNO3Std
      lSO4Std = mSO4Std
      lNH4Std = mNH4Std
      lCLArt = mCLArt
      lNO2Art = mNO2Art
      lNO3Art = mNO3Art
      lSO4Art = mSO4Art
      lNH4Art = mNH4Art
   ENDIF
ENDIF

*BOWA used the old lot for 1/7/04 through 1/19/04 by mistake. 1/7/04 and 1/10/04
   were EP samples - not run
IF INLIST(samdat, {^2004-01-13}, {^2004-01-16}, {^2004-01-19}) AND site="BOWA1"
   lCLStd = mCLoStd
   lNO2Std = mNO2oStd
   lNO3Std = mNO3oStd
   lSO4Std = mSO4oStd
   lNH4Std = mNH4oStd
   lCLArt = mCLoArt
   lNO2Art = mNO2oArt
   lNO3Art = mNO3oArt
```

```
   lSO4Art = mSO4oArt
   lNH4Art = mNH4oArt
ENDIF

SELECT ions
SET ORDER TO sitdatim
SET FILTER TO LEFT(STATUS,1)<>"F" AND LEFT(STATUS,1)<>"R"
SELECT logs
SELECT ions
IF INLIST(mflagb, &ValidStat)
   IF .NOT. EOF('ions') .AND. mvolb <>0
      IF INLIST(ions.STATUS, &ValidStat)
            IF ions.STATUS="SW"
                  mflagb=ions.STATUS
            ENDIF
****************** Chloride ******************
            mCl     = 1000*(ions.cl - lCLArt)/mvolb
*     mCl_Err = 1000*SQRT((mMFVOL*mcl/1000)^2 + (mcocl*mcl/1000)^2 +
   (lClSTD/mvolb)^2)
            mCl_Err = 1000*SQRT(lCLStd^2 + 2*(lCLArt)*(mCOCL^2)*MAX(0,ions.cl-
   lCLArt);
                  + mCOCL^2*(ions.cl-lCLArt)^2+ mMFVOL^2*(ions.cl-
   lCLArt)^2)/mvolb
            mCl_MDL = 1000*2*MAX(lCLStd,mdlcl)/mvolb

****************** Nitrite ******************
            mNO2     = 1000*(ions.NO2 - lNO2Art)/mvolb
            IF mNO2 > 0
*           mNO2_Err = 1000*SQRT((mMFVOL*mNO2/1000)^2 + (mcoNO2*mNO2/1000)^2 +
   (lNO2STD/mvolb)^2)
                  mNO2_Err = 1000*SQRT(lNO2Std^2 +
   2*(lNO2Art)*(mCONO2^2)*(ions.NO2-lNO2Art);
                        + (mCONO2*(ions.NO2-lNO2Art))^2+ (mMFVOL*(ions.NO2-
   lNO2Art))^2)/mvolb
            ELSE
                  mNO2_Err = 0
            ENDIF
            mNO2_MDL = 1000*2*MAX(lNO2Std,mdlno2)/mvolb


****************** Nitrate ******************
            mNO3     = 1000*(ions.NO3 - lNO3Art)/mvolb
*     mNO3_Err = 1000*SQRT((mMFVOL*mNO3/1000)^2 + (mcoNO3*mNO3/1000)^2 +
   (lNO3STD/mvolb)^2)
            mNO3_Err = 1000*SQRT(lNO3Std^2 + 2*(lNO3Art)*(mCONO3^2)*(ions.NO3-
   lNO3Art);
                  + mCONO3^2*(ions.NO3-lNO3Art)^2+ mMFVOL^2*(ions.NO3-
   lNO3Art)^2)/mvolb
            mNO3_MDL = 1000*2*MAX(lNO3Std,mdlno3)/mvolb

****************** Sulfate ******************
            mSO4     = 1000*(ions.SO4 - lSO4Art)/mvolb
*     mSO4_Err = 1000*SQRT((mMFVOL*mSO4/1000)^2 + (mcoSO4*mSO4/1000)^2 +
   (lSO4STD/mvolb)^2)
            mSO4_Err = 1000*SQRT(lSO4Std^2 + 2*(lSO4Art)*(mCOSO4^2)*(ions.SO4-
   lSO4Art);
                  + mCOSO4^2*(ions.SO4-lSO4Art)^2+ mMFVOL^2*(ions.SO4-
   lSO4Art)^2)/mvolb
```

```
            mSO4_MDL = 1000*2*MAX(lSO4Std,mdlso4)/mvolb

****************** Ammonium ******************
* Must account for records with NH4 values.
            IF EOF('nh4sites')
                  REPLACE ions.nh4 WITH -999
            ELSE
                  IF logs.samdat<nh4sites.startdate OR
   logs.samdat>nh4sites.enddate
                        REPLACE ions.nh4 WITH -999
                  ENDIF
            ENDIF
*           IF ions.nh4=0  AND NOT INLIST(ions.site,
   "COHU1","DOSO1","EVER1","GRSM1","GRSM9","JARI1","LIGO1","MACA1","ROMA1","SAMA
   1","SHEN1","SHRO1","SWAN1","MACAX","SIPS1")
*                 REPLACE ions.nh4 WITH -999
*           ENDIF
            IF ions.nh4 >= 0
                  mNH4     = 1000*(ions.nh4- lNH4Art)/mvolb
                  mNH4_Err = 1000*SQRT((mMFVOL*mNH4/1000)^2 +
   (mcoNH4*mNH4/1000)^2 + (lNH4Std/mvolb)^2)
                  mNH4_MDL = 1000*2*MAX(lNH4Std,mdlnh4)/mvolb
            ELSE
                  mNH4     = -999
                  mNH4_Err = -999
                  mNH4_MDL = -999
            ENDIF
      ELSE
            mCl      = -999
            mCl_Err  = -999
            mCl_MDL  = -999
            mNO2     = -999
            mNO2_Err = -999
            mNO2_MDL = -999
            mNO3     = -999
            mNO3_Err = -999
            mNO3_MDL = -999
            mSO4     = -999
            mSO4_Err = -999
            mSO4_MDL = -999
            mNH4     = -999
            mNH4_Err = -999
            mNH4_MDL = -999
            mflagb = ions.STATUS
      ENDIF
   ELSE
      mCl      = -999
      mCl_Err  = -999
      mCl_MDL  = -999
      mNO2     = -999
      mNO2_Err = -999
      mNO2_MDL = -999
      mNO3     = -999
      mNO3_Err = -999
      mNO3_MDL = -999
      mSO4     = -999
      mSO4_Err = -999
      mSO4_MDL = -999
```

```
       mNH4     = -999
       mNH4_Err = -999
       mNH4_MDL = -999
   ENDIF
ELSE
   mCl      = -999
   mCl_Err  = -999
   mCl_MDL  = -999
   mNO2     = -999
   mNO2_Err = -999
   mNO2_MDL = -999
   mNO3     = -999
   mNO3_Err = -999
   mNO3_MDL = -999
   mSO4     = -999
   mSO4_Err = -999
   mSO4_MDL = -999
   mNH4     = -999
   mNH4_Err = -999
   mNH4_MDL = -999
ENDIF

RETURN
```

## C.12. Carbon

```
PROCEDURE carbon

* Calculate carbon concentrations
* Modified 1/4/2006 to include new carbon pyrolysis fraction in DRI data.
   Beginning with January 2004
*  data, DRI is including OP calculated with both reflectance and transmittance
   levels. Beginning
*  with D04, then, the carbon files contain OPR and OPT values.
*
* DRI reports micrograms/filter. This program converts them to nanograms/cubic
   meter of air sampled.
*

PUBLIC mO1, mO1_Err, mO1_MDL
PUBLIC mO2, mO2_Err, mO2_MDL
PUBLIC mO3, mO3_Err, mO3_MDL
PUBLIC mO4, mO4_Err, mO4_MDL
PUBLIC mOP, mOP_Err, mOP_MDL
PUBLIC mOPT, mOPT_Err, mOPT_MDL
PUBLIC mE1, mE1_Err, mE1_MDL
PUBLIC mE2, mE2_Err, mE2_MDL
PUBLIC mE3, mE3_Err, mE3_MDL
PUBLIC mOC, mOC_Err, mOC_Mdl
PUBLIC mEC, mEC_Err, mEC_Mdl


IF INLIST(mflagc, &ValidStat)
   IF .NOT. EOF('carbon') .AND. mvolc <>0
      IF carbon.STATUS="SW"
            mflagc=carbon.STATUS
      ENDIF
      mO1     = 1000*(carbon.O1tc - mO1Art)/mvolc
      mO1_Err = 1000*SQRT(mO1Std^2 + 2*(mO1Art)*(mCOO1^2)*(carbon.O1tc-mO1Art);
            + (mCOO1*(carbon.O1tc-mO1Art))^2 + (mMFVOL*(carbon.O1tc-
   mO1Art))^2)/mvolc
      mO1_MDL = 1000*2*mO1Std/mvolc

      mO2     = 1000*(carbon.O2tc - mO2Art)/mvolc
      mO2_Err = 1000*SQRT(mO2Std^2 + 2*(mO2Art)*(mCOO2^2)*(carbon.O2tc-mO2Art);
            + (mCOO2*(carbon.O2tc-mO2Art))^2 + (mMFVOL*(carbon.O2tc-
   mO2Art))^2)/mvolc
      mO2_MDL = 1000*2*mO2Std/mvolc

      mO3     = 1000*(carbon.O3tc - mO3Art)/mvolc
      mO3_Err = 1000*SQRT(mO3Std^2 + 2*(mO3Art)*(mCOO3^2)*(carbon.O3tc-mO3Art);
            + (mCOO3*(carbon.O3tc-mO3Art))^2 + (mMFVOL*(carbon.O3tc-
   mO3Art))^2)/mvolc
      mO3_MDL = 1000*2*mO3Std/mvolc

      mO4     = 1000*(carbon.O4tc - mO4Art)/mvolc
      mO4_Err = 1000*SQRT(mO4Std^2 + 2*(mO4Art)*(mCOO4^2)*(carbon.O4tc-mO4Art);
            + (mCOO4*(carbon.O4tc-mO4Art))^2 + (mMFVOL*(carbon.O4tc-
   mO4Art))^2)/mvolc
      mO4_MDL = 1000*2*mO4Std/mvolc
```

```
      mE1     = 1000*(carbon.E1tc - mE1Art)/mvolc
      mE1_Err = 1000*SQRT(mE1Std^2 + 2*(mE1Art)*(mCOE1^2)*(carbon.E1tc-mE1Art);
            + (mCOE1*(carbon.E1tc-mE1Art))^2 + (mMFVOL*(carbon.E1tc-
   mE1Art))^2)/mvolc
      mE1_MDL = 1000*2*mE1Std/mvolc

      mE2     = 1000*(carbon.E2tc - mE2Art)/mvolc
      mE2_Err = 1000*SQRT(mE2Std^2 + 2*(mE2Art)*(mCOE2^2)*(carbon.E2tc-mE2Art);
            + (mCOE2*(carbon.E2tc-mE2Art))^2 + (mMFVOL*(carbon.E2tc-
   mE2Art))^2)/mvolc
      mE2_MDL = 1000*2*mE2Std/mvolc
      mE3     = 1000*(carbon.E3tc - mE3Art)/mvolc
      mE3_Err = 1000*SQRT(mE3Std^2 + 2*(mE3Art)*(mCOE3^2)*(carbon.E3tc-mE3Art);
            + (mCOE3*(carbon.E3tc-mE3Art))^2 + (mMFVOL*(carbon.E3tc-
   mE3Art))^2)/mvolc
      mE3_MDL = 1000*2*mE3Std/mvolc

** Starting with D04 use both OPR and OPT data. Prior to D04, use only OP - Not
   implemented yet
*     IF samdat<{12/1/2004}
      mOP     = 1000*(carbon.OPtc - mOPArt)/mvolc
      mOP_Err = 1000*SQRT(mOPStd^2 + 2*(mOPArt)*(mCOOP^2)*(carbon.OPtc-mOPArt);
            + (mCOOP*(carbon.OPtc-mOPArt))^2 + (mMFVOL*(carbon.OPtc-
   mOPArt))^2)/mvolc
      mOP_MDL = 1000*2*mOPStd/mvolc
*     ELSE
*           mOP     = 1000*(carbon.OPtrc - mOPArt)/mvolc
*           mOP_Err = 1000*SQRT(mOPStd^2 + 2*(mOPArt)*(mCOOP^2)*(carbon.OPtrc-
   mOPArt);
*                 + (mCOOP*(carbon.OPtrc-mOPArt))^2 + (mMFVOL*(carbon.OPtrc-
   mOPArt))^2)/mvolc
*           mOP_MDL = 1000*2*mOPStd/mvolc
*
*           mOPT     = 1000*(carbon.OPttc - mOPTArt)/mvolc
*           mOPT_Err = 1000*SQRT(mOPTStd^2 +
   2*(mOPTArt)*(mCOOP^2)*(carbon.OPttc-mOPTArt);
*                 + (mCOOP*(carbon.OPttc-mOPTArt))^2 + (mMFVOL*(carbon.OPttc-
   mOPTArt))^2)/mvolc
*           mOPT_MDL = 1000*2*mOPTStd/mvolc
*     ENDIF

      mOC     = mO1 + mO2 + mO3 + mO4 + mOP
      mOC_Err = SQRT((120^2) + (0.05*mOC)^2)
      mEC     = mE1 + mE2 + mE3 - mOP
      mEC_Err = SQRT((34^2) + (0.07*mEC)^2)
   ELSE
      mO1      = -999
      mO1_Err  = -999
      mO1_MDL  = -999
      mO2     = -999
      mO2_Err = -999
      mO2_MDL = -999
      mO3     = -999
      mO3_Err = -999
      mO3_MDL = -999
      mO4     = -999
      mO4_Err = -999
      mO4_MDL = -999
```

```
      mOP     = -999
      mOP_Err = -999
      mOP_MDL = -999
      mOPT     = -999
      mOPT_Err = -999
      mOPT_MDL = -999
      mE1      = -999
      mE1_Err  = -999
      mE1_MDL  = -999
      mE2     = -999
      mE2_Err = -999
      mE2_MDL = -999
      mE3     = -999
      mE3_Err = -999
      mE3_MDL = -999
      mOC     = -999
      mOC_Err = -999
      mOC_Mdl = -999
      mEC     = -999
      mEC_Err = -999
      mEC_Mdl = -999
   ENDIF
ELSE
   mO1     = -999
   mO1_Err = -999
   mO1_MDL = -999
   mO2     = -999
   mO2_Err = -999
   mO2_MDL = -999
   mO3     = -999
   mO3_Err = -999
   mO3_MDL = -999
   mO4     = -999
   mO4_Err = -999
   mO4_MDL = -999
   mOP     = -999
   mOP_Err = -999
   mOP_MDL = -999
   mOPT     = -999
   mOPT_Err = -999
   mOPT_MDL = -999
   mE1     = -999
   mE1_Err = -999
   mE1_MDL = -999
   mE2     = -999
   mE2_Err = -999
   mE2_MDL = -999
   mE3     = -999
   mE3_Err = -999
   mE3_MDL = -999
   mOC     = -999
   mOC_Err = -999
   mOC_Mdl = -999
   mEC     = -999
   mEC_Err = -999
   mEC_Mdl = -999
ENDIF
```

```
RETURN
```

## C.13. $SO_2$

```
PROCEDURE SO2
* Calculate SO2 concentrations

PUBLIC mSO2, mSO2_err, mSO2_mdl

*SELECT so2
*SET ORDER TO sitdatim
*SET FILTER TO left(status,1)<>"F" and left(status,1)<>"R"
*SELECT logs
*SELECT so2
*If INLIST(mflagb, &ValidStat)
*   IF .NOT. EOF('ions') .AND. mvolb <>0

mSO2 = -999
mSO2_err = -999
mSO2_mdl =-999

RETURN
```

## C.14. Elems

```
PROCEDURE elems

************************************************************************
* Calculate elemental concentrations.
* Originally used Fe from Mo-XRF. Changed to YFe from Cu-XRF in ???
*
* Modified 10/11/2005 by Lowell to add spectral interference adjustment
* for XRF data. Prior to sole use of XRF, the S and AL concentrations
* were adjusted for interference from PB and BR within the PIXE analysis
* routines.
*
* Modified 10/12/2005 by Lowell to disallow the spectral correction from
* making S or Al negative
************************************************************************

PUBLIC elements(75)
PUBLIC  mH,  mH_err,  mH_mdl, mNa, mNa_err, mNa_mdl, mAl, mAl_err, mAl_mdl
PUBLIC mSi, mSi_err, mSi_mdl,  mS,  mS_err,  mS_mdl,  mK,  mK_err,  mK_mdl
PUBLIC mCa, mCa_err, mCa_mdl, mFe, mFe_err, mFe_mdl, mTi, mTi_err, mTi_mdl

SELECT elements

IF INLIST(mflaga, 'UN', &ValidStat);
       .AND. .NOT. DELETED('elements');
       .AND. .NOT. EOF('elements') .AND. wts.postwght <> 0 .AND. mvola <>0
   IF samdat >= {12/1/2001}             && Started Cu-XRF reporting on 12/1/2001
       SCATTER TO elements FIELDS;
              H,   H_ERR,   H_MDL,;
              YNA, YNA_ERR, YNA_MDL,;
              YMG, YMG_ERR, YMG_MDL,;
              YAL, YAL_ERR, YAL_MDL,;
              YSI, YSI_ERR, YSI_MDL,;
              YP,  YP_ERR,  YP_MDL,;
              YS,  YS_ERR,  YS_MDL,;
              YCL, YCL_ERR, YCL_MDL,;
              YK,  YK_ERR,  YK_MDL,;
              YCA, YCA_ERR, YCA_MDL,;
              YTI, YTI_ERR, YTI_MDL,;
              YV,  YV_ERR,  YV_MDL,;
              YCR, YCR_ERR, YCR_MDL,;
              YMN, YMN_ERR, YMN_MDL,;
              YFE, YFE_ERR, YFE_MDL,;
              NI,  NI_ERR,  NI_MDL,;
              CU,  CU_ERR,  CU_MDL,;
              ZN,  ZN_ERR,  ZN_MDL,;
              AS,  AS_ERR,  AS_MDL,;
              PB,  PB_ERR,  PB_MDL,;
              SE,  SE_ERR,  SE_MDL,;
              BR,  BR_ERR,  BR_MDL,;
              RB,  RB_ERR,  RB_MDL,;
              SR,  SR_ERR,  SR_MDL,;
              ZR,  ZR_ERR,  ZR_MDL
*
* Correct Pb/S and Br/Al interference
* Modified 10/12/2005 to disallow negative numbers
```

```
*
       Elements(19) = MAX(0,Elements(19)-0.74*Elements(58))
       Elements(10) = MAX(0,Elements(10)-0.62*Elements(64))

   ELSE                                                  && PIXE data prior to
   12/1/2001
      SCATTER TO elements FIELDS;
             H,   H_ERR,   H_MDL,;
             PNA, PNA_ERR, PNA_MDL,;
             PMG, PMG_ERR, PMG_MDL,;
             PAL, PAL_ERR, PAL_MDL,;
             PSI, PSI_ERR, PSI_MDL,;
             PP,  PP_ERR,  PP_MDL,;
             PS,  PS_ERR,  PS_MDL,;
             PCL, PCL_ERR, PCL_MDL,;
             PK,  PK_ERR,  PK_MDL,;
             PCA, PCA_ERR, PCA_MDL,;
             PTI, PTI_ERR, PTI_MDL,;
             PV,  PV_ERR,  PV_MDL,;
             PCR, PCR_ERR, PCR_MDL,;
             PMN, PMN_ERR, PMN_MDL,;
             FE,  FE_ERR,  FE_MDL,; && Changed this to Mo-XRF FE data-LLA
   7/14/04
             NI,  NI_ERR,  NI_MDL,;
             CU,  CU_ERR,  CU_MDL,;
             ZN,  ZN_ERR,  ZN_MDL,;
             AS,  AS_ERR,  AS_MDL,;
             PB,  PB_ERR,  PB_MDL,;
             SE,  SE_ERR,  SE_MDL,;
             BR,  BR_ERR,  BR_MDL,;
             RB,  RB_ERR,  RB_MDL,;
             SR,  SR_ERR,  SR_MDL,;
             ZR,  ZR_ERR,  ZR_MDL
   ENDIF

* Convert from ng/cm2 to ng/m3
   FOR N=1 TO 75
      elements(N) = elements(N)*logs.area/mvola
   ENDFOR

ELSE
   FOR N=1 TO 75
      elements(N) = -999
   ENDFOR
ENDIF

IF NOT INLIST(elements.pesstat, &ValidStat)
   FOR N=1 TO 3
      elements(N) = -999
   ENDFOR
ENDIF

IF logs.samdat>{12/1/2001}       && Use status flags for Cu-XRF
   IF NOT INLIST(elements.xrcstat, &ValidStat)
      FOR N=4 TO 45
            elements(N) = -999
      ENDFOR
   ENDIF
```

```
   IF NOT INLIST(elements.xrmstat, &ValidStat)
      FOR N=46 TO 75
            elements(N) = -999
      ENDFOR
   ENDIF
ELSE                                    && Use status flags for PIXE prior to
   12/1/2001
   IF NOT INLIST(elements.pixstat, &ValidStat)
      FOR N=4 TO 42
            elements(N) = -999
      ENDFOR
   ENDIF
   IF NOT INLIST(elements.xrmstat, &ValidStat)
      FOR N=43 TO 75
            elements(N) = -999
      ENDFOR
   ENDIF
ENDIF

*Store some elemens in memory for later calculations
mH      = elements(1)
mH_err  = elements(2)
mH_mdl  = elements(3)
mNa     = elements(4)
mNa_err = elements(5)
mNa_mdl = elements(6)
mAl     = elements(10)
mAl_err = elements(11)
mAl_mdl = elements(12)
mSi     = elements(13)
mSi_err = elements(14)
mSi_mdl = elements(15)
mS      = elements(19)
mS_err  = elements(20)
mS_mdl  = elements(21)
mK      = elements(25)
mK_err  = elements(26)
mK_mdl  = elements(27)
mCa     = elements(28)
mCa_err = elements(29)
mCa_mdl = elements(30)
mTi     = elements(31)
mTi_err = elements(32)
mTi_mdl = elements(33)
mFe     = elements(43)
mFe_err = elements(44)
mFe_mdl = elements(45)

RETURN
```

## C.15. Laser

```
PROCEDURE laser
* Calculate LRNC from laser data

PUBLIC mLRNC, mLRNC_err, mLRNC_mdl


IF INLIST(mFlagA, &ValidStat)
   IF .NOT. EOF('laser') .AND. mvola <>0 .AND. laser.status <> "XX" ;
      .AND. .NOT. DELETED('laser') .AND. laser.T1>0
* From BRAVO        REPLACE LRNC_err WITH SQRT((mav*225)^2 + (.03*lrnc)^2)/100
* From BRAVO        REPLACE LRNC_mdl WITH mav*4.50
* From Brian        mLRNC_err = ((0.1/(1000-laser.R1))*SQRT(1+((1000-
   laser.R1)/laser.T1)^2))/(mConvA*10000)
* Code below is from VAUXDATA
      mLRNC = 10000 * LOG((1000-laser.R1)/laser.T1) / mConvA
      mLRNC_eRR = SQRT((10000*0.045/(2*mCONVA))^2 + (mMFVol*mLRNC)^2)
      mLRNC_mDL = 10000. * 0.045/mCONVA
      mLRNC_mDL = IIF(mLRNC < 0.0 .and. mLRNC_mDL = 0.0,ABS(mLRNC),mLRNC_mDL)
      mLRNC     = IIF(mLRNC < mLRNC_mDL,0.0,mLRNC)
      mLRNC_eRR = IIF(mLRNC < mLRNC_mDL,0.0,mLRNC_eRR)
   ELSE
      mLRNC = -999
      mLRNC_err = -999
      mLRNC_mdl =-999
   ENDIF
ELSE
   mLRNC = -999
   mLRNC_err = -999
   mLRNC_mdl =-999
ENDIF

RETURN
```

## C.16. Composites

```
PROCEDURE Composites
* Calculate composite species
* 6/17/04 Nicole changed OMC calculation.  OMC calculated with
*  negative carbon fractions. Calculation used to convert negative
*  carbon fractions into zeros.
* 4/6/05  Lowell changed the uncertainty calculation for OMC and LAC.
*   Does not affect data sent to CIRA.

PUBLIC mOMH,  mOMH_err,  mOMH_mdl
PUBLIC mOMCN, mOMCN_err, mOMCN_mdl
PUBLIC mLACN, mLACN_err, mLACN_mdl
PUBLIC mSOIL, mSOIL_err, mSOIL_mdl
PUBLIC mNHSO, mNHSO_err, mNHSO_mdl
PUBLIC mNHNO, mNHNO_err, mNHNO_mdl
PUBLIC mKNON, mKNON_err, mKNON_mdl
PUBLIC mRCMA, mRCMA_err, mRCMA_mdl
PUBLIC mRCMC, mRCMC_err, mRCMC_mdl
PUBLIC mRCMI, mRCMI_err, mRCMI_mdl
PUBLIC mS3,   mS3_err,   mS3_mdl
PUBLIC mRCNH, mRCNH_err, mRCNH_mdl
PUBLIC mOMHC, mOMHC_err, mOMHC_mdl

*********************************OMH*********
If mH > 0.and.mS > mS_mDL
   mOMH      = 13.75*(mH - (0.25*mS))
   mOMH_eRR = 13.75 * Sqrt((0.25*mS_eRR)^2 + mH_eRR^2)
   mOMH_mDL  = 0
Else
   mOMH     = -999
   mOMH_err = -999
   mOMH_mdl = -999
Endif

*****************************OMCN*********
If mO1 > 0 .or. mO1_eRR > 0
   mOMCN      = 1.4*(mO1 + mO2 + mO3 + mO4 + mOP)
* Uncertainty calculation changed 4/6/05. Does not affect data sent to CIRA.
*  mOMCN_eRR = 1.4*Sqrt((MAX(0,mO1_eRR))^2 + (MAX(0,mO2_eRR))^2 +
   (MAX(0,mO3_eRR))^2 + (MAX(0,mO4_eRR))^2 + (MAX(0,mOP_eRR))^2)
   mOMCN_eRR = SQRT((168)^2 + (0.05*mOMCN)^2)
   mOMCN_mDL  = 0
Else
   mOMCN     = -999
   mOMCN_err = -999
   mOMCN_mdl = -999
Endif

*******************************LACN*********
If mE1 > 0 .or. mE1_eRR > 0
   mLACN      = (mE1 + mE2 + mE3 - mOP)
* Uncertainty calculation changed 4/6/05. Does not affect data sent to CIRA.
*  mLACN_eRR = Sqrt((MAX(0,mE1_eRR))^2 + (MAX(0,mE2_eRR))^2 + (MAX(0,mE3_eRR))^2
   + (MAX(0,mOP_eRR))^2)
   mLACN_eRR = SQRT((34)^2 + (0.07*mLACN)^2)
   mLACN_mDL = 0
```

```
Else
   mLACN     = -999
   mLACN_err = -999
   mLACN_mdl = -999
Endif

*******************************SOIL*********
If mSI_mDL > 0 .and. mFE_mDL > 0
   mSOIL    =             3.48*MAX(mSI,mSI_mDL/2,0) + ;
                          1.63*MAX(mCA,mCA_mDL/2,0) + ;
                          1.94*MAX(mTI,mTI_mDL/2,0) + ;
                          2.42*MAX(mFE,mFE_mDL/2,0)
   mSOIL_eRR =SQRT( (3.48*MAX(mSI_eRR,mSI_mDL/2,0))^2 + ;
                                  (1.63*MAX(mCA_eRR,mCA_mDL/2,0))^2 + ;
                                  (1.94*MAX(mTI_eRR,mTI_mDL/2,0))^2 + ;
                                  (2.42*MAX(mFE_eRR,mFE_MDL/2,0))^2)
   mSOIL_mDL = 0
Else
   mSOIL     = -999
   mSOIL_err = -999
   mSOIL_mdl = -999
Endif

*******************************NHSO*********
mNHSO     = MAX(4.125 * MAX(mS, mS_mdl/2),-999)
mNHSO_err = MAX(4.125 * MAX(mS_err, mS_mdl/2),-999)
mNHSO_mdl = MAX(4.125 * mS_mdl,-999)

*******************************NHNO*********
mNHNO     = MAX(-999,1.29 * mNO3)
mNHNO_err = MAX(-999,1.29 * mNO3_err)
mNHNO_mdl = MAX(-999,1.29 * mNO3_mdl)

*******************************KNON*******
If mFE > 0 .and. mK > 0
   mKNON    = MAX(mK,mK_mDL) -0.6*MAX(mFE,mFE_mDL)
   mKNON_eRR = SQRT((0.6*mFE_eRR)^2+mK_eRR^2)
   mKNON_mDL = 0
Else
   mKNON     = -999
   mKNON_err = -999
   mKNON_mdl = -999
Endif

*******************************RCMA*********
If mLRNC_mDL > 0
   mRCMA    =             MAX(mNHSO,0.0)      + ;
                          MAX(mOMH, 0.0)      + ;
                          MAX(mSOIL,0.0)      + ;
                    1.4*MAX(mKNON,0.0)  + ;
                          MAX(mLRNC,mLRNC_mDL/2,0)+ ;
                    2.5*MAX(mNA,mNA_mDL/2)
   mRCMA_eRR    =   SQRT(  MAX(0, mNHSO_eRR)^2 + ;
                                       MAX(0, mOMH_eRR)^2 + ;
                                       MAX(0, mSOIL_eRR)^2 + ;
                                  (1.4*MAX(0, mKNON_eRR))^2 + ;
                                       MAX(0, mLRNC_eRR)^2 + ;
                                  (2.5*MAX(mNA_eRR,mNA_mDL/2,0))^2)
```

```
   mRCMA_mDL    = 0
Else
   mRCMA     = -999
   mRCMA_err = -999
   mRCMA_mdl = -999
Endif

****************************************RCMC*****************
If  mOMCN_eRR > 0 .and. mLACN_eRR > 0
   mRCMC    =             MAX(mNHSO,0.0)      + ;
                          MAX(mOMCN,0.0)      + ;
                          MAX(mSOIL,0.0)      + ;
                    1.4*MAX(mKNON,0.0)  + ;
                          MAX(mLACN,0.0)      + ;
                    2.5*MAX(mNA,mNA_mDL/2,0)
   mRCMC_eRR    =   SQRT(  MAX(0, mNHSO_eRR)^2 + ;
                                       MAX(0, mOMCN_eRR)^2 + ;
                                       MAX(0, mSOIL_eRR)^2 + ;
                                  (1.4*MAX(0, mKNON_eRR))^2 + ;
                                       MAX(0, mLACN_eRR)^2 + ;
                                  (2.5*MAX(mNA_eRR,mNA_mDL/2,0))^2)
   mRCMC_mDL    = 0
Else
   mRCMC     = -999
   mRCMC_err = -999
   mRCMC_mdl = -999
Endif

****************************************RCMI*****************
If  mSO4_eRR > 0 .and. mLRNC_mDL > 0
   mRCMI    =1.375*MAX(mSO4,0.0) + ;
                          MAX(mOMH, 0.0) + ;
                          MAX(mSOIL,0.0)      + ;
                    1.4*MAX(mKNON,0.0)  + ;
                          MAX(mLRNC,mLRNC_mDL/2,0) + ;
                    2.5*MAX(mNA,mNA_mDL/2,0)
   mRCMI_eRR = SQRT((1.375*MAX(0, mSO4_eRR))^2 + ;
                                       MAX(0, mOMH_eRR)^2 + ;
                                       MAX(0, mSOIL_eRR)^2 + ;
                                  (1.4*MAX(0, mKNON_eRR))^2 + ;
                                       MAX(0, mLRNC_eRR)^2 + ;
                                  (2.5*MAX(mNA_eRR,mNA_mDL/2,0))^2)
   mRCMI_mDL    = 0
Else
   mRCMI     = -999
   mRCMI_err = -999
   mRCMI_mdl = -999
Endif

*****************************S3*********
IF mS > 0
   mS3     = 3*mS
   mS3_err = 3*mS_err
   mS3_mdl = 3*mS_mdl
ELSE
   mS3     = -999
   mS3_err = -999
   mS3_mdl = -999
```

```
ENDIF

*******************************MC*********
IF mMF > 0
   mMC        =      MAX(mMT - mMF,0.0)
   mMC_eRR    =      SQRT(mMT_eRR^2 + mMF_eRR^2)
   mMC_mDL    =    0
ELSE
   mMC      = -999
   mMC_eRR = -999
   mMC_mDL = -999
ENDIF
*******************************RCNH*********
IF mSO4 > 0 AND mNO3 > 0
   mRCNH        =    0.375*mSO4 + 0.29*mNO3
   mRCNH_eRR    =    SQRT((0.375*mSO4_eRR)^2 + (0.29*mNO3_eRR)^2)
   mRCNH_mDL    =     0
ELSE
   mRCNH        =    -999
   mRCNH_eRR    =    -999
   mRCNH_mDL    =   -999
ENDIF
*******************************OMHC*********
If mOMH_eRR > 0 .and. mNO3_eRR > 0
   mOMHC        =    mOMH - 2*0.447*mNO3
   mOMHC_eRR    =    SQRT(mOMH_eRR^2 + mNO3_eRR^2)
   mOMHC_mDL    =     0
Else
   mOMHC        =    -999
   mOMHC_eRR    =    -999
   mOMHC_mDL    =   -999
Endif

RETURN
```

## C.17. Site9

```
* Process the "SITE9" files to add mass data to "SITE1" as MT and move MF to MT
   in
* "SITE9". The MF listed for SITE9 is really PM10 mass, so should be in the MT
   field.

SELECT site, samdat, mf, mf_err, mf_mdl, mt, mt_err, mt_mdl,;
       flow_a, time_a, flag_a;
 FROM out;
 INTO TABLE SITE9FILE;
 WHERE AT("9",site) > 0;
 ORDER BY site, samdat

GO TOP
SELECT out
GO TOP
SELECT site9file
DO WHILE NOT EOF("SITE9FILE")
   msitename = LEFT(site9file.site,4)
   mdate = samdat
   msite = msitename + "1"
   SELECT out
   LOCATE FOR out.site = msite AND samdat = mdate
   IF site9file.mf>0
      REPLACE out.mt WITH site9file.mf
      REPLACE out.mt_err WITH site9file.mf_err
      REPLACE out.mt_mdl WITH site9file.mf_mdl
      REPLACE out.flow_d WITH site9file.flow_a
      REPLACE out.time_d WITH site9file.time_a
      REPLACE out.flag_d WITH site9file.flag_a
      LOCATE FOR site = site9file.site AND samdat = mdate
      REPLACE out.mt WITH site9file.mf
      REPLACE out.mt_err WITH site9file.mf_err
      REPLACE out.mt_mdl WITH site9file.mf_mdl
      REPLACE out.time_d with 0
      REPLACE out.mf WITH -999
      REPLACE out.mf_err WITH -999
      REPLACE out.mf_mdl WITH -999
   ENDIF
   SELECT site9file
   SKIP
ENDDO

RETURN
```

## C.18. CleanUp

```
PROCEDURE cleanup
*******************************************************************************
* 10/13/2005 - Added MALO1 and MALO2 to the list of sites to remove from TOTFILE
*******************************************************************************

* Delete temporary files

mDefPath = SYS(5)+SYS(2003)
SET DEFAULT TO &mPathTemp

*DO Totfile
* Create the output file to send to CIRA

* This SQL code will select only the sites in SITEFILE.DBF
* to include in the file sent to CIRA. It then compares the resulting list
* to exclude sites held back for this quarter.

* Select only the network sites to include in the file to CIRA
* This processing takes place prior to adding in the corresponding "1" modules to
*   the SITEX data
SELECT site;
 FROM U:\Improve\QAPlots\Holds\Holdsite;
   HAVING holdsite.qtr=mSeason AND holdsite.mon=VAL(mMonth);
   AND NOT holdsite.cleared;
 INTO ARRAY Holdsites

*SUSPEND
SELECT out.*;
 FROM  out LEFT JOIN sites ;
   ON  out.site = Sites.site;
   WHERE out.site = sites.site;
  INTO TABLE totfile

SELECT totfile
SET FILTER TO ASCAN(holdsites, site)>0
DELETE ALL
SET FILTER TO INLIST(site, "BLNK1", "HANCS", "INGAS", "MALO1", "MALO2")
DELETE ALL
SET FILTER TO
PACK

USE &mspcl IN 0 ALIAS spl
SELECT spl
APPEND FROM totfile FOR INLIST(RIGHT(site,1), "5", "9")
SELECT totfile
SET FILTER TO INLIST(RIGHT(site,1), "5", "9")
DELETE ALL
PACK
SET FILTER TO
USE &mfinl IN 0 ALIAS fnl
SELECT fnl
APPEND FROM totfile
*COPY TO &mfinl FOX2X FOR NOT (INLIST(site, "BLNK1", "HANCS", "INGAS");
                                OR INLIST(RIGHT(site,1), "5", "9"))
*COPY TO &mspcl FOX2X FOR INLIST(RIGHT(site,1), "5", "9")
```

```
* Process X module data to include in QA file
DO sitexfile

* Copy the output file to the QA file
SELECT out
COPY TO &mout FOX2X

*Include next line to stop processing before deleting temporary files.
*RETURN

CLOSE DATABASES ALL
DELETE FILE tlogs.dbf
DELETE FILE tcarbon.dbf
DELETE FILE tions.dbf
DELETE FILE tlaser.dbf
DELETE FILE tele.dbf
DELETE FILE tmag.dbf
DELETE FILE tvac.dbf
DELETE FILE twts.dbf
DELETE FILE tout.dbf
DELETE FILE tfinl.dbf
DELETE FILE tsites.dbf
DELETE FILE tso2.dbf
DELETE FILE totfile.dbf
DELETE FILE tlogs.cdx
DELETE FILE tsites.cdx
DELETE FILE tso2.cdx
DELETE FILE tcarbon.cdx
DELETE FILE tions.cdx
DELETE FILE tlaser.cdx
DELETE FILE tele.cdx
DELETE FILE tmag.cdx
DELETE FILE tvac.cdx
DELETE FILE twts.cdx
DELETE FILE site9file.dbf
DELETE FILE sitexfile.dbf

*WAIT CLEAR

SET DEFAULT TO &mDefPath
RETURN
```

## C.19. SiteXFile

```
PROCEDURE sitexfile
* Processing for the "X Modules."  Adds the complimentary module data to the X
   module data to
* complete the data suite for validation purposes.
* 6/16/04 Nicole

* copy only X site data records into a temporary file

wait window at 10,40 "Processing X files" nowait
SELECT *;
 FROM out;
 WHERE right( Out.site,1) = "X";
 ORDER BY Out.site, Out.samdat;
 INTO TABLE sitexfile

*SELECT ALL;
*   FROM out;
*   INTO TABLE sitexfile;
*   WHERE RIGHT(out.site,1)="X";
*   ORDER BY site, samdat
GO TOP
SELECT sites
GO TOP
SELECT out
GO TOP
SELECT sitexfile
GO TOP
DO WHILE NOT EOF("sitexfile")   && loops thru entire sitexfile
    sitexname = sitexfile.site
    sitename = LEFT(sitexfile.site,4)
    site1name = sitename + "1"
    SELECT sites
    LOCATE FOR sites.site = sitexname
    configuration = sites.config
    SELECT out
    DO CASE  && determine if the X module is A, B, or C type and process
    appropriately
       CASE configuration = "A"   && X module is an A-type module
              DO WHILE sitexfile.site = sitexname AND NOT EOF("sitexfile")
                     mdate = sitexfile.samdat
                     SELECT out
                     LOCATE FOR out.site = site1name AND out.samdat = mdate
                     DO xmodule_add_B
                     DO xmodule_add_C
                     DO xmodule_add_D
                     DO Xcomposites
                     SKIP in sitexfile
              ENDDO
       CASE configuration = "B"   && X module is a B-type module
              DO WHILE sitexfile.site = sitexname AND NOT EOF("sitexfile")
                     mdate = sitexfile.samdat
                     SELECT out
                     LOCATE FOR out.site = site1name AND out.samdat = mdate
                     DO xmodule_add_A
                     DO xmodule_add_C
```

```
                    DO xmodule_add_D
                    DO Xcomposites
                    SKIP in sitexfile
             ENDDO
      CASE configuration = "C"   && X module is a C-type module
             DO WHILE sitexfile.site = sitexname AND NOT EOF("sitexfile")
                    mdate = sitexfile.samdat
                    SELECT out
                    LOCATE FOR out.site = site1name AND out.samdat = mdate
                    DO xmodule_add_A
                    DO xmodule_add_B
                    DO xmodule_add_D
                    DO Xcomposites
                    SKIP in sitexfile
             ENDDO
      CASE configuration = "D"   && X module is a D-type module
             DO WHILE sitexfile.site = sitexname AND NOT EOF("sitexfile")
                    mdate = sitexfile.samdat
                    SELECT out
                    LOCATE FOR out.site = site1name AND out.samdat = mdate
                    DO xmodule_add_A
                    DO xmodule_add_B
                    DO xmodule_add_C
                    DO Xcomposites
                    SKIP in sitexfile
             ENDDO
   ENDCASE

ENDDO

* Delete X records from out file
SELECT out
GO TOP
DELETE FOR right(site,1)="X"     && marks records for deletion
PACK                                          && deletes marked records
* Append X records from sitexfiles
APPEND FROM sitexfile

RETURN
```

## C.20. Xmodule_Add_A

```
PROCEDURE xmodule_add_a
* When the X module is not an A-type module, this procedure
* pastes the A-module routine data into the X site data set
* for validation purposes.
* Created 6/17/04 by Nicole
* Added LRNC to replacements on 6/24/04 Nicole

REPLACE sitexfile.flow_a WITH out.flow_a
REPLACE sitexfile.time_a WITH out.time_a
REPLACE sitexfile.flag_a WITH out.flag_a
REPLACE sitexfile.mf WITH out.mf
REPLACE sitexfile.mf_err WITH out.mf_err
REPLACE sitexfile.mf_mdl WITH out.mf_mdl
REPLACE sitexfile.H      WITH out.H
REPLACE sitexfile.H_err  WITH out.H_err
REPLACE sitexfile.H_mdl  WITH out.H_mdl
REPLACE sitexfile.Na     WITH out.Na
REPLACE sitexfile.Na_err WITH out.Na_err
REPLACE sitexfile.Na_mdl WITH out.Na_mdl
REPLACE sitexfile.Mg    WITH out.Mg
REPLACE sitexfile.Mg_err WITH out.Mg_err
REPLACE sitexfile.Mg_mdl WITH out.Mg_mdl
REPLACE sitexfile.Al     WITH out.Al
REPLACE sitexfile.Al_err WITH out.Al_err
REPLACE sitexfile.Al_mdl WITH out.Al_mdl
REPLACE sitexfile.Si     WITH out.Si
REPLACE sitexfile.Si_err WITH out.Si_err
REPLACE sitexfile.Si_mdl WITH out.Si_mdl
REPLACE sitexfile.P      WITH out.P
REPLACE sitexfile.P_err  WITH out.P_err
REPLACE sitexfile.P_mdl  WITH out.P_mdl
REPLACE sitexfile.S      WITH out.S
REPLACE sitexfile.S_err  WITH out.S_err
REPLACE sitexfile.S_mdl  WITH out.S_mdl
REPLACE sitexfile.Cl      WITH out.Cl
REPLACE sitexfile.Cl_err  WITH out.Cl_err
REPLACE sitexfile.Cl_mdl  WITH out.Cl_mdl
REPLACE sitexfile.K    WITH out.K
REPLACE sitexfile.K_err WITH out.K_err
REPLACE sitexfile.K_mdl WITH out.K_mdl
REPLACE sitexfile.Ca     WITH out.Ca
REPLACE sitexfile.Ca_err WITH out.Ca_err
REPLACE sitexfile.Ca_mdl WITH out.Ca_mdl
REPLACE sitexfile.Ti     WITH out.Ti
REPLACE sitexfile.Ti_err WITH out.Ti_err
REPLACE sitexfile.Ti_mdl WITH out.Ti_mdl
REPLACE sitexfile.V      WITH out.V
REPLACE sitexfile.V_err  WITH out.V_err
REPLACE sitexfile.V_mdl  WITH out.V_mdl
REPLACE sitexfile.Cr     WITH out.Cr
REPLACE sitexfile.Cr_err WITH out.Cr_err
REPLACE sitexfile.Cr_mdl WITH out.Cr_mdl
REPLACE sitexfile.Mn      WITH out.Mn
REPLACE sitexfile.Mn_err  WITH out.Mn_err
REPLACE sitexfile.Mn_mdl  WITH out.Mn_mdl
```

```
REPLACE sitexfile.Fe     WITH out.Fe
REPLACE sitexfile.Fe_err WITH out.Fe_err
REPLACE sitexfile.Fe_mdl WITH out.Fe_mdl
REPLACE sitexfile.Ni      WITH out.Ni
REPLACE sitexfile.Ni_err  WITH out.Ni_err
REPLACE sitexfile.Ni_mdl  WITH out.Ni_mdl
REPLACE sitexfile.Cu      WITH out.Cu
REPLACE sitexfile.Cu_err  WITH out.Cu_err
REPLACE sitexfile.Cu_mdl  WITH out.Cu_mdl
REPLACE sitexfile.Zn      WITH out.Zn
REPLACE sitexfile.Zn_err  WITH out.Zn_err
REPLACE sitexfile.Zn_mdl  WITH out.Zn_mdl
REPLACE sitexfile.AS      WITH out.AS
REPLACE sitexfile.As_err  WITH out.As_err
REPLACE sitexfile.As_mdl  WITH out.As_mdl
REPLACE sitexfile.Pb      WITH out.Pb
REPLACE sitexfile.Pb_err  WITH out.Pb_err
REPLACE sitexfile.Pb_mdl  WITH out.Pb_mdl
REPLACE sitexfile.Se      WITH out.Se
REPLACE sitexfile.Se_err  WITH out.Se_err
REPLACE sitexfile.Se_mdl  WITH out.Se_mdl
REPLACE sitexfile.Br      WITH out.Br
REPLACE sitexfile.Br_err  WITH out.Br_err
REPLACE sitexfile.Br_mdl  WITH out.Br_mdl
REPLACE sitexfile.Rb      WITH out.Rb
REPLACE sitexfile.Rb_err  WITH out.Rb_err
REPLACE sitexfile.Rb_mdl  WITH out.Rb_mdl
REPLACE sitexfile.Sr      WITH out.Sr
REPLACE sitexfile.Sr_err  WITH out.Sr_err
REPLACE sitexfile.Sr_mdl  WITH out.Sr_mdl
REPLACE sitexfile.Zr      WITH out.Zr
REPLACE sitexfile.Zr_err  WITH out.Zr_err
REPLACE sitexfile.Zr_mdl  WITH out.Zr_mdl
REPLACE sitexfile.LRNC       WITH out.LRNC
REPLACE sitexfile.LRNC_err WITH out.LRNC_err
REPLACE sitexfile.LRNC_mdl WITH out.LRNC_mdl
RETURN
```

## C.21. Xmodule_Add_B

```
PROCEDURE xmodule_add_b
* When the X module is not a B-type module, this procedure
* pastes the B-module routine data into the X site data set
* for validation purposes.
* Created 6/17/04 by Nicole
* Changed Cl to Cld on 6/24/04 Nicole

SELECT sitexfile
REPLACE sitexfile.flow_b WITH out.flow_b
REPLACE sitexfile.time_b WITH out.time_b
REPLACE sitexfile.flag_b WITH out.flag_b
REPLACE sitexfile.Cld WITH out.Cld
REPLACE sitexfile.Cld_Err WITH out.Cld_Err
REPLACE sitexfile.Cld_MDL WITH out.Cld_MDL
REPLACE sitexfile.NO2 WITH out.NO2
REPLACE sitexfile.NO2_Err WITH out.NO2_Err
REPLACE sitexfile.NO2_MDL WITH out.NO2_MDL
REPLACE sitexfile.NO3 WITH out.NO3
REPLACE sitexfile.NO3_Err WITH out.NO3_Err
REPLACE sitexfile.NO3_MDL WITH out.NO3_MDL
REPLACE sitexfile.SO4 WITH out.SO4
REPLACE sitexfile.SO4_Err WITH out.SO4_Err
REPLACE sitexfile.SO4_MDL WITH out.SO4_MDL
REPLACE sitexfile.NH4 WITH out.NH4
REPLACE sitexfile.NH4_Err WITH out.NH4_Err
REPLACE sitexfile.NH4_MDL WITH out.NH4_MDL
RETURN
```

## C.22. Xmodule_Add_C

```
PROCEDURE xmodule_add_c
* When the X module is not a C-type module, this procedure
* pastes the C-module routine data into the X site data set
* for validation purposes.
* Created 6/17/04 by Nicole
* Fixed typo on 6/24/04 Nicole

REPLACE sitexfile.flow_c WITH out.flow_c
REPLACE sitexfile.time_c WITH out.time_c
REPLACE sitexfile.flag_c WITH out.flag_c
REPLACE sitexfile.O1 WITH out.O1
REPLACE sitexfile.O1_ERR WITH out.O1_ERR
REPLACE sitexfile.O1_MDL WITH out.O1_MDL
REPLACE sitexfile.O2 WITH out.O2
REPLACE sitexfile.O2_ERR WITH out.O2_ERR
REPLACE sitexfile.O2_MDL WITH out.O2_MDL
REPLACE sitexfile.O3 WITH out.O3
REPLACE sitexfile.O3_ERR WITH out.O3_ERR
REPLACE sitexfile.O3_MDL WITH out.O3_MDL
REPLACE sitexfile.O4 WITH out.O4
REPLACE sitexfile.O4_ERR WITH out.O4_ERR
REPLACE sitexfile.O4_MDL WITH out.O4_MDL
REPLACE sitexfile.OP WITH out.OP
REPLACE sitexfile.OP_ERR WITH out.OP_ERR
REPLACE sitexfile.OP_MDL WITH out.OP_MDL
REPLACE sitexfile.E1 WITH out.E1
REPLACE sitexfile.E1_ERR WITH out.E1_ERR
REPLACE sitexfile.E1_MDL WITH out.E1_MDL
REPLACE sitexfile.E2 WITH out.E2
REPLACE sitexfile.E2_ERR WITH out.E2_ERR
REPLACE sitexfile.E2_MDL WITH out.E2_MDL
REPLACE sitexfile.E3 WITH out.E3
REPLACE sitexfile.E3_ERR WITH out.E3_ERR
REPLACE sitexfile.E3_MDL WITH out.E3_MDL
RETURN
```

## C.23. Xmodule_Add_D

```
PROCEDURE xmodule_add_d
* When the X module is not a D-type module, this procedure
* pastes the D-module routine data into the X site data set
* for validation purposes.
* Created 6/17/04 by Nicole

REPLACE sitexfile.flow_d WITH out.flow_d
REPLACE sitexfile.time_d WITH out.time_d
REPLACE sitexfile.flag_d WITH out.flag_d
REPLACE sitexfile.mt WITH out.mt
REPLACE sitexfile.mt_err WITH out.mt_err
REPLACE sitexfile.mt_mdl WITH out.mt_mdl
REPLACE sitexfile.SO2 WITH out.SO2
REPLACE sitexfile.SO2_err WITH out.SO2_err
REPLACE sitexfile.SO2_mdl WITH out.SO2_mdl
RETURN
```

## C.24. Xcomposites

```
PROCEDURE Xcomposites
* Calculate composites for X module data records, which are
* compiled after the composites for the routine data are calculated.
* 6/17/04 Nicole created

*********************************OMH*********
IF sitexfile.H > 0 AND sitexfile.S > -999
   REPLACE sitexfile.Omh    WITH 13.75*(sitexfile.H - (0.25 * sitexfile.S))
   REPLACE sitexfile.Omh_err WITH 13.75 * SQRT((0.25 * sitexfile.S_eRR)^2 +
   sitexfile.H_eRR^2)
   REPLACE sitexfile.Omh_mdl WITH 0
ELSE
   REPLACE sitexfile.Omh     WITH -999
   REPLACE sitexfile.Omh_err WITH -999
   REPLACE sitexfile.Omh_mdl WITH -999
ENDIF

*****************************OMCN*********
IF sitexfile.O1 <> -999
   REPLACE sitexfile.OMCN     WITH 1.4*(sitexfile.O1 + sitexfile.O2 +
   sitexfile.O3 + sitexfile.O4 + sitexfile.OP)
   REPLACE sitexfile.OMCN_eRR WITH 1.4*SQRT((MAX(0,sitexfile.O1_eRR))^2 +
   (MAX(0,sitexfile.O2_eRR))^2 + (MAX(0,sitexfile.O3_eRR))^2 +
   (MAX(0,sitexfile.O4_eRR))^2 + (MAX(0,sitexfile.OP_eRR))^2)
   REPLACE sitexfile.OMCN_MDL WITH 0
ELSE
   REPLACE sitexfile.OMCN     WITH -999
   REPLACE sitexfile.OMCN_eRR WITH -999
   REPLACE sitexfile.OMCN_MDL WITH -999
ENDIF

*********************************LACN*********
IF sitexfile.E1 <> -999
   REPLACE sitexfile.LACN     WITH (sitexfile.E1 + sitexfile.E2 + sitexfile.E3 -
   sitexfile.OP)
   REPLACE sitexfile.LACN_eRR WITH SQRT((MAX(0,sitexfile.E1_eRR))^2 +
   (MAX(0,sitexfile.E2_eRR))^2 + (MAX(0,sitexfile.E3_eRR))^2 +
   (MAX(0,sitexfile.OP_eRR))^2)
   REPLACE sitexfile.LACN_MDL WITH 0
ELSE
   REPLACE sitexfile.LACN     WITH -999
   REPLACE sitexfile.LACN_eRR WITH -999
   REPLACE sitexfile.LACN_MDL WITH -999
ENDIF

*****************************SOIL*********
IF sitexfile.SI_MDL > 0 AND sitexfile.FE_MDL > 0
   REPLACE sitexfile.SOIL WITH 3.48*MAX(sitexfile.SI,sitexfile.SI_MDL/2,0) + ;
      1.63*MAX(sitexfile.CA,sitexfile.CA_MDL/2,0) + ;
      1.94*MAX(sitexfile.TI,sitexfile.TI_MDL/2,0) + ;
      2.42*MAX(sitexfile.FE,sitexfile.FE_MDL/2,0)
   REPLACE sitexfile.SOIL_eRR  WITH SQRT(
      (3.48*MAX(sitexfile.SI_eRR,sitexfile.SI_MDL/2,0))^2 + ;
      (1.63*MAX(sitexfile.CA_eRR,sitexfile.CA_MDL/2,0))^2 + ;
      (1.94*MAX(sitexfile.TI_eRR,sitexfile.TI_MDL/2,0))^2 + ;
```

```
       (2.42*MAX(sitexfile.FE_eRR,sitexfile.FE_MDL/2,0))^2)
   REPLACE sitexfile.SOIL_MDL WITH 0
ELSE
   REPLACE sitexfile.SOIL     WITH -999
   REPLACE sitexfile.SOIL_eRR WITH -999
   REPLACE sitexfile.SOIL_MDL WITH -999
ENDIF

*******************************NHSO*********
REPLACE sitexfile.NHSO     WITH MAX(4.125 * MAX(sitexfile.S, sitexfile.S_MDL/2),-
   999)
REPLACE sitexfile.NHSO_err WITH MAX(4.125 * MAX(sitexfile.S_eRR,
   sitexfile.S_MDL/2),-999)
REPLACE sitexfile.NHSO_MDL WITH MAX(4.125 * sitexfile.S_MDL,-999)

*******************************NHNO*********
REPLACE sitexfile.NHNO     WITH MAX(-999,1.29 * sitexfile.NO3)
REPLACE sitexfile.NHNO_err WITH MAX(-999,1.29 * sitexfile.NO3_err)
REPLACE sitexfile.NHNO_MDL WITH MAX(-999,1.29 * sitexfile.NO3_MDL)

*******************************KNON*******
IF sitexfile.FE > 0 AND sitexfile.K > 0
   REPLACE sitexfile.KNON     WITH MAX(sitexfile.K,sitexfile.K_MDL) -
   0.6*MAX(sitexfile.FE,sitexfile.FE_MDL)
   REPLACE sitexfile.KNON_eRR WITH
   SQRT((0.6*sitexfile.FE_eRR)^2+sitexfile.K_eRR^2)
   REPLACE sitexfile.KNON_MDL WITH 0
ELSE
   REPLACE sitexfile.KNON     WITH -999
   REPLACE sitexfile.KNON_eRR WITH -999
   REPLACE sitexfile.KNON_MDL WITH -999
ENDIF

*******************************RCMA*********
IF sitexfile.LRNC_MDL > 0 AND sitexfile.Omh <> -999 AND sitexfile.SOIL <> -999
   AND sitexfile.NHSO <> -999
   REPLACE sitexfile.RCMA WITH MAX(sitexfile.NHSO,0.0)     + ;
      MAX(sitexfile.Omh, 0.0)    + ;
      MAX(sitexfile.SOIL,0.0)    + ;
      1.4*MAX(sitexfile.KNON,0.0)      + ;
      MAX(sitexfile.LRNC,sitexfile.LRNC_MDL/2,0)+ ;
      2.5*MAX(sitexfile.NA,sitexfile.NA_MDL/2)
   REPLACE sitexfile.RCMA_eRR  WITH SQRT(MAX(0, sitexfile.NHSO_err)^2 + ;
      MAX(0, sitexfile.Omh_err)^2 + ;
      MAX(0, sitexfile.SOIL_eRR)^2 + ;
      (1.4*MAX(0, sitexfile.KNON_eRR))^2 + ;
      MAX(0, sitexfile.LRNC_eRR)^2 + ;
      (2.5*MAX(sitexfile.NA_eRR,sitexfile.NA_MDL/2,0))^2)
   REPLACE sitexfile.RCMA_MDL WITH 0
ELSE
   REPLACE sitexfile.RCMA     WITH -999
   REPLACE sitexfile.RCMA_eRR WITH -999
   REPLACE sitexfile.RCMA_MDL WITH -999
ENDIF

*************************************RCMC*****************
IF sitexfile.OMCN_eRR > 0 AND sitexfile.LACN_eRR > 0 AND sitexfile.SOIL <> -999
   AND sitexfile.NHSO <> -999
```

```
   REPLACE sitexfile.RCMC WITH MAX(sitexfile.NHSO,0.0)     + ;
      MAX(sitexfile.OMCN,0.0)    + ;
      MAX(sitexfile.SOIL,0.0)    + ;
      1.4*MAX(sitexfile.KNON,0.0)      + ;
      MAX(sitexfile.LACN,0.0)    + ;
      2.5*MAX(sitexfile.NA,sitexfile.NA_MDL/2,0)
   REPLACE sitexfile.RCMC_eRR WITH SQRT(      MAX(0, sitexfile.NHSO_err)^2 + ;
      MAX(0, sitexfile.OMCN_eRR)^2 + ;
      MAX(0, sitexfile.SOIL_eRR)^2 + ;
      (1.4*MAX(0, sitexfile.KNON_eRR))^2 + ;
      MAX(0, sitexfile.LACN_eRR)^2 + ;
      (2.5*MAX(sitexfile.NA_eRR,sitexfile.NA_MDL/2,0))^2)
   REPLACE sitexfile.RCMC_MDL WITH 0
ELSE
   REPLACE sitexfile.RCMC     WITH -999
   REPLACE sitexfile.RCMC_eRR WITH -999
   REPLACE sitexfile.RCMC_MDL WITH -999
ENDIF

****************************************RCMI*****************
IF sitexfile.SO4_eRR > 0 AND sitexfile.LRNC_MDL > 0 AND sitexfile.Omh <> -999 AND
   sitexfile.SOIL <> -999
   REPLACE sitexfile.RCMI WITH 1.375*MAX(sitexfile.SO4,0.0) + ;
      MAX(sitexfile.Omh, 0.0) + ;
      MAX(sitexfile.SOIL,0.0)    + ;
      1.4*MAX(sitexfile.KNON,0.0)      + ;
      MAX(sitexfile.LRNC,sitexfile.LRNC_MDL/2,0) + ;
      2.5*MAX(sitexfile.NA,sitexfile.NA_MDL/2,0)
   REPLACE sitexfile.RCMI_eRR WITH SQRT((1.375*MAX(0, sitexfile.SO4_eRR))^2 + ;
      MAX(0, sitexfile.Omh_err)^2 + ;
      MAX(0, sitexfile.SOIL_eRR)^2 + ;
      (1.4*MAX(0, sitexfile.KNON_eRR))^2 + ;
      MAX(0, sitexfile.LRNC_eRR)^2 + ;
      (2.5*MAX(sitexfile.NA_eRR,sitexfile.NA_MDL/2,0))^2)
   REPLACE sitexfile.RCMI_MDL WITH 0
ELSE
   REPLACE sitexfile.RCMI     WITH -999
   REPLACE sitexfile.RCMI_eRR WITH -999
   REPLACE sitexfile.RCMI_MDL WITH -999
ENDIF


*****************************S3*********
IF sitexfile.S > 0
   REPLACE sitexfile.S3     WITH 3*sitexfile.S
   REPLACE sitexfile.S3_err WITH 3*sitexfile.S_eRR
   REPLACE sitexfile.S3_MDL WITH 3*sitexfile.S_MDL
ELSE
   REPLACE sitexfile.S3     WITH -999
   REPLACE sitexfile.S3_err WITH -999
   REPLACE sitexfile.S3_MDL WITH -999
ENDIF

*****************************MC*********
*IF sitexfile.MF <> -999 AND sitexfile.MT <> -999
*  REPLACE sitexfile.MC     WITH       MAX(sitexfile.MT - sitexfile.MF,0.0)
*  REPLACE sitexfile.MC_eRR WITH       SQRT(sitexfile.MT_eRR^2 +
   sitexfile.MF_eRR^2)
```

```
*   REPLACE sitexfile.MC_MDL WITH       0
*ELSE
*   REPLACE sitexfile.MC    WITH -999
*   REPLACE sitexfile.MC_eRR WITH -999
*   REPLACE sitexfile.MC_MDL WITH -999
*ENDIF
*******************************RCNH*********
IF sitexfile.SO4 > 0 AND sitexfile.NO3 > 0
   REPLACE sitexfile.RCNH       WITH    0.375*sitexfile.SO4 + 0.29*sitexfile.NO3
   REPLACE sitexfile.RCNH_eRR   WITH    SQRT((0.375*sitexfile.SO4_eRR)^2 +
   (0.29*sitexfile.NO3_err)^2)
   REPLACE sitexfile.RCNH_MDL   WITH   0
ELSE
   REPLACE sitexfile.RCNH       WITH    -999
   REPLACE sitexfile.RCNH_eRR   WITH    -999
   REPLACE sitexfile.RCNH_MDL   WITH   -999
ENDIF
*******************************OMHC*********
IF sitexfile.Omh_err > 0 AND sitexfile.NO3_err > 0
   REPLACE sitexfile.OMHC       WITH    sitexfile.Omh - 2*0.447*sitexfile.NO3
   REPLACE sitexfile.OMHC_eRR   WITH    SQRT(sitexfile.Omh_err^2 +
   sitexfile.NO3_err^2)
   REPLACE sitexfile.OMHC_MDL   WITH   0
ELSE
   REPLACE sitexfile.OMHC       WITH    -999
   REPLACE sitexfile.OMHC_eRR   WITH    -999
   REPLACE sitexfile.OMHC_MDL   WITH   -999
ENDIF

RETURN
```

## C.25. QlogsErr

```
PROCEDURE QLOGSERR
PARAMETER mFile, mERROR, mMessage
SET ESCAPE OFF
WAIT WINDOW ;
   "Error on "+mFile + ". May be not on Disk or already open" ;
   + CHR(13) + CHR(10) + mMessage  + ;
   + CHR(13) + "Hit ESC or ENTER to return to program" TIMEOUT 2
*  Wait &mLogFile  window Timeout 1
DO CASE
   CASE LASTKEY() = 138
      DEACTIVATE WINDOW ALL
      CLOSE DATABASES ALL
      CANCEL
*     QUIT
   CASE LASTKEY()=13 OR LASTKEY()=32 OR LASTKEY()=27
      mBadLog = .T.
      RETURN
   OTHERWISE
      mBadLog = .T.
      RETRY               &&
ENDCASE

IF SELECT('logs')<>0
   SELECT logs
   USE
ENDIF
SET ESCAPE ON
RETURN
```

## C.26. Errhand

```
PROCEDURE errhand
PARAMETER merror, mess, mess1, mprog, mlineno
CLEAR
? 'Error number: ' + LTRIM(STR(merror))
? 'Error message: ' + mess
? 'Line of code with error: ' + mess1
? 'Line number of error: ' + LTRIM(STR(mlineno))
? 'Program with error: ' + mprog
*CLOSE DATABASES ALL
WAIT
ON ERROR  && restore system error handler
CANCEL
```

**APPENDIX D. SWAP CODE**

# Table of Contents

## D.1. Swap

```
PROCEDURE SWAP

PUBLIC mSite, mSeason, mVolsummary, mFile, mThisSeason, mLogFile, medit, nofile
PUBLIC mBadLog, CurrSeas, mMonth, mYear
PUBLIC mGETENV, mVolsummary, mRootPath, mCarbonPath, mIonsPath, mXRFPath, mLaserPath
PUBLIC mWtsPath, mLogsPath, mCalPath, mSiteFile, mSuppPath, mHoldPath, mLogFile
PUBLIC mFlashPath, EditFile, mUSER, mPathTemp, mQtr

DIMENSION QTR(4)
mBadLog = .F.

ON KEY LABEL CTRL+F12 SUSPEND
*ON ERROR DO errhand WITH ;
ERROR( ), MESSAGE( ), MESSAGE(1), PROGRAM( ), LINENO( )
*ON ERROR do Qlogserr

ON KEY LABEL CTRL+F11 DO EDITFORM

SET TALK OFF
SET SAFETY OFF  && Make this active to remove dialog box on overwriting site and
   sites.

QTR(1) = "A"
QTR(2) = "B"
QTR(3) = "C"
QTR(4) = "D"
mUSER = GETENV('USERNAME')

CLEAR
CLOSE DATABASES ALL
STORE SYS(5)+SYS(2003) TO DefaultDir
IF DIRECTORY("M:\")
   mPathTemp = "m:\improve\Temp\"
   IF NOT DIRECTORY("&mPathTemp")
      RUN MD &mPathTemp
   ENDIF
   IF NOT DIRECTORY("m:\IMPROVE\PROGRAMS")
      RUN MD "m:\IMPROVE\PROGRAMS"
   ENDIF
   SET PATH TO "m:\IMPROVE\PROGRAMS", mdisk + "IMPROVE\PROGRAMS"
ELSE
   SET PATH TO mdisk + "IMPROVE\PROGRAMS"
   IF NOT DIRECTORY(mdisk + "improve\Temp\")
      tdisk = &mdisk + "m:\improve\Temp\"
      RUN MD &tdisk
   ENDIF
   mPathTemp = mdisk + "improve\Temp\"
ENDIF
mGETENV      = 'M:\zDEFAULT\FOXPRO\'
mVolsummary  = mGETENV + "volsummary.dbf"
mRootPath    = "U:\IMPROVE\"
mCarbonPath  = mRootPath + "Carbon\"
mIonsPath    = mRootPath + "Ions\"
mXRFPath     = mRootPath + "PIXEXRF\"
mLaserPath   = mRootPath + "Laser\"
mWtsPath     = mRootPath + "Weights\"
```

```
mLogsPath     = mRootPath + "Logs\"
mCalPath      = mRootPath + "SiteCal\"
mSiteFile     = mCalPath + "sitefile.dbf"
mSuppPath     = mRootPath + "Support\"
mHoldPath     = mRootPath + "QAPlots\Holds\"
*mLogFile     = mLogsPath + "logs.dbf"
mLogFile      = "u:\improve\logs\logs.dbf"
mso2path    = mrootpath + "so2\"
mFlashPath    = mRootPath + "FlashDBF\"
EditFile = mLogFile

STORE SYS(5)+SYS(2003) TO mDefDir
&& Moved section from here
IF NOT DIRECTORY("M:\IMPROVE\Temp")
   MKDIR "M:\IMPROVE\Temp"
ENDIF
SET DEFAULT TO M:\IMPROVE\Temp
ON ERROR DO QLOGSERR WITH mLogFile, ERROR(), MESSAGE()
USE &mLogFile IN 0 ALIAS logs
IF mBadLog
   LOOP
ENDIF
ON ERROR DO errhand WITH ;
   ERROR( ), MESSAGE( ), MESSAGE(1), PROGRAM( ), LINENO( )
GO top
mSite = logs.site
mDate = logs.samdat
SELECT DISTINCT logs.site;
   FROM logs;
   ORDER BY logs.site;
   INTO TABLE LogSites
*INSERT INTO Sites (site) values ("  ALL")
*INSERT INTO Sites (site) values (" QUIT")
INDEX ON site TAG site
GO TOP
IF LogSites.site="     "
   DELETE
   PACK
ENDIF
GO TOP
mSite=LogSites.site

*GO TOP IN Site
SELECT logs
USE

SET DEFAULT TO U:\IMPROVE\SUPPORT

mMonth = MONTH(mDate)
mYear = YEAR(mDate)
mQtr = QTR(mMonth/3) + RIGHT(STR(mYear),2)
mSeason = mQtr
CurrSeas = mSeason
*STORE "U:\IMPROVE\FLASHDBF\" to mFlashDir
*IF SELECT("volsummary")>0
*   SELECT volsummary
*   USE
*ENDIF
```

```
*IF FILE('&mvolsummary')
*   DELETE FILE &mvolsummary.dbf
*ENDIF

DO WHILE .T.
   medit=" "
*  DO FormInput
   mBadLog=.F.
   frmInput = CREATEOBJECT('Form')
   frmInput.CLOSABLE = .F.
   frmInput.MOVABLE = .T.
   frmInput.BORDERSTYLE = 3
   IF mUSER = "ashbaugh"
      frmInput.MOVE(0,0,424,494)
   ELSE
      frmInput.MOVE(0,0,424,396)
   ENDIF
   frmInput.CAPTION = "Edit data records for selected site/quarter"
   frmInput.NAME = "Form1"
   frmInput.ADDOBJECT('Label1', 'SiteLabel')
   frmInput.ADDOBJECT('Label2', 'SeasonLabel')
   frmInput.ADDOBJECT('Label3', 'LogsLabel')
   frmInput.ADDOBJECT('Label4', 'BlanksLabel')
   frmInput.ADDOBJECT('Label5', 'DataLabel')
   frmInput.ADDOBJECT('Label6', 'CalLabel')
   frmInput.ADDOBJECT('Label7', 'BalLabel')
   frmInput.ADDOBJECT('mSite', 'SiteBox')
   frmInput.ADDOBJECT('mSeason', 'SeasonBox')
   frmInput.ADDOBJECT('LogStat', 'EditLogs')
   frmInput.ADDOBJECT('LogFlow', 'EditFlow')
   frmInput.ADDOBJECT('LogVFlow', 'EditVFlow')
   frmInput.ADDOBJECT('QuitBtn', 'QuitBtn1')
   frmInput.ADDOBJECT('FBs', 'FBLevel')
   frmInput.ADDOBJECT('IonsFB', 'EditIonsFB')
   frmInput.ADDOBJECT('CarbonCS', 'CarbonCs')
   frmInput.ADDOBJECT('Ions', 'EditIons')
   frmInput.ADDOBJECT('XRF', 'EditXRF')
   frmInput.ADDOBJECT('Weights', 'EditWeights')
   frmInput.ADDOBJECT('Problems', 'EditProb')
   frmInput.ADDOBJECT('Carbon', 'EditCarbon')
   frmInput.ADDOBJECT('Laser', 'EditLaser')
   frmInput.ADDOBJECT('SO2', 'EditSO2')
   frmInput.ADDOBJECT('Flash', 'EditFlash')
   frmInput.ADDOBJECT('MagCal', 'EditMag')
   frmInput.ADDOBJECT('VacCal', 'EditVac')
   frmInput.ADDOBJECT('Bal25', 'Bal25')
   frmInput.ADDOBJECT('Bal30', 'Bal30')
   frmInput.ADDOBJECT('Bal30a', 'Bal30a')
   frmInput.ADDOBJECT('Bal31a', 'Bal31a')
   IF INLIST(mUSER, "ashbaugh")
      frmInput.ADDOBJECT('Label8', 'ProcLabel')
      frmInput.ADDOBJECT('ArtHist', 'ArtHist')
      frmInput.ADDOBJECT('FlowRSD', 'FlowRSD')
      frmInput.ADDOBJECT('BuildDBF', 'BuildDBF')
      frmInput.ADDOBJECT('Holds', 'EditHold')
      frmInput.ADDOBJECT('ClearQD', 'ClearQD')
      frmInput.ADDOBJECT('FlowRate', 'FlowRate')
      frmInput.ADDOBJECT('EditForm', 'EditForm')
```

```
      frmInput.ADDOBJECT('SwapCheck', 'SwapCheck')
      frmInput.ADDOBJECT('FinalCheck', 'FinalCheck')
      frmInput.Label8.VISIBLE = .T.
      frmInput.ArtHist.VISIBLE = .T.
      frmInput.FlowRSD.VISIBLE = .T.
      frmInput.BuildDBF.VISIBLE = .T.
      frmInput.Holds.VISIBLE = .T.
      frmInput.ClearQD.VISIBLE = .T.
      frmInput.FlowRate.VISIBLE = .T.
      frmInput.EditForm.VISIBLE = .T.
      frmInput.SwapCheck.VISIBLE = .T.
      frmInput.FinalCheck.VISIBLE = .T.
   ENDIF
   frmInput.Label1.VISIBLE = .T.
   frmInput.Label2.VISIBLE = .T.
   frmInput.Label3.VISIBLE = .T.
   frmInput.Label4.VISIBLE = .T.
   frmInput.Label5.VISIBLE = .T.
   frmInput.Label6.VISIBLE = .T.
   frmInput.Label7.VISIBLE = .T.
   frmInput.mSite.VISIBLE = .T.
   frmInput.mSeason.VISIBLE = .T.
   frmInput.LogStat.VISIBLE = .T.
   frmInput.LogFlow.VISIBLE = .T.
   frmInput.LogVFlow.VISIBLE = .T.
   frmInput.QuitBtn.VISIBLE = .T.
   frmInput.FBs.VISIBLE = .T.
   frmInput.IonsFB.VISIBLE = .T.
   frmInput.CarbonCS.VISIBLE = .T.
   frmInput.Ions.VISIBLE = .T.
   frmInput.XRF.VISIBLE = .T.
   frmInput.weights.VISIBLE = .T.
   frmInput.Problems.VISIBLE = .T.
   frmInput.Carbon.VISIBLE = .T.
   frmInput.Laser.VISIBLE = .T.
   frmInput.SO2.VISIBLE = .T.
   frmInput.Flash.VISIBLE = .T.
   frmInput.MagCal.VISIBLE = .T.
   frmInput.VacCal.VISIBLE = .T.
   frmInput.Bal25.VISIBLE = .T.
   frmInput.Bal30.VISIBLE = .T.
   frmInput.Bal30a.VISIBLE = .T.
   frmInput.Bal31a.VISIBLE = .T.

   frmInput.mSite.VISIBLE = .T.
   SELECT LogSites
   LOCATE FOR LogSites.site=mSite
   frmInput.mSite.VALUE = mSite  && Comment this out to return to same site
   frmInput.SHOW
   READ EVENTS
*? msite, mLogfile, mFile
   nofile = .F.

* Object definitions for display form follow
*  ON ERROR DO errhand WITH ;
ERROR( ), MESSAGE( ), MESSAGE(1), PROGRAM( ), LINENO( )
   ON ERROR DO QLOGSERR WITH EditFile, ERROR(), MESSAGE()
```

```
DO CASE
   CASE medit="Logs"
          DO EditLogs
   CASE medit="Flows"
          DO EditFlows
   CASE medit="VFlows"
          DO EditVFlows
   CASE medit="Weights"
          DO EditWeights
   CASE medit="FBs"
          DO FBLevel2
   CASE medit="Ions"
          DO EditIons
   CASE medit="Carbon"
          DO EditCarbon
   CASE medit="FBIons"
          DO FBIons
   CASE medit="CSCarbon"
          DO CarbonCS
   CASE medit="XRF"
          DO EditXRF
   CASE medit="Laser"
          DO EditLaser
   CASE medit="SO2"
          DO EditSO2
   CASE medit="Problems"
          DO EditProblems
   CASE medit="Holds"
          DO EditHolds
   CASE medit="Flash"
          DO EditFlash
   CASE medit="Mag"
          DO EditMag
   CASE medit="Vac"
          DO EditVac
   CASE medit="Edit Form"
          mSite=LogSites.site
          DO EditForm
   CASE medit="25"
          EditFile = mSuppPath + "BalEq25.DBF"
          cTitle = "Cahn " + medit + " Balance Equation"
          DO EditBal
   CASE medit="30 "
          EditFile = mSuppPath + "BalEq30.DBF"
          cTitle = "Cahn " + medit + " Balance Equation"
          DO EditBal
   CASE medit="30a"
          EditFile = mSuppPath + "BalEq30a.DBF"
          cTitle = "Cahn " + medit + " Balance Equation"
          DO EditBal
   CASE medit="31a"
          EditFile = mSuppPath + "BalEq31a.DBF"
          cTitle = "Cahn " + medit + " Balance Equation"
          DO EditBal
   CASE medit="FlowRSD"
          mSite = LogSites.site
          DO FlowRSD.prg WITH .T.
          SET safety off
```

```
*             SELECT site
*             LOCATE FOR site.site=sites.site
       CASE medit="FlowRate"
              mSite = LogSites.site
              DO flowrate.prg WITH .T.
              LOOP
       CASE medit="BuildDBF"
              HoldSeason = mSeason
              DO BuildDBF.prg WITH .T.
              IF SELECT("logsites")=0
                     USE m:\improve\temp\logsites IN 0
              ENDIF
              mSeason = HoldSeason
              LOOP
       CASE medit="SwapCheck"
              DO SwapCheck.prg WITH .T.
              LOOP
       CASE medit="ArtHist"
              DO ArtHist.prg
              LOOP
       CASE medit="ClearQD"
              DO ClearQD.prg
              LOOP
       CASE medit="Check"
              DO OutCheck.prg
              LOOP
       OTHERWISE
              DO EditLogs
   ENDCASE

*frmInput.Grid1.height = reccount("volsummary")*20
   SET DEFAULT TO M:\IMPROVE\Temp
   ON ERROR DO QLOGSERR WITH mLogFile, ERROR(), MESSAGE()
   IF SELECT('logs')<>0
      SELECT logs
      USE
   ENDIF
   USE &mLogFile IN 0 ALIAS logs
   IF NOT mBadLog
      SELECT logs
      ON ERROR DO errhand WITH ;
             ERROR( ), MESSAGE( ), MESSAGE(1), PROGRAM( ), LINENO( )
      GO TOP
*     mSite = logs.site
*     mDate = logs.samdat
      SELECT DISTINCT logs.site;
             FROM logs;
             ORDER BY logs.site;
             INTO TABLE LogSites
*INSERT INTO Sites (site) values ("  ALL")
*INSERT INTO Sites (site) values (" QUIT")
      INDEX ON site TAG site
      GO TOP
      IF LogSites.site="     "
             DELETE
             PACK
      ENDIF
   ENDIF
```

```
*GO TOP IN Site
   SELECT logs
   USE

*SET DEFAULT TO U:\IMPROVE\SUPPORT

ENDDO
DEFINE CLASS SiteLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 9
   ALIGNMENT = 0
   CAPTION = "Site Name:"
   HEIGHT = 20
   LEFT = 35
   TOP = 24
   WIDTH = 75
   NAME = "Label1"
ENDDEFINE

DEFINE CLASS SeasonLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 9
   ALIGNMENT = 1
   CAPTION = "Season:"
   TOP = 28
   LEFT = 220
   HEIGHT = 20
   WIDTH = 78
   NAME = "Label2"
ENDDEFINE

DEFINE CLASS LogsLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 10
   ALIGNMENT = 0
   CAPTION = "Logs:"
   HEIGHT = 20
   LEFT = 35
   TOP = 72
   WIDTH = 75
   NAME = "Label3"
ENDDEFINE

DEFINE CLASS BlanksLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 10
   ALIGNMENT = 0
   CAPTION = "Blanks & Artifacts:"
   HEIGHT = 20
   LEFT = 35
   TOP = 132
   WIDTH = 120
   NAME = "Label4"
```

```
ENDDEFINE

DEFINE CLASS DataLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 10
   ALIGNMENT = 0
   CAPTION = "Data Files:"
   HEIGHT = 20
   LEFT = 35
   TOP = 192
   WIDTH = 65
   NAME = "Label5"
ENDDEFINE

DEFINE CLASS CalLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 10
   ALIGNMENT = 0
   CAPTION = "Calibrations:"
   HEIGHT = 20
   LEFT = 35
   TOP = 288
   WIDTH = 80
   NAME = "Label6"
ENDDEFINE

DEFINE CLASS BalLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 10
   ALIGNMENT = 0
   CAPTION = "Balance Equations:"
   HEIGHT = 20
   LEFT = 220
   TOP = 288
   WIDTH = 130
   NAME = "Label7"
ENDDEFINE

DEFINE CLASS ProcLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 10
   ALIGNMENT = 0
   CAPTION = "Data Processing:"
   HEIGHT = 20
   LEFT = 35
   TOP = 384
   WIDTH = 110
   NAME = "Label8"
ENDDEFINE

DEFINE CLASS SiteBox AS LISTBOX
   FONTBOLD = .T.
   FONTSIZE = 8
   VALUE = LogSites.site
```

```
    CONTROLSOURCE = LogSites.site
    TOP = 12
    LEFT = 108
    WIDTH = 75
    HEIGHT = 50
    MAXLENGTH = 5
    SPECIALEFFECT = 0
    COLUMNCOUNT = 1
    NAME = "mSite"
    SELSTART = 1
    SELLENGTH = 5
    SELECTONENTRY = .T.
*   ROWSOURCETYPE = 3
*   ROWSOURCE = "select site from LogSites into cursor site ORDER BY site"
    ROWSOURCETYPE = 2
    ROWSOURCE = "LogSites"
*   DisplayValue = 1
    NUMBEROFELEMENTS = 180
    INPUTMASK = "!!!!!"
    READONLY = .F.
    INCREMENTALSEARCH = .T.
    PROCEDURE VALID
*       m.mSite = site.site
        m.mSite = LogSites.site
        CLEAR EVENTS
*       THISFORM.RELEASE
        THISFORM.HIDE
        WAIT CLEAR
        IF SELECT("Flash")>0
               SELECT Flash
               USE
        ENDIF
    ENDPROC
ENDDEFINE

DEFINE CLASS SeasonBox AS TEXTBOX
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    VALUE = m.mSeason
    SELSTART = 0
    SELLENGTH = 3
    SELECTONENTRY = .T.
    CONTROLSOURCE = "m.mSeason"
    FORMAT = "!"
    TOP = 24
    LEFT = 310
    HEIGHT = 25
    WIDTH = 48
    MAXLENGTH = 3
    SPECIALEFFECT = 0
    NAME = "mSeason"
    PROCEDURE VALID
    IF mSeason = CurrSeas
       mLogFile = mLogsPath + "logs.dbf"
    ELSE
       mLogFile = mLogsPath + mSeason + "logs.dbf"
    ENDIF
```

```
   ENDPROC
ENDDEFINE

*DEFINE CLASS FileLabel AS LABEL
*   AUTOSIZE = .F.
*   FONTBOLD = .T.
*   FONTSIZE = 9
*   ALIGNMENT = 1
*   CAPTION = "File to Edit"
*   HEIGHT = 90
*   LEFT = 3
*   TOP = 80
*   WIDTH = 93
*   NAME = "Label3"
*ENDDEFINE

DEFINE CLASS EditLogs AS COMMANDBUTTON
   TOP = 96
   LEFT = 24
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "Log\<Status"
   DEFAULT = .T.
   TERMINATEREAD = .F.
   NAME = "Logs"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="Logs"
   ENDPROC
ENDDEFINE

DEFINE CLASS EditFlow AS COMMANDBUTTON
   TOP = 96
   LEFT = 120
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "Mag\<Flow"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "Flows"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="Flows"
   ENDPROC
```

```
ENDDEFINE

DEFINE CLASS EditVFlow AS COMMANDBUTTON
   TOP = 96
   LEFT = 216
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "Vac Flow"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "VFlows"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="VFlows"
   ENDPROC
ENDDEFINE

DEFINE CLASS QuitBtn1 AS COMMANDBUTTON
   TOP = 96
   LEFT = 312
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .T.
   CAPTION = "\<Quit"
   TERMINATEREAD = .F.
   NAME = "QuitBtn"
   PROCEDURE CLICK
   ON ERROR  && restore system error handler
*  SET DEFAULT TO &DefaultDir
*  CLOSE DATABASES ALL
*  SET SAFETY ON
   POP KEY ALL
   IF INLIST(mUser, "ashbaugh", "sengupta")
      CANCEL
   ENDIF
   QUIT
   ENDPROC
ENDDEFINE

DEFINE CLASS FBLevel AS COMMANDBUTTON
   TOP = 156
   LEFT = 24
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "FB Level"
   DEFAULT = .F.
```

```
   TERMINATEREAD = .F.
   NAME = "FBs"
   PROCEDURE CLICK
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="FBs"
   ENDPROC
ENDDEFINE

DEFINE CLASS EditIonsFB AS COMMANDBUTTON
   TOP = 156
   LEFT = 120
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "IonsF\<B"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "IonsFB"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="FBIons"
   ENDPROC
ENDDEFINE

DEFINE CLASS CarbonCS AS COMMANDBUTTON
   TOP = 156
   LEFT = 216
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "CarbonCS"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "CarbonCS"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="CSCarbon"
   ENDPROC
ENDDEFINE

DEFINE CLASS ArtHist AS COMMANDBUTTON
   TOP = 156
   LEFT = 312
```

```
    HEIGHT = 25
    WIDTH = 85
    FONTBOLD = .T.
    FONTSIZE = 10
    CANCEL = .F.
    CAPTION = "ArtHist"
    TERMINATEREAD = .F.
    NAME = "ArtHist"
    PROCEDURE CLICK
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
    m.mSite = LogSites.site
    CLEAR EVENTS
    THISFORM.RELEASE
    WAIT CLEAR
    medit="ArtHist"
    ENDPROC
ENDDEFINE

DEFINE CLASS EditIons AS COMMANDBUTTON
    TOP = 216
    LEFT = 24
    HEIGHT = 25
    WIDTH = 85
    FONTBOLD = .T.
    FONTSIZE = 10
    CANCEL = .F.
    CAPTION = "\<Ions"
    DEFAULT = .F.
    TERMINATEREAD = .F.
    NAME = "Ions"
    PROCEDURE CLICK
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
    m.mSite = LogSites.site
    CLEAR EVENTS
    THISFORM.RELEASE
    WAIT CLEAR
    medit="Ions"
    ENDPROC
ENDDEFINE

DEFINE CLASS EditXRF AS COMMANDBUTTON
    TOP = 216
    LEFT = 120
    HEIGHT = 25
    WIDTH = 85
    FONTBOLD = .T.
    FONTSIZE = 10
    CANCEL = .F.
    CAPTION = "\<XRF"
    DEFAULT = .F.
    TERMINATEREAD = .F.
    NAME = "Carbon"
    PROCEDURE CLICK
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
    m.mSite = LogSites.site
    CLEAR EVENTS
    THISFORM.RELEASE
    WAIT CLEAR
```

```
   medit="XRF"
   ENDPROC
ENDDEFINE

DEFINE CLASS EditWeights AS COMMANDBUTTON
   TOP = 216
   LEFT = 216
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "\<Weights"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "Weights"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="Weights"
   ENDPROC
ENDDEFINE

DEFINE CLASS EditProb AS COMMANDBUTTON
   TOP = 216
   LEFT = 312
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "\<Problems"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "Problems"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="Problems"
   ENDPROC
ENDDEFINE

DEFINE CLASS EditCarbon AS COMMANDBUTTON
   TOP = 252
   LEFT = 24
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "\<Carbon"
   DEFAULT = .F.
```

```
   TERMINATEREAD = .F.
   NAME = "Carbon"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="Carbon"
   ENDPROC
ENDDEFINE

DEFINE CLASS EditLaser AS COMMANDBUTTON
   TOP = 252
   LEFT = 120
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "\<Laser"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "Ions"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="Laser"
   ENDPROC
ENDDEFINE

DEFINE CLASS EditSO2 AS COMMANDBUTTON
   TOP = 252
   LEFT = 216
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "SO\<2"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "SO2"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="SO2"
   ENDPROC
ENDDEFINE

DEFINE CLASS EditFlash AS COMMANDBUTTON
   TOP = 252
```

```
    LEFT = 312
    HEIGHT = 25
    WIDTH = 85
    FONTBOLD = .T.
    FONTSIZE = 10
    CANCEL = .F.
    CAPTION = "Flash \<Data"
    DEFAULT = .F.
    TERMINATEREAD = .F.
    NAME = "Flash"
    PROCEDURE CLICK
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
    m.mSite = LogSites.site
    CLEAR EVENTS
    THISFORM.RELEASE
    WAIT CLEAR
    medit="Flash"
    ENDPROC
ENDDEFINE

DEFINE CLASS EditMag AS COMMANDBUTTON
    TOP = 312
    LEFT = 24
    HEIGHT = 25
    WIDTH = 85
    FONTBOLD = .T.
    FONTSIZE = 10
    CANCEL = .F.
    CAPTION = "\<Mag Cal"
    DEFAULT = .F.
    TERMINATEREAD = .F.
    NAME = "Mag"
    PROCEDURE CLICK
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
    m.mSite = LogSites.site
    CLEAR EVENTS
    THISFORM.RELEASE
    WAIT CLEAR
    medit="Mag"
    ENDPROC
ENDDEFINE

DEFINE CLASS EditVac AS COMMANDBUTTON
    TOP = 348
    LEFT = 24
    HEIGHT = 25
    WIDTH = 85
    FONTBOLD = .T.
    FONTSIZE = 10
    CANCEL = .F.
    CAPTION = "\<Vac Cal"
    TERMINATEREAD = .F.
    NAME = "Vac"
    PROCEDURE CLICK
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
    m.mSite = LogSites.site
    CLEAR EVENTS
    THISFORM.RELEASE
```

```
   WAIT CLEAR
   medit="Vac"
   ENDPROC
ENDDEFINE

DEFINE CLASS Bal25 AS COMMANDBUTTON
   TOP = 312
   LEFT = 216
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "C25 Eqn"
   TERMINATEREAD = .F.
   NAME = "Bal25"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="25"
   ENDPROC
ENDDEFINE

DEFINE CLASS Bal30 AS COMMANDBUTTON
   TOP = 312
   LEFT = 312
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "C30 Eqn"
   TERMINATEREAD = .F.
   NAME = "Bal30"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="30 "
   ENDPROC
ENDDEFINE

DEFINE CLASS Bal30a AS COMMANDBUTTON
   TOP = 348
   LEFT = 216
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "C30a Eqn"
   TERMINATEREAD = .F.
   NAME = "Bal30a"
```

```
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="30a"
   ENDPROC
ENDDEFINE

DEFINE CLASS Bal31a AS COMMANDBUTTON
   TOP = 348
   LEFT = 312
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "C31a Eqn"
   TERMINATEREAD = .F.
   NAME = "Bal31a"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="31a"
   ENDPROC
ENDDEFINE

DEFINE CLASS FlowRSD AS COMMANDBUTTON
   TOP = 408
   LEFT = 24
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "FlowRSD"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "FlowRSD"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
       m.mSite = LogSites.site
       CLEAR EVENTS
       THISFORM.RELEASE
       WAIT CLEAR
       medit="FlowRSD"
   ENDPROC
ENDDEFINE

DEFINE CLASS BuildDBF AS COMMANDBUTTON
   TOP = 408
   LEFT = 120
   HEIGHT = 25
   WIDTH = 85
```

```
    FONTBOLD = .T.
    FONTSIZE = 10
    CANCEL = .F.
    CAPTION = "BuildDBF"
    TERMINATEREAD = .F.
    NAME = "BuildDBF"
    PROCEDURE CLICK
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
    m.mSite = LogSites.site
    CLEAR EVENTS
    THISFORM.RELEASE
    WAIT CLEAR
    medit="BuildDBF"
    ENDPROC
ENDDEFINE

DEFINE CLASS EditHold AS COMMANDBUTTON
    TOP = 408
    LEFT = 216
    HEIGHT = 25
    WIDTH = 85
    FONTBOLD = .T.
    FONTSIZE = 10
    CANCEL = .F.
    CAPTION = "\<Hold Sites"
    DEFAULT = .F.
    TERMINATEREAD = .F.
    NAME = "Holds"
    PROCEDURE CLICK
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
    m.mSite = LogSites.site
    CLEAR EVENTS
    THISFORM.RELEASE
    WAIT CLEAR
    medit="Holds"
    ENDPROC
ENDDEFINE

DEFINE CLASS ClearQD AS COMMANDBUTTON
    TOP = 408
    LEFT = 312
    HEIGHT = 25
    WIDTH = 85
    FONTBOLD = .T.
    FONTSIZE = 10
    CANCEL = .F.
    CAPTION = "Clear QDs"
    TERMINATEREAD = .F.
    NAME = "ClearQD"
    PROCEDURE CLICK
*       IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
    m.mSite = LogSites.site
    CLEAR EVENTS
    THISFORM.RELEASE
    WAIT CLEAR
    medit="ClearQD"
    ENDPROC
ENDDEFINE
```

```
DEFINE CLASS FlowRate AS COMMANDBUTTON
   TOP = 444
   LEFT = 24
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "FlowRate"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "FlowRate"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
       m.mSite = LogSites.site
       CLEAR EVENTS
       THISFORM.RELEASE
       WAIT CLEAR
       medit="FlowRate"
   ENDPROC
ENDDEFINE

DEFINE CLASS EditForm AS COMMANDBUTTON
   TOP = 444
   LEFT = 120
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "\<Edit Form"
   DEFAULT = .F.
   TERMINATEREAD = .F.
   NAME = "EditForm"
   PROCEDURE CLICK
   m.mSite = logsites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit = "Edit Form"
   ENDPROC
ENDDEFINE

DEFINE CLASS SwapCheck AS COMMANDBUTTON
   TOP = 444
   LEFT = 216
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "SwapCheck"
   TERMINATEREAD = .F.
   NAME = "SwapCheck"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
```

```
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="SwapCheck"
   ENDPROC
ENDDEFINE

DEFINE CLASS FinalCheck AS COMMANDBUTTON
   TOP = 444
   LEFT = 312
   HEIGHT = 25
   WIDTH = 85
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "Final Check"
   TERMINATEREAD = .F.
   NAME = "FinalCheck"
   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = LogSites.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   medit="Check"
   ENDPROC
ENDDEFINE
```

## D.2. ErrHand

```
PROCEDURE errhand
PARAMETER merror, MESS, mess1, mprog, mlineno
CLEAR
CLEAR WINDOWS

WAIT WINDOW TIMEOUT 4 'Error number: ' + LTRIM(STR(merror));
   + CHR(13)+ 'Error message: ' + MESS;
   + CHR(13)+ 'Line of code with error: ' + mess1;
   + CHR(13)+ 'Line number of error: ' + LTRIM(STR(mlineno));
   + CHR(13)+ 'Program with error: ' + mprog
IF merror=1
   nofile=.T.
ENDIF
*CLOSE DATABASES ALL
*ON ERROR  && restore system error handler
*CANCEL
*EXIT
RETURN
```

## D.3. EditForm

```
PROCEDURE EditForm

PUBLIC notesite, notedate, mAffectedModule, mTDate, mrecnum, mSDate, mEDate, mOther,
   mProblemDescription, mSwapDateChangedTo, mFlag

msite=logsites.site
STORE SYS(5)+SYS(2003) TO DefaultDir

* used for the list of problem descriptions
*USE J:\user\annexfront\sengupta\swap\problems.dbf IN 0
ProbDesc = mGETENV + "problems.dbf"
USE &ProbDesc IN 0 ALIAS problems

mproblem = problems.COMMENT
SELECT problems
INDEX ON COMMENT TAG COMMENT
GO TOP

*used for the list of flags
*USE J:\user\annexfront\sengupta\swap\flag.dbf IN 0
FlagFile = mGETENV + "flag.dbf"
USE &FlagFile IN 0 ALIAS FLAG

mFlag = FLAG.bi
SELECT FLAG
INDEX ON bi TAG bi
GO TOP

*used for the actual validation notes table where everything is inputed
*USE J:\user\annexfront\sengupta\swap\ValidationNotes.dbf IN 0
NotesFile = mGETENV + "ValidationNotes.dbf"
USE &NotesFile IN 0 ALIAS ValidationNotes

SELECT ValidationNotes
INDEX ON recnum TAG recnum
SET ORDER TO recnum
GO TOP

* creates all the variables where the input data is stored
mAffectedModule = ValidationNotes.MODULE
mTDate = DATE()
mSDate = ValidationNotes.startdate
mEDate = ValidationNotes.enddate
mSwapDateChangedTo = ValidationNotes.swapdate

mBadLog=.F.
frmInput = CREATEOBJECT('Form')
frmInput.CLOSABLE = .F.
frmInput.MOVABLE = .T.
frmInput.BORDERSTYLE = 3

frmInput.MOVE(0,0,425, 325)
frmInput.CAPTION = "Validate records for selected site/quarter"
frmInput.NAME = "EditForm"
```

```
*create all the objects on the form
frmInput.ADDOBJECT('Label1', 'SiteLabel')
frmInput.ADDOBJECT('Label11', 'SiteBox')

frmInput.ADDOBJECT('Label3', 'DateLabel')
frmInput.ADDOBJECT('EntryDate', 'DateBox')

frmInput.ADDOBJECT('Label4', 'SDateLabel')
frmInput.ADDOBJECT('StartDate', 'SDateBox')

frmInput.ADDOBJECT('Label5', 'EDateLabel')
frmInput.ADDOBJECT('EndDate', 'EDateBox')

frmInput.ADDOBJECT('Label6', 'ModuleLabel')
frmInput.ADDOBJECT('AffectedModule', 'AffectedModuleBox')

frmInput.ADDOBJECT('Label7', 'ProblemLabel')
frmInput.ADDOBJECT('ProblemDescription', 'ProblemDescriptionBox')

frmInput.ADDOBJECT('Label8', 'OtherLabel')
frmInput.ADDOBJECT('Other', 'OtherBox')

frmInput.ADDOBJECT('Label9', 'SwapLabel')
frmInput.ADDOBJECT('SwapDateChangedTo', 'SwapDateChangedToBox')

frmInput.ADDOBJECT('Label10', 'FlagLabel')
frmInput.ADDOBJECT('Flag', 'FlagBox')

frmInput.ADDOBJECT('Quitbtn', 'QuitBtn')
frmInput.ADDOBJECT('EnterBtn', 'EnterBtn')

frmInput.Label1.VISIBLE = .T.
frmInput.Label11.VISIBLE = .T.
frmInput.Label3.VISIBLE = .T.
frmInput.EntryDate.VISIBLE = .T.
frmInput.Label4.VISIBLE = .T.
frmInput.startdate.VISIBLE = .T.
frmInput.Label5.VISIBLE = .T.
frmInput.enddate.VISIBLE = .T.
frmInput.Label6.VISIBLE = .T.
frmInput.AffectedModule.VISIBLE = .T.
frmInput.Label7.VISIBLE = .T.
frmInput.ProblemDescription.VISIBLE = .T.
frmInput.Label8.VISIBLE = .T.
frmInput.OTHER.VISIBLE = .T.
frmInput.Label9.VISIBLE = .T.
frmInput.SwapDateChangedTo.VISIBLE = .T.
frmInput.Label10.VISIBLE = .T.
frmInput.FLAG.VISIBLE = .T.
frmInput.QuitBtn.VISIBLE = .T.
frmInput.EnterBtn.VISIBLE = .T.

frmInput.Label11.CAPTION = msite
frmInput.SHOW
*frmInput.REFRESH
READ EVENTS

*? msite, mLogfile, mFile
```

```
nofile = .F.

* Object definitions for display form follow
DEFINE CLASS SiteLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 9
   ALIGNMENT = 1
   CAPTION = "Site Name:  "&& + msite
   HEIGHT = 30
   LEFT = 35
   TOP = 24
   WIDTH = 93
   NAME = "Label1"
ENDDEFINE

* Object definitions for display form follow
DEFINE CLASS SiteBox AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 9
   ALIGNMENT = 1
   CAPTION = m.msite
   HEIGHT = 30
   LEFT = 130
   TOP = 24
   WIDTH = 60
   NAME = "Label11"
ENDDEFINE

************************************************
DEFINE CLASS DateLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 9
   ALIGNMENT = 1
   CAPTION = "Today's Date:"
   TOP = 70
   LEFT = 18
   HEIGHT = 25
   WIDTH = 100
   NAME = "Label3"
ENDDEFINE

DEFINE CLASS DateBox AS TEXTBOX
   FONTBOLD = .T.
   FONTSIZE = 9
   ALIGNMENT = 1
   SELSTART = 0
   SELLENGTH = 8
   SELECTONENTRY = .T.
   CONTROLSOURCE = "mTDate"
   FORMAT = "!"
   TOP = 70
   LEFT = 144
   HEIGHT = 25
   WIDTH = 80
   MAXLENGTH = 8
```

```
    SPECIALEFFECT = 0
    NAME = "mTDate"
ENDDEFINE

************************
DEFINE CLASS ModuleLabel AS LABEL
    AUTOSIZE = .F.
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    CAPTION = "Affected Module:"
    HEIGHT = 25
    LEFT = 230
    TOP = 70
    WIDTH = 100
    NAME = "Label6"
ENDDEFINE

DEFINE CLASS AffectedModuleBox AS TEXTBOX
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    VALUE = m.mAffectedModule
    SELSTART = 0
    SELLENGTH = 5
    SELECTONENTRY = .T.
    CONTROLSOURCE = "m.mAffectedModule"
    FORMAT = "!"
    TOP = 70
    LEFT = 340
    HEIGHT = 25
    WIDTH = 60
    MAXLENGTH = 5
    SPECIALEFFECT = 0
    NAME = "mAffectedModule"
ENDDEFINE

*******************************
DEFINE CLASS SDateLabel AS LABEL
    AUTOSIZE = .F.
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    CAPTION = "Start Date:"
    TOP = 110
    LEFT = 18
    HEIGHT = 25
    WIDTH = 100
    NAME = "Label4"
ENDDEFINE

DEFINE CLASS SDateBox AS TEXTBOX
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    SELSTART = 0
    SELLENGTH = 8
    SELECTONENTRY = .T.
```

```
   CONTROLSOURCE = "mSDate"
   FORMAT = "!"
   TOP = 110
   LEFT = 144
   HEIGHT = 25
   WIDTH = 80
   MAXLENGTH = 8
   SPECIALEFFECT = 0
   NAME = "mSDateBox"
ENDDEFINE

***********************************
DEFINE CLASS ProblemLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 9
   ALIGNMENT = 1
   CAPTION = "Problem:"
   TOP = 150
   LEFT = 18
   HEIGHT = 25
   WIDTH = 100
   NAME = "Label7"
ENDDEFINE

DEFINE CLASS ProblemDescriptionBox AS LISTBOX
   FONTBOLD = .T.
   FONTSIZE = 8
   VALUE = problems.COMMENT
   CONTROLSOURCE = problems.COMMENT
   TOP = 140
   LEFT = 144
   WIDTH = 250
   HEIGHT = 50
   MAXLENGTH = 60
   SPECIALEFFECT = 0
   COLUMNCOUNT = 1
   NAME = "ProblemDescription"
   SELSTART = 1
   SELLENGTH = 5
   SELECTONENTRY = .T.
   ROWSOURCETYPE = 3
   ROWSOURCE = "select comment from Problems into cursor comment ORDER BY comment"
   NUMBEROFELEMENTS = 62
   INPUTMASK = "!!!!!!!!"
   READONLY = .F.
   INCREMENTALSEARCH = .T.
   PROCEDURE VALID
   m.ProblemDescription = problems.COMMENT
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   IF SELECT("Flash")>0
      SELECT Flash
      USE
   ENDIF
   ENDPROC
ENDDEFINE
```

```
*************************

DEFINE CLASS EDateLabel AS LABEL
    AUTOSIZE = .F.
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    CAPTION = "End Date:"
    TOP = 110
    LEFT = 230
    HEIGHT = 25
    WIDTH = 60
    NAME = "Label5"
ENDDEFINE

DEFINE CLASS EDateBox AS TEXTBOX
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    SELSTART = 0
    SELLENGTH = 8
    SELECTONENTRY = .T.
    CONTROLSOURCE = "mEDate"
    FORMAT = "!"
    TOP = 110
    LEFT = 300
    HEIGHT = 25
    WIDTH = 80
    MAXLENGTH = 8
    SPECIALEFFECT = 0
    NAME = "mEDateBox"
ENDDEFINE

*****************************
DEFINE CLASS OtherLabel AS LABEL
    AUTOSIZE = .F.
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    CAPTION = "Or Other:"
    TOP = 200
    LEFT = 18
    HEIGHT = 25
    WIDTH = 100
    NAME = "Label8"
ENDDEFINE

DEFINE CLASS OtherBox AS TEXTBOX
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    SELSTART = 0
    SELLENGTH = 60
    SELECTONENTRY = .T.
    CONTROLSOURCE = "mOther"
    TOP = 200
    LEFT = 144
    HEIGHT = 25
```

```
    WIDTH = 250
    MAXLENGTH = 60
    SPECIALEFFECT = 0
    NAME = "mOtherBox"
ENDDEFINE

*******************************
DEFINE CLASS SwapLabel AS LABEL
    AUTOSIZE = .F.
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    CAPTION = "Swap Date Changed To:"
    TOP = 230
    LEFT = 18
    HEIGHT = 25
    WIDTH = 150
    NAME = "Label9"
ENDDEFINE

DEFINE CLASS SwapDateChangedToBox AS TEXTBOX
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    SELSTART = 0
    SELLENGTH = 8
    SELECTONENTRY = .T.
    CONTROLSOURCE = "mSwapDateChangedTo"
    FORMAT = "!"
    TOP = 230
    LEFT = 200
    HEIGHT = 25
    WIDTH = 70
    MAXLENGTH = 8
    SPECIALEFFECT = 0
    NAME = "mSwapDateChangedToBox"

ENDDEFINE
*******************************
DEFINE CLASS FlagLabel AS LABEL
    AUTOSIZE = .F.
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    CAPTION = "Flag:"
    TOP = 270
    LEFT = 18
    HEIGHT = 25
    WIDTH = 75
    NAME = "Label10"
ENDDEFINE

DEFINE CLASS FlagBox AS LISTBOX
    FONTBOLD = .T.
    FONTSIZE = 8
    VALUE = FLAG.bi
    CONTROLSOURCE = FLAG.bi
    TOP = 270
```

```
   LEFT = 144
   WIDTH = 60
   HEIGHT = 50
   MAXLENGTH = 3
   SPECIALEFFECT = 0
   COLUMNCOUNT = 1
   NAME = "flag"
   SELSTART = 1
   SELLENGTH = 3
   SELECTONENTRY = .T.
   ROWSOURCETYPE = 3
   ROWSOURCE = "select bi from flag into cursor bi ORDER BY bi"
   NUMBEROFELEMENTS = 18
   INPUTMASK = "!!!"
   READONLY = .F.
   INCREMENTALSEARCH = .T.
   PROCEDURE VALID
   m.flag = FLAG.bi
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   IF SELECT("Flash")>0
      SELECT Flash
      USE
   ENDIF
   ENDPROC
ENDDEFINE

DEFINE CLASS EnterBtn AS COMMANDBUTTON
   TOP = 270
   LEFT = 280
   HEIGHT = 25
   WIDTH = 50
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .T.
   CAPTION = "\<Enter"
   TERMINATEREAD = .F.
   NAME = "Enterbtn"

   PROCEDURE CLICK
* the first 2 lines allows the clicked selection from the list to be saved
   mProblemDescription = COMMENT.COMMENT
   mFlag = bi.bi
*mOther = validationnotes.comment


   ON ERROR && restore system error handler
   SELECT ValidationNotes
* if there is an added comment, then do not add the clicked problem selection
*IF !EMPTY(TAG(mOther))
*  INSERT INTO ValidationNotes (EntryDate, Site, Module, StartDate,;
EndDate, Comment, SwapDate, Flag);
VALUES( mTDate, m.mSite, mAffectedModule, mSDate, mEDate,;
mOther, mSwapDateChangedTo, mflag)
*ELSE
   INSERT INTO ValidationNotes ( EntryDate, site, MODULE, startdate,;
      enddate, COMMENT, swapdate, FLAG);
```

```
       VALUES(mTDate, m.msite, mAffectedModule, mSDate, mEDate,;
       mProblemDescription, mSwapDateChangedTo, mFlag)
*ENDIF
   SET SAFETY ON
*POP KEY ALL
*HIDE WINDOW output
*USE
   ENDPROC
ENDDEFINE

****************************************
DEFINE CLASS QuitBtn AS COMMANDBUTTON
   TOP = 270
   LEFT = 340
   HEIGHT = 25
   WIDTH = 50
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .T.
   CAPTION = "\<Quit"
   TERMINATEREAD = .F.
   NAME = "Quitbtn"

   PROCEDURE CLICK
   ON ERROR && restore system error handler
   SET DEFAULT TO &DefaultDir
   SET SAFETY ON
   DEACTIVATE WINDOW ALL
   POP KEY ALL
*CANCEL
*  RETURN TO MASTER
*RETURN
*CLEAR EVENTS
   THISFORM.RELEASE
   SET SAFETY OFF
   SELECT ValidationNotes
   USE
   SELECT FLAG
   USE
   SELECT bi
   USE
   SELECT COMMENT
   USE
   SELECT problems
   USE
   RETURN TO MASTER
   CANCEL
   ENDPROC

ENDDEFINE
```

## D.4. QLogsErr

```
PROCEDURE QLOGSERR
PARAMETER mFile, mERROR, mMessage
SET ESCAPE OFF
WAIT WINDOW ;
   "Error on "+mFile + ". May be not on Disk or already open" ;
   + CHR(13) + CHR(10) + mMessage  + ;
   + CHR(13) + "Hit ESC or ENTER to return to program" TIMEOUT 2
*  Wait &mLogFile  window Timeout 1
DO CASE
   CASE LASTKEY() = 138
      DEACTIVATE WINDOW ALL
      CLOSE DATABASES ALL
      CANCEL
*     QUIT
   CASE LASTKEY()=13 OR LASTKEY()=32 OR LASTKEY()=27
      mBadLog = .T.
      RETURN
   OTHERWISE
      mBadLog = .T.
      RETRY               &&
ENDCASE

IF SELECT('logs')<>0
   SELECT logs
   USE
ENDIF
SET ESCAPE ON
RETURN
```

## D.5. Errhand

```
PROCEDURE errhand
PARAMETER merror, mess, mess1, mprog, mlineno
CLEAR
? 'Error number: ' + LTRIM(STR(merror))
? 'Error message: ' + mess
? 'Line of code with error: ' + mess1
? 'Line number of error: ' + LTRIM(STR(mlineno))
? 'Program with error: ' + mprog
*CLOSE DATABASES ALL
WAIT
ON ERROR  && restore system error handler
CANCEL
```

## D.6. EditLogs

```
PROCEDURE EditLogs
IF mSeason = CurrSeas
   EditFile = mLogsPath + "logs.dbf"
ELSE
   EditFile = mLogsPath + mSeason + "logs.dbf"
ENDIF
USE &EditFile IN 0 ALIAS logs
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,165 TITLE 'Logs Status - Hit ESC to quit' ;
             FLOAT GROW ZOOM MDI FONT 'Arial', 8
      ACTIVATE WINDOW OUTPUT
      SELECT logs
      SET FILTER TO logs.site=m.mSite
      IF samdat>={^2004/09/01}
             BROWSE FIELDS site:W=.F., DAY:W=.F., ;
                    BOX=RIGHT(DTOS(predate),2):W="F", area:W=.F., samdat:W=.F.,;
                    af1nm:P="!!", bf1nm:P="!!", cf1nm:P="!!", df1nm:P="!!",
   comments:90,;
                    usela:P="!", uselb:P="!", uselc:P="!", useld:P="!", uselt:P="!";
                    WINDOW OUTPUT
      ELSE
             BROWSE FIELDS site:W=.F., DAY:W=.F., ;
                    BOX=RIGHT(DTOS(predate),2):W="F", area:W=.F., samdat:W=.F.,;
                    af1nm:P="!!", bf1nm:P="!!", cf1nm:P="!!", df1nm:P="!!", area,
   comments;
                    WINDOW OUTPUT
      ENDIF
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.7. EditFlows

```
PROCEDURE EditFlows
EditFile = mLogsPath + mSeason + "logs.dbf"
USE &EditFile IN 0 ALIAS logs
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,165 TITLE 'Flows' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 8
      ACTIVATE WINDOW OUTPUT
      SELECT logs
      SET FILTER TO logs.site=m.mSite
      IF samdat>{8/31/2004}
             IF RIGHT(mSite,1)="9"
                    BROWSE FIELDS site:W=.F., DAY:W=.F., samdat:W=.F.,;
                           tempcur:8, af1et:8, bf1et:8, cf1et:8, df1et:8,;
                           af1gi:8, af1gf:8, bf1gi:8, bf1gf:8, cf1gi:8, cf1gf:8,
   df1gi:8, df1gf:8, comments:85,;
                           usela:P="!", uselb:P="!", uselc:P="!", useld:P="!",
   uselt:P="!";
                           WINDOW OUTPUT
             ELSE
                    BROWSE FIELDS site:W=.F., DAY:W=.F., samdat:W=.F.,;
                           tempcur:8, af1et:8, bf1et:8, cf1et:8, df1et:8,;
                           af1mi:8, af1mf:8, bf1mi:8, bf1mf:8, cf1mi:8, cf1mf:8,
   df1gi:8, df1gf:8, comments:85,;
                           usela:P="!", uselb:P="!", uselc:P="!", useld:P="!",
   uselt:P="!";
                           WINDOW OUTPUT
             ENDIF
      ELSE
             IF RIGHT(mSite,1)="9"
                    BROWSE FIELDS site:W=.F., DAY:W=.F., samdat:W=.F.,;
                           tempcur:8, af1et:8, bf1et:8, cf1et:8, df1et:8,;
                           af1gi:8, af1gf:8, bf1gi:8, bf1gf:8, cf1gi:8, cf1gf:8,
   df1gi:8, df1gf:8, comments:85;
                           WINDOW OUTPUT
             ELSE
                    BROWSE FIELDS site:W=.F., DAY:W=.F., samdat:W=.F.,;
                           tempcur:8, af1et:8, bf1et:8, cf1et:8, df1et:8,;
                           af1mi:8, af1mf:8, bf1mi:8, bf1mf:8, cf1mi:8, cf1mf:8,
   df1gi:8, df1gf:8, comments:85;
                           WINDOW OUTPUT
             ENDIF
      ENDIF
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.8. EditVFlows

```
PROCEDURE EditVFlows
EditFile = mLogsPath + mSeason + "logs.dbf"
USE &EditFile IN 0 ALIAS logs
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,165 TITLE 'Flows' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT logs
      SET FILTER TO logs.site=m.mSite
      IF samdat>{8/31/2004}
             IF RIGHT(mSite,1)="9"
                    BROWSE FIELDS site:W=.F., DAY:W=.F., samdat:W=.F.,;
                           tempcur:8, af1et:8, bf1et:8, cf1et:8, df1et:8,;
                           af1gi:8, af1gf:8, bf1gi:8, bf1gf:8, cf1gi:8, cf1gf:8,
   df1gi:8, df1gf:8, comments:85,;
                           usela:P="!", uselb:P="!", uselc:P="!", useld:P="!",
   uselt:P="!";
                           WINDOW OUTPUT
             ELSE
                    BROWSE FIELDS site:W=.F., DAY:W=.F., samdat:W=.F.,;
                           tempcur:8, af1et:8, bf1et:8, cf1et:8, df1et:8,;
                           af1gi:8, af1gf:8, bf1gi:8, bf1gf:8, cf1gi:8, cf1gf:8,
   df1gi:8, df1gf:8, comments:85,;
                           usela:P="!", uselb:P="!", uselc:P="!", useld:P="!",
   uselt:P="!";
                           WINDOW OUTPUT
             ENDIF
      ELSE
             IF RIGHT(mSite,1)="9"
                    BROWSE FIELDS site:W=.F., DAY:W=.F., samdat:W=.F.,;
                           tempcur:8, af1et:8, bf1et:8, cf1et:8, df1et:8,;
                           af1gi:8, af1gf:8, bf1gi:8, bf1gf:8, cf1gi:8, cf1gf:8,
   df1gi:8, df1gf:8, comments:85;
                           WINDOW OUTPUT
             ELSE
                    BROWSE FIELDS site:W=.F., DAY:W=.F., samdat:W=.F.,;
                           tempcur:8, af1et:8, bf1et:8, cf1et:8, df1et:8,;
                           af1gi:8, af1gf:8, bf1gi:8, bf1gf:8, cf1gi:8, cf1gf:8,
   df1mi:8, df1mf:8, comments:85;
                           WINDOW OUTPUT
             ENDIF
      ENDIF
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.9. EditWeights

```
PROCEDURE EditWeights
IF mSeason = CurrSeas
   EditFile = mWtsPath + "weights.dbf"
ELSE
   EditFile = mWtsPath + mSeason + "wts.dbf"
ENDIF

USE &EditFile IN 0 ALIAS weights
IF NOT mBadLog
   IF NOT nofile
      SELECT weights
      SET FILTER TO weights.site=m.mSite
      mTmpWt = mGETENV + "TmpWt.dbf"
      COPY TO &mTmpWt
      USE &mTmpWt IN 0 ALIAS Wts
      SELECT Wts
      DO calcwts
      SELECT Wts
      INDEX ON site+DTOC(samdat)+CHAN TAG sitedate
      SELECT weights
      GO TOP
      SET RELATION TO site+DTOC(samdat)+CHAN INTO Wts ADDITIVE
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,145 ;
            TITLE 'Weights - Press F1 to create XLS file in M:\IMPROVE\Temp' ;
            CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      PUSH KEY
      ON KEY LABEL F1 DO WTout
      DO CASE
            CASE weights.samdat<{09/01/2001}
                  BROWSE FIELDS site:W=.F., samdat, CHAN, STATUS:P="!!",;
                        Cahn25wt, Prewght:W=.F., Postwght, DIFF=Postwght-
   Prewght:W=.F., ;
                        prindate:W=.F., printime:W=.F.,;
                        prbalance:W=.F., prname:W=.F., pobalance:W=.F.,
   poname:W=.F.;
                        LOCK -4;
                        WINDOW OUTPUT
            CASE weights.samdat<{06/01/2002}
                  BROWSE FIELDS site:W=.F., samdat, CHAN, STATUS:P="!!",;
                        Cahn25wt, Post30a, Prewght:W=.F., Postwght:W=.F.,
   DIFF=Postwght-Prewght:W=.F., ;
                        prindate:W=.F., printime:W=.F.,;
                        prbalance:W=.F., prname:W=.F., pobalance:W=.F.,
   poname:W=.F.;
                        LOCK -4;
                        WINDOW OUTPUT
            OTHERWISE
                  BROWSE FIELDS site:W=.F., samdat, CHAN, STATUS:P="!!",;
                        prebalwt, pstbalwt, Wts.Prewght:W=.F., Wts.Postwght:W=.F.,
   ;
                        Wts.DIFF:W=.F., prindate:W=.F., printime:W=.F.,;
                        prbalance:W=.F., prname:W=.F., pobalance:W=.F.,
   poname:W=.F.;
                        LOCK -4;
```

```
                              WINDOW OUTPUT
      ENDCASE
      HIDE WINDOW OUTPUT
      SELECT weights
      USE
      SELECT Wts
      USE
      POP KEY
   ENDIF
ENDIF

PROCEDURE WTout
outname = mPathtemp + ALLTRIM(wts.site) + mSeason + "WT.xls"
DO CASE
   CASE weights.samdat<{09/01/2001}
      COPY TO &outname XL5 FIELDS site, samdat, CHAN, STATUS, ;
            Cahn25wt, PSTBAL=postwght, Prewght, Postwght, DIFF=Postwght-Prewght, ;
            prindate, printime, ;
            prbalance, prname, pobalance, poname
   CASE weights.samdat<{06/01/2002}
      COPY TO &outname XL5 FIELDS site, samdat, CHAN, STATUS, ;
            Cahn25wt, Post30a, Prewght, Postwght, DIFF=Postwght-Prewght, ;
            prindate, printime, ;
            prbalance, prname, pobalance, poname
   OTHERWISE
      COPY TO &outname XL5 FIELDS site, samdat, CHAN, STATUS, ;
            prebalwt, pstbalwt, Wts.Prewght, Wts.Postwght, ;
            Wts.DIFF, prindate, printime, ;
            prbalance, prname, pobalance, poname
ENDCASE
RETURN
```

## D.10. CalcWts

```
PROCEDURE CalcWts

* Recalculates prewt, postwt, and diff in the WTS file for selected quarter

PUBLIC mPrewght, mPstwght

mDefPath = SYS(5)+SYS(2003)
SET DEFAULT TO &mPathTemp

*Delete temporary files if they exist
IF FILE('tbal25.dbf')
   DELETE FILE tbal25.dbf
ENDIF
IF FILE('tbal30.dbf')
   DELETE FILE tbal30.dbf
ENDIF
IF FILE('tbal30a.dbf')
   DELETE FILE tbal30a.dbf
ENDIF
IF FILE('tbal31a.dbf')
   DELETE FILE tbal31a.dbf
ENDIF

USE "u:\improve\support\baleq25.dbf" IN 0 Alias bal
SELECT bal
   COPY ALL TO tbal25
USE "u:\improve\support\baleq30.dbf"
   COPY ALL TO tbal30
USE "u:\improve\support\baleq30a.dbf"
   COPY ALL TO tbal30a
USE "u:\improve\support\baleq31a.dbf"
   COPY ALL TO tbal31a
USE

USE tbal25 IN 0 ALIAS bal25
USE tbal30 IN 0 ALIAS bal30
USE tbal30a IN 0 ALIAS bal30a
USE tbal31a IN 0 ALIAS bal31a

SELECT wts

lPrewght = .F.
FOR n = 1 TO FCOUNT("wts")
   IF FIELD(n) = "PREWGHT"
      lPrewght = .T.
   ENDIF
ENDFOR

IF NOT lPrewght
   ALTER TABLE wts ADD COLUMN Prewght N(6,3)
   ALTER TABLE wts ADD COLUMN Postwght N(6,3)
   ALTER TABLE wts ADD COLUMN Diff N(6,3)
   REPLACE ALL Prewght WITH Prebalwt
   REPLACE ALL Postwght WITH Pstbalwt
   REPLACE ALL Diff WITH Postwght-Prewght
```

```
ENDIF

GO TOP
DO WHILE NOT EOF('wts')
   DO GETPREWT
   DO GETPSTWT
   IF  (wts.prewght <> 0 .and. (wts.prewght <> mPrewght)) .or. ;
       (wts.postwght <> 0 .and. (wts.postwght <> mPstwght)) .or. ;
       wts.diff <> mPstwght - mPrewght .and. ;
       wts.postwght<>0
       REPLACE wts.prewght WITH mPrewght
       REPLACE wts.postwght WITH mPstwght
       REPLACE wts.diff WITH mPstwght - mPrewght
   ENDIF
   skip in wts
ENDDO

* Clean up files
SELECT bal25
USE
SELECT bal30
USE
SELECT bal30a
USE
SELECT bal31a
USE
DELETE FILE tbal25.dbf
DELETE FILE tbal30.dbf
DELETE FILE tbal30a.dbf
DELETE FILE tbal31a.dbf

RETURN

************************************************
Procedure GETPREWT
   SELECT wts
   PUBLIC mprecaldate
   mPRINDATE = wts.prindate
   mPRINTIME = wts.printime
   SET DELETED ON
   IF FIELD(1,"wts") = "SITE"
      STORE "Prebalwt" to Fprebalwt    && Select the balance prewt regardless of
   field name
   ELSE
      STORE FIELD(8,"wts") to Fprebalwt
   ENDIF
   mprebalwt = &Fprebalwt
*  IF mseason="B02"
*     mprebalwt = wts.cahn25wt
*  ELSE
*     mprebalwt = wts.prebalwt
*  ENDIF
   Do Case
   Case wts.prbalance = '31' .or. mprebalwt = 0 .or. wts.SAMDAT < {^1996-03-01}
      && Use the PREWGHT for all before A96
      mPREWGHT = wts.prewght
                  && This is because of the 20 mg addition stuff on the 25
      mprecaldate = wts.prindate
```

```
   Case wts.prbalance = '25'
      SELECT bal25
      Locate For BEGDAT > mPRINDATE
      If Found()
            Skip - 1
      Else
            Goto Bottom
      Endif
      mTAREINT  = tareint
      mTARESLP = tareslp
      mPREWGHT=round(mTAREINT+(mprebalwt*mTARESLP),3)
      mprecaldate = begdat
   Case wts.prbalance = '30'
      Sele bal30
      Locate For BEGDAT > mPRINDATE
      If Found()
            Skip - 1
      Else
            Goto Bottom
      Endif
      mTAREINT  = TAREINT
      mTARESLP = TARESLP
      mPREWGHT=round(mTAREINT+(mprebalwt*mTARESLP),3)
      mprecaldate = begdat
   Case wts.prbalance = '3A'
      Sele bal30a
      Locate For BEGDAT > mPRINDATE
      If Found()
            Skip - 1
      Else
            Goto Bottom
      Endif
      mTAREINT  = TAREINT
      mTARESLP = TARESLP
      mPREWGHT=round(mTAREINT+(mprebalwt*mTARESLP),3)
      mprecaldate = begdat
   Case wts.prbalance = '1A'
      Sele bal31a
      Locate For BEGDAT > mPRINDATE
      If Found()
            Skip - 1
      Else
            Goto Bottom
      Endif
      mTAREINT  = TAREINT
      mTARESLP = TARESLP
      mPREWGHT=round(mTAREINT+(mprebalwt*mTARESLP),3)
      mprecaldate = begdat
   OTHERWISE
      mPREWGHT=mprebalwt
      mprecaldate = begdat
   Endcase
   SELECT wts
Return
************************************************
Procedure GETPSTWT
   SELECT wts
   PUBLIC mpstcaldate
```

```
mPOINDATE = wts.poindate
mPOINTIME = wts.pointime
Set Dele on
IF FIELD(1,"wts") = "SITE"
   STORE "Pstbalwt" to Fpstbalwt    && Select the balance pstwt regardless of
field name
ELSE
   STORE FIELD(10,"wts") to Fpstbalwt
ENDIF
mpstbalwt = &Fpstbalwt
Do Case
Case wts.pobalance = '25'
   SELECT bal25
   Locate For BEGDAT > mPoINDATE
   If Found()
          Skip - 1
   Else
          Goto Bottom
   Endif
   mTAREINT  = tareint
   mTARESLP = tareslp
   mPstwght =ROUND(mTAREINT+(mpstbalwt*mTARESLP),3)
   mpstcaldate = begdat
Case wts.pobalance = '30'
   Sele bal30
   Locate For BEGDAT > mPOINDATE
   If Found()
          Skip - 1
   Else
          Goto Bottom
   Endif
   mTAREINT  = TAREINT
   mTARESLP  = TARESLP
   mPstwght =ROUND(mTAREINT+(mpstbalwt*mTARESLP),3)
   mpstcaldate = begdat
Case wts.pobalance = '3A'
   Sele bal30a
   Locate For BEGDAT > mPOINDATE
   If Found()
          Skip - 1
   Else
          Goto Bottom
   Endif
   mTAREINT  = TAREINT
   mTARESLP  = TARESLP
   mPstwght =ROUND(mTAREINT+(mpstbalwt*mTARESLP),3)
   mpstcaldate = begdat
Case wts.pobalance = '1A'
   Sele bal31a
   Locate For BEGDAT > mPOINDATE
   If Found()
          Skip - 1
   Else
          Goto Bottom
   Endif
   mTAREINT  = TAREINT
   mTARESLP  = TARESLP
   mPstwght =ROUND(mTAREINT+(mpstbalwt*mTARESLP),3)
```

```
      mpstcaldate = begdat
   Otherwise                                        &&POBALANCE = 31 and POBALANCE =
   '  '
      mPstwght = wts.postwght                 && This is because of the 20 mg
   addition stuff on the 25
      mpstcaldate = wts.poindate
   Endcase
Return
```

## D.11. FBLevel2

```
PUBLIC numrec

*CLOSE DATABASES all
IF FILE("fblist.dbf")
   DELETE FILE fblist.DBF
ENDIF
IF mSeason = CurrSeas
   EditFile = mLogsPath + "logs.dbf"
ELSE
   EditFile = mLogsPath + mSeason + "logs.dbf"
ENDIF
USE &EditFile IN 0 ALIAS logs
IF NOT mBadLog

   SELECT DISTINCT MONTH(logs.samdat) AS MONTH, COUNT(logs.fbchan), YEAR(logs.samdat)
   as YEAR;
      FROM logs;
      WHERE  logs.fbchan = ( "" );
      GROUP BY 1, 3;
      INTO CURSOR Fb_total
   INDEX ON MONTH TAG MONTH
*BROWSE LAST
** IF SELECT("fbcount")<>0
**    SELECT fbcount
**    USE
** ENDIF
** DELETE FILE fbcount.DBF
   SELECT DISTINCT MONTH(logs.samdat) AS MONTH, logs.fbchan,;
      COUNT(logs.fbchan), YEAR(logs.samdat) as year ;
      FROM ;
      logs;
      WHERE  logs.fbchan <> ( " " );
      GROUP BY 1, logs.fbchan, 4;
      INTO TABLE fbcount
   SELECT fbcount
   ALTER TABLE fbcount ALTER COLUMN cnt_fbchan fieldtype(6,2)
   SET RELATION TO MONTH INTO Fb_total ADDITIVE
   REPLACE ALL cnt_fbchan WITH cnt_fbchan/Fb_total.cnt_fbchan*100
   SET RELATION TO
   REPLACE ALL month WITH 0 FOR month=12
   INDEX ON month TAG month
*BROWSE LAST
   DO GENXTAB WITH 'Fb',.F.,.T.,.T.,1,2,3,.F. && There should be exactly three
   columns in result, in order to execute this command.
   REPLACE ALL month WITH 12 FOR month=0
   SET RELATION TO MONTH INTO Fb_total ADDITIVE
*BROWSE LAST
** SELECT logs
** USE
   SELECT fb
   REPORT FORM fb PREVIEW
*  DEFINE WINDOW OUTPUT FROM 0,0 TO 45,100 ;
      TITLE 'Field Blank Report - Press any key to continue' ;
      CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
*  ACTIVATE WINDOW output
```

```
*   REPORT FORM fb IN WINDOW output
*   SET ESCAPE off
*   WAIT ""
*   SET ESCAPE on
*   HIDE WINDOW output
ENDIF
RETURN
```

## D.12. GenXTab

```
*:*********************************************************************
*:
*: Procedure file: C:\FOXPRO2\GENXTAB\GENXTAB.PRG
*:
*:         System: GENXTAB
*:         Author: Microsoft Corp.
*:      Copyright (c) 1994, Microsoft Corp.
*:  Last modified: 6/30/94     10:17
*:
*:  Procs & Fncts: APPERROR
*:               : ESC_PROC
*:               : JUSTFNAME()
*:               : JUSTSTEM()
*:               : BAILOUT
*:               : DEFAULTEXT()
*:               : ALERT
*:               : ACTTHERM
*:               : UPDTHERM
*:               : MAPNAME()
*:               : DEACTTHERMO
*:               : FORCEEXT
*:               : JUSTPATH
*:               : ADDBS
*:               : MAKESTRG
*:
*:          Calls: APPERROR       (procedure in GENXTAB.PRG)
*:               : ESC_PROC       (procedure in GENXTAB.PRG)
*:               : JUSTFNAME()    (function  in GENXTAB.PRG)
*:               : JUSTSTEM()     (function  in GENXTAB.PRG)
*:               : BAILOUT        (procedure in GENXTAB.PRG)
*:               : DEFAULTEXT()   (function  in GENXTAB.PRG)
*:               : ALERT          (procedure in GENXTAB.PRG)
*:               : ACTTHERM       (procedure in GENXTAB.PRG)
*:               : UPDTHERM       (procedure in GENXTAB.PRG)
*:               : MAPNAME()      (function  in GENXTAB.PRG)
*:               : DEACTTHERMO    (procedure in GENXTAB.PRG)
*:
*:           Uses: XTABTEMP.DBF
*:
*:*********************************************************************
**********************************************************************
*
* Notes: This program is intended to be called by RQBE or a program
*        generated by RQBE.  On entry, a table should be open in the
*        current work area, and it should contain at most one record
*        for each cell in a cross-tabulation.  This table *must* be in
*        row order, or you will receive an "unexpected end of file"
*        error when you run GENXTAB.
*
*        The rowfld field in each record becomes the y-axis (rows) for
*        a cross-tab and the colfld field becomes the x-axis (columns)
*        The actual cross-tab results are saved to the database name
*        specified by "outfname."
*
*        The basic strategy goes like this.  Produce an empty database
```

```
*        with one field/column for each unique value of input field
*        colfld, plus one additional field for input field rowfld values.
*        This process determines the column headings in the database.
*        Next fill in the rows, but only for the first field in the output
*        database--the one that contains values for input field rowfld.
*        At this point, we have column headings "across the top"
*        and row identifiers "down the side."  Finally, look up
*        the cell values for the row/column intersections and put
*        them into the output database.
*
*
* Calling example:
*        DO genxtab WITH 'XTAB.DBF',.T.,.T.,.T.,1,2,5,.T.
*
*        This command causes GENXTAB to write the output database to
*        'XTAB.DBF'.  However, XTAB.DBF will be deleted and the output
*        stored to a cursor called XTAB.  The input database will be closed
*        at the conclusion of the program.  The rows in XTAB.DBF will
*        contain the unique values of field 1 in the database that is
*        selected when GENXTAB is called, the columns will contain
*        unique values of field 2 in the input database, and the
*        cell values will come from field 5 in the input database.
*        The thermometer will be shown.  A total field will be created.
*
**********************************************************************

PARAMETERS outfname,   ;
   cursonly,   ;
   closeinput, ;
   showtherm,  ;
   rowfld,     ;
   colfld,     ;
   cellfld,    ;
   xfoot

PRIVATE ALL

m.g_dlgface   = IIF(_MAC,"Geneva","MS Sans Serif")
m.g_dlgsize   = IIF(_MAC,10,8.000)
m.g_dlgstyle = IIF(_MAC,"","B")

EXTERNAL ARRAY coluniq
EXTERNAL ARRAY colcnt

* ------------------------------------------------------------------------
* Do opening housekeeping
* ------------------------------------------------------------------------
IF SET("TALK") = "ON"
   SET TALK OFF
   xtalk_stat = "ON"
ELSE
   xtalk_stat = "OFF"
ENDIF
xsafe_stat = SET("SAFETY")
SET SAFETY OFF
xesc_stat = SET("ESCAPE")
SET ESCAPE ON
```

```
m.mfieldsto = SET("FIELDS",1)
m.fields = SET("FIELDS")
SET FIELDS TO
SET FIELDS OFF
m.udfparms = SET("UDFPARMS")
SET UDFPARMS TO VALUE

#if "MAC" $ UPPER(VERSION(1))
   IF _MAC
      m.mmacdesk = SET("MACDESKTOP")
      SET MACDESKTOP ON
   ENDIF
#endif
in_esc = ON('ESCAPE')
in_err = ON('ERROR')

ON ERROR DO apperror WITH PROGRAM(),MESSAGE(),MESSAGE(1),LINENO(),ERROR()
ON ESCAPE DO esc_proc

* ------------------------------------------------------------------------
* Set default values for parameters
* ------------------------------------------------------------------------
IF PARAMETERS() < 1
   m.outfname = 'XTAB.DBF'
ENDIF
IF PARAMETERS() < 2
   * Default to creating the same kind of output as we got as input.
   * If the input "database" is a cursor, make the output a cursor.
   * If the input "database" is an actual database, make the output a table.
   cname = justfname(DBF())
   DO CASE
   CASE EMPTY(cname)   && create a table if nothing is currently selected
      cursonly = .F.
   CASE ISDIGIT(LEFT(cname,1))
      cursonly = .T.
   OTHERWISE
      cursonly = .F.
   ENDCASE
ENDIF
IF PARAMETERS() < 3
   * Close the input database
   closeinput = .T.
ENDIF
IF PARAMETERS() < 4
   * show the thermometer
   showtherm = .T.
ENDIF
IF PARAMETERS() < 5
   * the field position in the input database for the crosstab rows
   m.rowfld = 1
ENDIF
IF PARAMETERS() < 6
   * the field position in the input database for the crosstab columns
   m.colfld = 2
ENDIF
IF PARAMETERS() < 7
   * the field position in the input database for the crosstab cells
   m.cellfld = 3
```

```
ENDIF
IF PARAMETERS() < 8
   * Create a total field?
   m.xfoot = .F.
ENDIF

* Define characters that are not allowed in field names
m.badchars     = '•,ƒ„…†‡ˆ‰Š‹ŒŽ••'’“”•—˜™š ¡¢£¤¥ /\,-=:;{}[]!@#$%^&*.<>()?'+;
   '+|€›œ•žŸ¦§¨©ª«¬®¯°±²³´µ¶·¸¹º»¼½¾¿ÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏ'+;
   'ÐÑÒÓÔÕÖ×ØÙÚÛÜÝÞßàáâãäåæçèéêëìíîïðñòóôõö÷øùúûüýþ'+CHR(39)
* Map European characters to these
m.stdascii     = 'ueaaaaceeeiiAaEaAooouuyouaiounN'

IF !showtherm
   m.recthresh = 100000000    && don't show the thermometer
ELSE
   m.recthresh = 1            && show it if more than this many input records
ENDIF
m.g_thermwidth = 0               && Thermometer width

m.outfname     = removequotes(m.outfname)
m.outstem      = juststem(m.outfname)

* ------------------------------------------------------------------------
* Construct the output database structure
* ------------------------------------------------------------------------

m.dbfname = ALIAS()

m.dbfstem = Juststem(m.dbfname)

therm_on = (RECCOUNT() >= recthresh)

* Select one, if no database is open in the current workarea
m.ok = .F.
DO WHILE NOT ok
   DO CASE
   CASE EMPTY(m.dbfname)
      m.dbfname = GETFILE('DBF','Please locate the input database')
      m.dbfstem = juststem(m.dbfname)
      IF EMPTY(m.dbfname)
         * User canceled out of dialog, so quit the program
         DO bailout WITH .T.
      ENDIF
   CASE FULLPATH(defaultext(m.dbfname,'DBF')) == ;
         FULLPATH(defaultext(m.outfname,'DBF'))
      SET CURSOR OFF
      WAIT WINDOW "The input and output databases must be different."
      SET CURSOR ON
      m.dbfname = ''
   OTHERWISE
      IF USED(m.dbfstem)
         SELECT (m.dbfstem)
      ELSE
         SELECT 0
         USE (m.dbfname) ALIAS (m.dbfstem)
      ENDIF
      IF FCOUNT() < 3
```

```
         DO alert WITH "Crosstab input databases require; at least three fields"
         m.dbfname = ''
      ELSE
         ok = .T.
      ENDIF
   ENDCASE
ENDDO

IF RECCOUNT() = 0
   DO alert WITH "Cannot prepare crosstab on empty database"
   DO bailout WITH .T.
ENDIF

* Gather information on the currently selected database fields
DIMENSION inpfields[FCOUNT(),4]
m.numflds = AFIELDS(inpfields)

* Map the physical input database field to logical field positions
m.rowfldname    = inpfields[m.rowfld,1]
m.colfldname    = inpfields[m.colfld,1]
m.cellfldname   = inpfields[m.cellfld,1]

* None of these fields are allowed to be memo fields
IF inpfields[1,2] $ 'MGP'
   DO alert WITH "The crosstab row field in the input; database cannot be a memo,
    general or picture  field."
   DO bailout WITH .T.
ENDIF
IF inpfields[2,2] $ 'MGP'
   DO alert WITH "The crosstab column field in the input; database cannot be a memo,
    general or picture field."
   DO bailout WITH .T.
ENDIF
IF inpfields[3,2] $ 'MGP'
   DO alert WITH "The crosstab cell field in the input; database cannot be a memo,
    general or picture field."
   DO bailout WITH .T.
ENDIF

IF therm_on
   DO acttherm WITH "Generating cross-tabulation ..."
   DO updtherm WITH 5
ENDIF

* Set the mouse off to avoid flicker on some systems
SET MOUSE OFF

* Count the number of columns we need to create the cross tab.
* This step could be combined with the following one so that there
* would only be one SELECT operation performed.  It is coded in this
* way to avoid running out of memory if there are an unexpectedly
* large number of unique values of field 2 in the input database.
SELECT COUNT(DISTINCT &colfldname) FROM (m.dbfname) INTO ARRAY colcnt

DO CASE
CASE colcnt[1] > 254
   DO alert WITH "Too many unique values of "+PROPER(m.colfldname);
      + ".;  The maximum is 254."
```

```
   DO bailout WITH .T.
CASE colcnt[1] = 0
   DO alert WITH "No columns found."
   DO bailout WITH .T.
ENDCASE

* Get the number of decimal places in numeric fields
* and extract all the unique values of colfldname
IF inpfields[m.colfld,2] $ 'NF'   && numeric or floating field
   m.cdec = inpfields[m.colfld,4]
   * Handle numbers separately to preserve correct sort order
   SELECT DISTINCT &colfldname ;
      FROM (m.dbfname) INTO ARRAY coluniq
   FOR i = 1 TO ALEN(coluniq)
      coluniq[i] = mapname(coluniq[i],m.cdec)
   ENDFOR
ELSE        && non-numeric field
   m.cdec = 0
   * Create an array to hold the output database fields.
   SELECT DISTINCT mapname(&colfldname,m.cdec) ;
      FROM (m.dbfname) INTO ARRAY coluniq
ENDIF

IF therm_on
   DO updtherm WITH 15
ENDIF

* The field type, length and decimals in the output array control the
* cross-tab cells
IF !m.xfoot
   DIMENSION outarray[ALEN(coluniq)+1,4]
ELSE
   DIMENSION outarray[ALEN(coluniq)+2,4]
ENDIF

* Field 1 in the output DBF holds the unique values of the row input field.
* It is handled separately from the other fields, which take their names
* from input database colfld and their parameters (e.g., length) from
* input database cellfld.

outarray[1,1] = mapname(inpfields[1,1])
outarray[1,2] = inpfields[1,2]
outarray[1,3] = inpfields[1,3]
outarray[1,4] = inpfields[1,4]

FOR i = 2 TO ALEN(coluniq) + 1
   outarray[i,1] = mapname(coluniq[i-1],m.cdec)
   outarray[i,2] = inpfields[3,2]                  && field type
   outarray[i,3] = inpfields[3,3]                  && field length
   outarray[i,4] = inpfields[3,4]                  && decimals
ENDFOR

* Create a field for the cross-footing, if that option was selected
IF m.xfoot
   outarray[ALEN(coluniq)+2,1] = 'XTOTALS'
   outarray[ALEN(coluniq)+2,2] = inpfields[3,2]
   outarray[ALEN(coluniq)+2,3] = inpfields[3,3]
   outarray[ALEN(coluniq)+2,4] = inpfields[3,4]
```

```
ENDIF

* Make sure that the output file is not already in use somewhere
IF USED(m.outstem)
   SELECT (m.outstem)
   USE
ENDIF

IF !cursonly
   CREATE TABLE (outfname) FROM ARRAY outarray
ELSE
   CREATE CURSOR (outfname) FROM ARRAY outarray
ENDIF

IF therm_on
   DO updtherm WITH 25
ENDIF

* Get rid of the temporary arrays
RELEASE outarray, coluniq, inpfields

* ------------------------------------------------------------------------
* Add output database rows and replace the first field
* ------------------------------------------------------------------------

* Select distinct rows into a table (instead of an array) so that
* there can be lots of rows.  If we select into an array, we may
* run out of RAM if there are many rows.

SELECT DISTINCT &rowfldname FROM (m.dbfname) INTO TABLE xtabtemp

IF therm_on
   DO updtherm WITH 30
ENDIF

SELECT (m.outstem)
APPEND FIELD (FIELD(1)) FROM xtabtemp

IF therm_on
   DO updtherm WITH 35
ENDIF
* ------------------------------------------------------------------------
* Look up and replace the cell values
* ------------------------------------------------------------------------
*
* This algorithm makes one pass through the input file, dropping its
* values into the output file.  It exploits the fact that the output
* file is known to be in row order.
*

* Start at the top of the output file
SELECT (m.outstem)
GOTO TOP
outf1name = FIELD(1)

* Start at the top of the input file
SELECT (m.dbfstem)
GOTO TOP
```

```
SCAN
   m.f1 = EVAL(m.rowfldname)                    && get next row value from input
   m.f2 = mapname(EVAL(m.colfldname),m.cdec)  && get corresponding column value
   m.f3 = EVAL(m.cellfldname)                   && get cell value

   * Find the right row in the output file
   SELECT (m.outstem)
   DO WHILE !(EVAL(outf1name) == m.f1) AND !EOF()
      SKIP
   ENDDO

   IF !EOF()
      IF TYPE(m.f2) $ "NF"
         REPLACE (m.f2) WITH &f2 + m.f3
      ELSE
         REPLACE (m.f2) WITH m.f3
      ENDIF
   ELSE
      DO alert WITH "Unexpected end of output file.;" ;
         + "The input file may be out of sequence."
      DO bailout WITH .T.
   ENDIF

   SELECT (m.dbfstem)

   * Map thermometer to remaining portion of display
   IF therm_on
      DO CASE
      CASE RECCOUNT() > 1000
         IF RECNO() % 100 = 0
            DO updtherm WITH INT(RECNO() / RECCOUNT() * 65)+ 35
         ENDIF
      OTHERWISE
         IF RECNO() % 10  = 0
            DO updtherm WITH INT(RECNO() / RECCOUNT() * 65)+ 35
         ENDIF
      ENDCASE
   ENDIF
ENDSCAN

* Cross-foot the columns and put the results into the total field
IF m.xfoot
   SELECT (m.outstem)
   m.totfldname = FIELD(FCOUNT())
   SCAN
      * Sum the relevant fields
      m.gtotal = 0
      FOR i = 2 TO FCOUNT() - 1
         m.gtotal = m.gtotal + EVAL(FIELD(i))
      ENDFOR

      REPLACE (m.totfldname) WITH m.gtotal
   ENDSCAN
ENDIF

IF therm_on
   DO updtherm WITH 100
```

```
   DO deactthermo
ENDIF

IF USED("XTABTEMP")
   SELECT xtabtemp
   USE
ENDIF
IF FILE("xtabtemp.dbf")
   DELETE FILE xtabtemp.dbf
ENDIF

* Close the input database
IF closeinput
   SELECT (m.dbfstem)
   USE
ENDIF

* Leave the output database/cursor selected
SELECT (m.outstem)
GOTO TOP

* Do closing housekeeping
DO bailout WITH .F.


RETURN


*!*****************************************************************
*!
*!       Function: MAPNAME()
*!
*!      Called by: GENXTAB.PRG
*!
*!          Calls: ALERT          (procedure in GENXTAB.PRG)
*!               : BAILOUT        (procedure in GENXTAB.PRG)
*!
*!*****************************************************************
FUNCTION mapname
* Translate a field value of any type into a string containing a valid
* field name.

PARAMETER in_name, in_dec
IF PARAMETERS() = 1
   in_dec = 0
ENDIF
DO CASE
CASE TYPE("in_name") $ 'CM'
   DO CASE
   CASE EMPTY(m.in_name)
      m.retval = 'C_BLANK'
   OTHERWISE
      m.retval = SUBSTR(CHRTRAN(m.in_name,m.badchars,m.stdascii),1,10)
      IF !ISALPHA(LEFT(m.retval,1))
         m.retval = 'C_'+LEFT(m.retval,8)
      ENDIF
   ENDCASE
CASE TYPE("in_name") $ 'NF'
```

```
   m.retval = 'N_'+ALLTRIM(CHRTRAN(STR(m.in_name,8,in_dec),'.',''))
CASE TYPE("in_name") = 'D'
   DO CASE
   CASE EMPTY(m.in_name)
      m.retval = 'D_BLANK'
   OTHERWISE
      m.retval = 'D_' + CHRTRAN(DTOS(m.in_name),m.badchars,m.stdascii)
   ENDCASE
CASE TYPE("in_name") = 'L'
   IF m.in_name = .T.
      m.retval = 'T'
   ELSE
      m.retval = 'F'
   ENDIF
CASE TYPE("in_name") = 'P'
   DO alert WITH "Picture type fields are not allowed here."
   DO bailout WITH .T.
OTHERWISE
   DO alert WITH "Unknown field type."
   DO bailout WITH .T.
ENDCASE
m.retval = PADR(UPPER(ALLTRIM(m.retval)),10)
RETURN m.retval

*!*************************************************************************
*!
*!       Function: JUSTSTEM()
*!
*!      Called by: GENXTAB.PRG
*!
*!*************************************************************************
FUNCTION juststem
* Return just the stem name from "filname"
PARAMETERS filname
PRIVATE ALL
IF RAT('\',m.filname) > 0
   m.filname = SUBSTR(m.filname,RAT('\',m.filname)+1,255)
ENDIF
IF RAT(':',m.filname) > 0
   m.filname = SUBSTR(m.filname,RAT(':',m.filname)+1,255)
ENDIF
IF RAT('.',m.filname) > 0
   m.filname = SUBSTR(m.filname,1,RAT('.',m.filname)-1)
ENDIF
RETURN ALLTRIM(UPPER(m.filname))

*!*************************************************************************
*!
*!      Procedure: FORCEEXT
*!
*!          Calls: JUSTPATH       (procedure in GENXTAB.PRG)
*!               : JUSTFNAME()    (function  in GENXTAB.PRG)
*!               : ADDBS          (procedure in GENXTAB.PRG)
*!
*!*************************************************************************
FUNCTION forceext
* Force the extension of "filname" to be whatever ext is.
PARAMETERS filname,ext
```

```
PRIVATE ALL
IF SUBSTR(m.ext,1,1) = "."
   m.ext = SUBSTR(m.ext,2,3)
ENDIF

m.pname = justpath(m.filname)
m.filname = justfname(UPPER(ALLTRIM(m.filname)))
IF RAT('.',m.filname) > 0
   m.filname = SUBSTR(m.filname,1,RAT('.',m.filname)-1) + '.' + m.ext
ELSE
   m.filname = m.filname + '.' + m.ext
ENDIF
RETURN addbs(m.pname) + m.filname

*!*************************************************************************
*!
*!       Function: DEFAULTEXT()
*!
*!      Called by: GENXTAB.PRG
*!
*!          Calls: JUSTPATH       (procedure in GENXTAB.PRG)
*!               : JUSTFNAME()    (function  in GENXTAB.PRG)
*!               : ADDBS          (procedure in GENXTAB.PRG)
*!
*!*************************************************************************
FUNCTION defaultext
* Add a default extension to "filname" if it doesn't have one already
PARAMETERS filname,ext
PRIVATE ALL
IF SUBSTR(ext,1,1) = "."
   m.ext = SUBSTR(m.ext,2,3)
ENDIF

m.pname = justpath(m.filname)
m.filname = justfname(UPPER(ALLTRIM(m.filname)))
IF !EMPTY(m.filname) AND AT('.',m.filname) = 0
   m.filname = m.filname + '.' + m.ext
   RETURN addbs(m.pname) + m.filname
ELSE
   RETURN filname
ENDIF
*!*************************************************************************
*!
*!       Function: JUSTFNAME()
*!
*!      Called by: GENXTAB.PRG
*!               : DEFAULTEXT()   (function  in GENXTAB.PRG)
*!               : FORCEEXT       (procedure in GENXTAB.PRG)
*!
*!*************************************************************************
FUNCTION justfname
* Return just the filename (i.e., no path) from "filname"
PARAMETERS filname
PRIVATE ALL
IF RAT('\',m.filname) > 0
   m.filname = SUBSTR(m.filname,RAT('\',m.filname)+1,255)
ENDIF
IF RAT(':',m.filname) > 0
```

```
   m.filname = SUBSTR(m.filname,RAT(':',m.filname)+1,255)
ENDIF
RETURN ALLTRIM(UPPER(m.filname))

*!*************************************************************************
*!
*!      Procedure: JUSTPATH
*!
*!      Called by: DEFAULTEXT()   (function  in GENXTAB.PRG)
*!               : FORCEEXT       (procedure in GENXTAB.PRG)
*!
*!*************************************************************************
FUNCTION justpath
* Return just the path name from "filname"
PARAMETERS m.filname
PRIVATE ALL
m.filname = ALLTRIM(UPPER(m.filname))
m.pathsep = IIF(_MAC,":", "\")
IF _MAC
   m.found_it = .F.
   m.maxchar = max(RAT("\", m.filname), RAT(":", m.filname))
   IF m.maxchar > 0
      m.filname = SUBSTR(m.filname,1,m.maxchar)
      IF RIGHT(m.filname,1) $ ":\" AND LEN(m.filname) > 1 ;
            AND !(SUBSTR(m.filname,LEN(m.filname)-1,1)  $ ":\")
         m.filname = SUBSTR(m.filname,1,LEN(m.filname)-1)
      ENDIF
      RETURN m.filname
   ENDIF
ELSE
   IF m.pathsep $ filname
      m.filname = SUBSTR(m.filname,1,RAT(m.pathsep,m.filname))
      IF RIGHT(m.filname,1) = m.pathsep AND LEN(m.filname) > 1 ;
            AND SUBSTR(m.filname,LEN(m.filname)-1,1) <> m.pathsep
         m.filname = SUBSTR(m.filname,1,LEN(m.filname)-1)
      ENDIF
      RETURN m.filname
   ENDIF
ENDIF
RETURN ''

*!*************************************************************************
*!
*!      Procedure: ADDBS
*!
*!      Called by: DEFAULTEXT()   (function  in GENXTAB.PRG)
*!               : FORCEEXT       (procedure in GENXTAB.PRG)
*!
*!*************************************************************************
FUNCTION addbs
* Add a backslash to a path name, if there isn't already one there
PARAMETER pathname
PRIVATE ALL
m.pathname = ALLTRIM(UPPER(m.pathname))
IF !(RIGHT(m.pathname,1) $ '\:') AND !EMPTY(m.pathname)
   m.pathname = m.pathname + IIF(_MAC,":",'\')
ENDIF
RETURN m.pathname
```

```
*!*********************************************************************
*!
*!      Procedure: APPERROR
*!
*!      Called by: GENXTAB.PRG
*!
*!          Calls: ALERT          (procedure in GENXTAB.PRG)
*!               : BAILOUT        (procedure in GENXTAB.PRG)
*!
*!*********************************************************************
PROCEDURE apperror
* Simple ON ERROR routine

PARAMETERS e_program,e_message,e_source,e_lineno,e_error
ON ERROR
SET MOUSE ON
m.e_source = ALLTRIM(m.e_source)
DO alert WITH 'Line No.: '+ALLTRIM(STR(m.e_lineno,5))+';' ;
   +'Program: '+m.e_program +';' ;
   +'  Error: '+m.e_message +';' ;
   +' Source: '+IIF(LEN(m.e_source)<50,;
   m.e_source,SUBSTR(m.e_source,1,50)+'...')
DO bailout WITH .T.

*!*********************************************************************
*!
*!      Procedure: ALERT
*!
*!      Called by: GENXTAB.PRG
*!               : APPERROR       (procedure in GENXTAB.PRG)
*!               : MAPNAME()      (function  in GENXTAB.PRG)
*!
*!*********************************************************************
PROCEDURE alert
* Display an error message, automatically sizing the message window
*    as necessary.  Semicolons in "strg" mean "new line".
PARAMETERS strg
PRIVATE ALL

SET MOUSE ON
in_talk = SET('TALK')
SET TALK OFF
in_cons = SET('CONSOLE')

m.numlines = OCCURS(';',m.strg) + 1

DIMENSION alert_arry[m.numlines]
m.remain = m.strg
m.maxlen = 0
FOR i = 1 TO m.numlines
   IF AT(';',m.remain) > 0
      alert_arry[i] = SUBSTR(m.remain,1,AT(';',m.remain)-1)
      alert_arry[i] = CHRTRAN(alert_arry[i],';','')
      m.remain = SUBSTR(m.remain,AT(';',m.remain)+1)
   ELSE
      alert_arry[i] = m.remain
```

```
      m.remain = ''
   ENDIF
   IF LEN(alert_arry[i]) > SCOLS() - 6
      alert_arry[i] = SUBSTR(alert_arry[i],1,SCOLS()-6)
   ENDIF
   IF LEN(alert_arry[i]) > m.maxlen
      m.maxlen = LEN(alert_arry[i])
   ENDIF
ENDFOR

m.top_row = INT( (SROWS() - 4 - m.numlines) / 2)
m.bot_row = m.top_row + 3 + m.numlines

m.top_col = INT((SCOLS() - m.maxlen - 6) / 2)
m.bot_col = m.top_col + m.maxlen + 6

IF _MAC
   DEFINE WINDOW alert FROM m.top_row,m.top_col TO m.bot_row,m.bot_col;
   DOUBLE COLOR SCHEME 7
ELSE
   DEFINE WINDOW alert FROM m.top_row,m.top_col TO m.bot_row,m.bot_col;
   DOUBLE COLOR SCHEME 7
ENDIF
ACTIVATE WINDOW alert

IF _WINDOWS
   FOR i = 1 TO m.numlines
   @ i,3 SAY PADC(alert_arry[i],m.maxlen) FONT "MS Sans Serif",8
   ENDFOR
ELSE
   FOR i = 1 TO m.numlines
   @ i,3 SAY PADC(alert_arry[i],m.maxlen)
   ENDFOR
ENDIF
SET CONSOLE OFF
keycode = INKEY(0,'HM')
SET CONSOLE ON

RELEASE WINDOW alert
IF m.in_talk = "ON"
   SET TALK ON
ENDIF
IF m.in_cons = "OFF"
   SET CONSOLE OFF
ENDIF

RETURN

*!*************************************************************************
*!
*!      Procedure: MAKESTRG
*!
*!*************************************************************************
FUNCTION makestrg
PARAMETER in_val
DO CASE
CASE TYPE("in_val") = "C"
   RETURN in_val
```

```
CASE TYPE("in_val") $ "NF"
   RETURN ALLTRIM(STR(in_val))
CASE TYPE("in_val") = "D"
   RETURN DTOC(in_val)
CASE TYPE("in_val") = "L"
   IF in_val
      RETURN ".T."
   ELSE
      RETURN ".F."
   ENDIF
OTHERWISE
   RETURN in_val
ENDCASE

*!*********************************************************************
*!
*!      Procedure: ESC_PROC
*!
*!      Called by: GENXTAB.PRG
*!
*!          Calls: BAILOUT        (procedure in GENXTAB.PRG)
*!
*!*********************************************************************
PROCEDURE esc_proc
WAIT WINDOW "Cross tabulation terminated." TIMEOUT 1
CLEAR TYPEAHEAD
DO bailout

*!*********************************************************************
*!
*!      Procedure: BAILOUT
*!
*!      Called by: GENXTAB.PRG
*!               : APPERROR       (procedure in GENXTAB.PRG)
*!               : ESC_PROC       (procedure in GENXTAB.PRG)
*!               : MAPNAME()      (function  in GENXTAB.PRG)
*!
*!           Uses: XTABTEMP.DBF
*!
*!*********************************************************************
PROCEDURE bailout
PARAMETER docancl
PRIVATE docancl
DO CASE
CASE PARAMETERS() = 0
   m.docancl   = .T.
ENDCASE
IF WONTOP('THERMOMETE')
   RELEASE WINDOW thermomete
ENDIF

IF USED("XTABTEMP")
   SELECT xtabtemp
   USE
ENDIF
IF FILE("xtabtemp.dbf")
   DELETE FILE xtabtemp.dbf
ENDIF
```

```
SET FIELDS TO &mfieldsto
IF m.fields = "ON"
   SET FIELDS ON
ELSE
   SET FIELDS OFF
ENDIF

SET UDFPARMS TO &udfparms

IF m.xsafe_stat = "ON"
   SET SAFETY ON
ENDIF
IF m.xesc_stat = "ON"
   SET ESCAPE ON
ELSE
   SET ESCAPE OFF
ENDIF
IF m.xtalk_stat = "ON"
   SET TALK ON
ENDIF
#if "MAC" $ UPPER(VERSION(1))
   IF _MAC
      SET MACDESKTOP &mmacdesk
   ENDIF
#endif

ON ERROR &in_err
ON ESCAPE &in_esc

SET MOUSE ON
IF m.docancl
   m.outfname = ''
   CANCEL
ENDIF


*
* ACTTHERM(<text>) - Activate thermometer.
*
* Activates thermometer.  Update the thermometer with UPDTHERM().
* Thermometer window is named "thermometer."  Be sure to RELEASE
* this window when done with thermometer.  Creates the global
* m.g_thermwidth.
*
*!*************************************************************************
*!
*!      Procedure: ACTTHERM
*!
*!*************************************************************************
PROCEDURE acttherm
PARAMETER m.prompt
PRIVATE m.text
m.text = ""
IF _MAC OR _WINDOWS
   IF TXTWIDTH(m.prompt, m.g_dlgface, m.g_dlgsize, m.g_dlgstyle) > 43
      DO WHILE TXTWIDTH(m.prompt+"...", m.g_dlgface, m.g_dlgsize, m.g_dlgstyle) > 43
         m.prompt = LEFT(m.prompt, LEN(m.prompt)-1)
```

```
      ENDDO
      m.prompt = m.prompt + "..."
   ENDIF
   DO CASE
   CASE _WINDOWS
      DEFINE WINDOW thermomete ;
         AT  INT((SROW() - (( 5.615 * ;
         FONTMETRIC(1, m.g_dlgface, m.g_dlgsize, m.g_dlgstyle )) / ;
         FONTMETRIC(1, WFONT(1,""), WFONT( 2,""), WFONT(3,"")))) / 2), ;
         INT((SCOL() - (( 63.833 * ;
         FONTMETRIC(6, m.g_dlgface, m.g_dlgsize, m.g_dlgstyle )) / ;
         FONTMETRIC(6, WFONT(1,""), WFONT( 2,""), WFONT(3,"")))) / 2) ;
         SIZE 5.615,63.833 ;
         FONT m.g_dlgface, m.g_dlgsize ;
         STYLE m.g_dlgstyle ;
         NOFLOAT ;
         NOCLOSE ;
         NONE ;
         COLOR RGB(0, 0, 0, 192, 192, 192)
      MOVE WINDOW thermomete CENTER
      ACTIVATE WINDOW thermomete NOSHOW

      @ 0.5,3 SAY m.text FONT m.g_dlgface, m.g_dlgsize STYLE m.g_dlgstyle
      @ 1.5,3 SAY m.prompt FONT m.g_dlgface, m.g_dlgsize STYLE m.g_dlgstyle
      @ 0.000,0.000 TO 0.000,63.833 ;
         COLOR RGB(255, 255, 255, 255, 255, 255)
      @ 0.000,0.000 TO 5.615,0.000 ;
         COLOR RGB(255, 255, 255, 255, 255, 255)
      @ 0.385,0.667 TO 5.231,0.667 ;
         COLOR RGB(128, 128, 128, 128, 128, 128)
      @ 0.308,0.667 TO 0.308,63.167 ;
         COLOR RGB(128, 128, 128, 128, 128, 128)
      @ 0.385,63.000 TO 5.308,63.000 ;
         COLOR RGB(255, 255, 255, 255, 255, 255)
      @ 5.231,0.667 TO 5.231,63.167 ;
         COLOR RGB(255, 255, 255, 255, 255, 255)
      @ 5.538,0.000 TO 5.538,63.833 ;
         COLOR RGB(128, 128, 128, 128, 128, 128)
      @ 0.000,63.667 TO 5.615,63.667 ;
         COLOR RGB(128, 128, 128, 128, 128, 128)
      @ 3.000,3.333 TO 4.231,3.333 ;
         COLOR RGB(128, 128, 128, 128, 128, 128)
      @ 3.000,60.333 TO 4.308,60.333 ;
         COLOR RGB(255, 255, 255, 255, 255, 255)
      @ 3.000,3.333 TO 3.000,60.333 ;
         COLOR RGB(128, 128, 128, 128, 128, 128)
      @ 4.231,3.333 TO 4.231,60.500 ;
         COLOR RGB(255, 255, 255, 255, 255, 255)
      m.g_thermwidth = 56.269
   CASE _MAC
      DEFINE WINDOW thermomete ;
         AT  INT((SROW() - (( 5.62 * ;
         FONTMETRIC(1, m.g_dlgface, m.g_dlgsize, m.g_dlgstyle )) / ;
         FONTMETRIC(1, WFONT(1,""), WFONT( 2,""), WFONT(3,"")))) / 2), ;
         INT((SCOL() - (( 63.83 * ;
         FONTMETRIC(6, m.g_dlgface, m.g_dlgsize, m.g_dlgstyle )) / ;
         FONTMETRIC(6, WFONT(1,""), WFONT( 2,""), WFONT(3,"")))) / 2) ;
         SIZE 5.62,63.83 ;
```

```
         FONT m.g_dlgface, m.g_dlgsize ;
         STYLE m.g_dlgstyle ;
         NOFLOAT ;
         NOCLOSE ;
              NONE ;
         COLOR RGB(0, 0, 0, 192, 192, 192)
      MOVE WINDOW thermomete CENTER
      ACTIVATE WINDOW thermomete NOSHOW

      IF ISCOLOR()
         @ 0.000,0.000 TO 5.62,63.83 PATTERN 1;
             COLOR RGB(192, 192, 192, 192, 192, 192)
       @ 0.000,0.000 TO 0.000,63.83 ;
             COLOR RGB(255, 255, 255, 255, 255, 255)
       @ 0.000,0.000 TO 5.62,0.000 ;
             COLOR RGB(255, 255, 255, 255, 255, 255)
       @ 0.385,0.67 TO 5.23,0.67 ;
             COLOR RGB(128, 128, 128, 128, 128, 128)
       @ 0.31,0.67 TO 0.31,63.17 ;
             COLOR RGB(128, 128, 128, 128, 128, 128)
       @ 0.385,63.000 TO 5.31,63.000 ;
             COLOR RGB(255, 255, 255, 255, 255, 255)
       @ 5.23,0.67 TO 5.23,63.17 ;
             COLOR RGB(255, 255, 255, 255, 255, 255)
       @ 5.54,0.000 TO 5.54,63.83 ;
             COLOR RGB(128, 128, 128, 128, 128, 128)
       @ 0.000,63.67 TO 5.62,63.67 ;
             COLOR RGB(128, 128, 128, 128, 128, 128)
       @ 3.000,3.33 TO 4.23,3.33 ;
             COLOR RGB(128, 128, 128, 128, 128, 128)
       @ 3.000,60.33 TO 4.31,60.33 ;
             COLOR RGB(255, 255, 255, 255, 255, 255)
       @ 3.000,3.33 TO 3.000,60.33 ;
             COLOR RGB(128, 128, 128, 128, 128, 128)
       @ 4.23,3.33 TO 4.23,60.33 ;
             COLOR RGB(255, 255, 255, 255, 255, 255)
      ELSE
         @ 0.000, 0.000 TO 5.62, 63.830  PEN 2
         @ 0.230, 0.500 TO 5.39, 63.333  PEN 1
       ENDIF
      @ 0.5,3 SAY m.text FONT m.g_dlgface, m.g_dlgsize STYLE m.g_dlgstyle+"T" ;
         COLOR RGB(0,0,0,192,192,192)
      @ 1.5,3 SAY m.prompt FONT m.g_dlgface, m.g_dlgsize STYLE m.g_dlgstyle+"T" ;
         COLOR RGB(0,0,0,192,192,192)

      m.g_thermwidth = 56.27
       IF !ISCOLOR()
       @ 3.000,3.33 TO 4.23,m.g_thermwidth + 3.33
       ENDIF
   ENDCASE
   SHOW WINDOW thermomete TOP
ELSE

   DEFINE WINDOW thermomete;
      FROM INT((SROW()-6)/2), INT((SCOL()-57)/2) ;
      TO INT((SROW()-6)/2) + 6, INT((SCOL()-57)/2) + 57;
      DOUBLE COLOR SCHEME 5
   ACTIVATE WINDOW thermomete NOSHOW
```

```
   m.g_thermwidth = 50
   @ 0,3 SAY m.prompt
   @ 2,1 TO 4,m.g_thermwidth+4

   SHOW WINDOW thermomete TOP
ENDIF
RETURN

*
* UPDTHERM(<percent>) - Update thermometer.
*
*!*************************************************************************
*!
*!      Procedure: UPDTHERM
*!
*!      Called by: BUILD              (procedure in GENSCRN.PRG)
*!               : DISPATCHBUILD      (procedure in GENSCRN.PRG)
*!               : BUILDCTRL          (procedure in GENSCRN.PRG)
*!               : EXTRACTPROCS       (procedure in GENSCRN.PRG)
*!               : BUILDFMT           (procedure in GENSCRN.PRG)
*!
*!*************************************************************************
PROCEDURE updtherm
PARAMETER m.percent
PRIVATE m.nblocks, m.percent

IF !WEXIST("thermomete")
   DO acttherm WITH "Generating cross-tabulation ..."
ENDIF
ACTIVATE WINDOW thermomete

m.nblocks = (m.percent/100) * (m.g_thermwidth)
DO CASE
CASE _WINDOWS
   @ 3.000,3.333 TO 4.231,m.nblocks + 3.333 ;
      PATTERN 1 COLOR RGB(128, 128, 128, 128, 128, 128)
CASE _MAC
   @ 3.000,3.33 TO 4.23,m.nblocks + 3.33 ;
      PATTERN 1 COLOR RGB(0, 0, 128, 0, 0, 128)
OTHERWISE
   @ 3,3 SAY REPLICATE("Û",m.nblocks)
ENDCASE
RETURN

*
* DEACTTHERMO - Deactivate and Release thermometer window.
*
*!*************************************************************************
*!
*!      Procedure: DEACTTHERMO
*!
*!*************************************************************************
PROCEDURE deacttherm
IF WEXIST("thermomete")
   RELEASE WINDOW thermomete
ENDIF
RETURN
```

```
*!*****************************************************************************
*!
*!      Procedure: PARTIALFNAME
*!
*!*****************************************************************************
FUNCTION partialfname
PARAMETER m.filname, m.fillen
* Return a filname no longer than m.fillen characters.  Take some chars
* out of the middle if necessary.  No matter what m.fillen is, this function
* always returns at least the file stem and extension.
PRIVATE m.bname, m.elipse
m.elipse = "..." + c_pathsep
m.bname = justfname(m.filname)
DO CASE
CASE LEN(m.filname) <= m.fillen
   RETURN filname
CASE LEN(m.bname) + LEN(m.elipse) >= m.fillen
   RETURN m.bname
OTHERWISE
   m.remain = MAX(m.fillen - LEN(m.bname) - LEN(m.elipse), 0)
   RETURN LEFT(justpath(m.filname),remain)+m.elipse+m.bname
ENDCASE

*!*****************************************************************************
*!
*!      Procedure: removequotes
*!
*!*****************************************************************************
FUNCTION removequotes
PARAMETER m.fname
PRIVATE m.leftchar, m.rightchar
m.fname = ALLTRIM(m.fname)
m.leftchar = LEFT(m.fname,1)
m.rightchar = RIGHT(m.fname, 1)

IF m.leftchar = '"' AND m.rightchar = '"'    ;
   OR m.leftchar = "'" AND m.rightchar = "'"  ;
   OR m.leftchar = '[' AND m.rightchar = ']'
      RETURN SUBSTR(m.fname, 2, LEN(m.fname) - 2)
ELSE
   RETURN m.fname
ENDIF

*: EOF: GENXTAB.PRG
```

## D.13. EditIons

```
PROCEDURE EditIons
EditFile = mIonsPath + mSeason + "ions.dbf"
USE &EditFile IN 0 ALIAS Ions
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,85 TITLE 'Ions data' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT Ions
      SET FILTER TO Ions.site=m.mSite
      BROWSE FIELDS site:W=.F., samdat, STATUS:P="!!",;
             cl:W=.F.:P="#####.##", no2:W=.F.:P="#####.##", ;
             no3:W=.F.:P="#####.##", so4:W=.F.:P="#####.##", ;
             nh4:W=.F.:P="#####.##";
             WINDOW OUTPUT
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.14. EditCarbon

```
PROCEDURE EditCarbon
EditFile = mCarbonPath + mSeason + "Car.dbf"
USE &EditFile IN 0 ALIAS Carbon
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,110 TITLE 'Carbon data' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT Carbon
      SET FILTER TO Carbon.site=m.mSite
      BROWSE FIELDS site:W=.F., samdat, STATUS:P="!!",;
             Octc:W=.F., Ectc:W=.F.,;
             O1tc:W=.F., O2tc:W=.F., O3tc:W=.F., O4tc:W=.F.,;
             OPtc:W=.F., E1tc:W=.F., E2tc:W=.F., E3tc:W=.F.;
             WINDOW OUTPUT
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.15. FBIons

```
PROCEDURE FBIons
EditFile = mIonsPath + mSeason + "ions.dbf"
USE &EditFile IN 0 ALIAS Ions
IF NOT mBadLog
   SELECT Ions
   SELECT DISTINCT Ions.*;
      FROM Ions ;
      WHERE  Ions.STATUS = "FB";
      ORDER BY Ions.site, Ions.samdat;
      INTO TABLE IonsBlanks
   SELECT IonsBlanks
   COUNT TO NumFB
   DEFINE WINDOW OUTPUT FROM 0,0 TO 35,160 ;
      TITLE STR(NumFB) + ' Ions Field Blanks - Sort by:  F1-Cl,  F2-NO2,  F3-NO3,
   F4-SO4,  SHIFT F1-F4 for ascending' ;
      CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
   ACTIVATE WINDOW OUTPUT
   INDEX ON cl TAG cl
   INDEX ON no2 TAG no2
   INDEX ON no3 TAG no3
   INDEX ON so4 TAG so4
   PUSH KEY
   ON KEY LABEL F1 DO ClOrderD
   ON KEY LABEL F2 DO NO2OrderD
   ON KEY LABEL F3 DO NO3OrderD
   ON KEY LABEL F4 DO SO4OrderD
   ON KEY LABEL F5 SKIP ROUND(NumFB/2,0)-1
   ON KEY LABEL SHIFT+F1 DO ClOrder
   ON KEY LABEL SHIFT+F2 DO NO2Order
   ON KEY LABEL SHIFT+F3 DO NO3Order
   ON KEY LABEL SHIFT+F4 DO SO4Order
   ON KEY LABEL ESC DO FBStop
   lEndFB=.F.
   DO WHILE NOT lEndFB
      IF FIELD("comments")="COMMENTS"
            BROWSE SAVE ;
                  FIELDS site:R, samdat:R, strtim:R, STATUS, cl:R, no2:R, no3:R,
   so4:R, nh4:R, comments;
                  WINDOW OUTPUT
      ELSE
            BROWSE SAVE ;
                  FIELDS site:R, samdat:R, strtim:R, STATUS, cl:R, no2:R, no3:R,
   so4:R, nh4:R;
                  WINDOW OUTPUT
      ENDIF
   ENDDO
   POP KEY
*            HIDE WINDOW OUTPUT
*            RETURN
ENDIF
RETURN

PROCEDURE ClOrderD
SET ORDER TO cl DESCENDING   && CL
DEACTIVATE WINDOW OUTPUT
```

```
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by Cl.  F1-Cl,  F2-NO2,
   F3-NO3,  F4-SO4,  SHIFT F1-F4 for ascending,  F5 for Median"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE NO2OrderD
SET ORDER TO no2 DESCENDING   && NO2
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by NO2.  F1-Cl,  F2-NO2,
   F3-NO3,  F4-SO4,  SHIFT F1-F4 for ascending,  F5 for Median"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE NO3OrderD
SET ORDER TO no3 DESCENDING   && NO3
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by NO3.  F1-Cl,  F2-NO2,
   F3-NO3,  F4-SO4,  SHIFT F1-F4 for ascending,  F5 for Median"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE SO4OrderD
SET ORDER TO so4 DESCENDING   && SO4
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by SO4.  F1-Cl,  F2-NO2,
   F3-NO3,  F4-SO4,  SHIFT F1-F4 for ascending,  F5 for Median"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE ClOrder
SET ORDER TO cl   && CL
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by Cl.  F1-Cl,  F2-NO2,
   F3-NO3,  F4-SO4,  SHIFT F1-F4 for ascending,  F5 for Median"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE NO2Order
SET ORDER TO no2   && NO2
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by NO2.  F1-Cl,  F2-NO2,
   F3-NO3,  F4-SO4,  SHIFT F1-F4 for ascending,  F5 for Median"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE NO3Order
SET ORDER TO no3   && NO3
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by NO3.  F1-Cl,  F2-NO2,
   F3-NO3,  F4-SO4,  SHIFT F1-F4 for ascending,  F5 for Median"
GO TOP
ACTIVATE WINDOW OUTPUT
```

```
RETURN

PROCEDURE SO4Order
SET ORDER TO so4   && SO4
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by SO4.  F1-Cl,  F2-NO2,
   F3-NO3,  F4-SO4,  SHIFT F1-F4 for ascending,  F5 for Median"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE FBStop
DEACTIVATE WINDOW OUTPUT
POP KEY
USE
DELETE FILE IonsBlanks.DBF
SELECT Ions
USE
lEndFB=.T.
RETURN
```

## D.16. CarbonCS

```
PROCEDURE CARBONCS
EditFile = mCarbonPath + mSeason + "car.dbf"
USE &EditFile IN 0 ALIAS Carbon
IF NOT mBadLog
   SELECT carbon
   SELECT DISTINCT Carbon.*;
      FROM Carbon ;
      WHERE  Carbon.STATUS = "CS";
      ORDER BY Carbon.site, Carbon.samdat;
      INTO TABLE CarbonBlanks
   SELECT CarbonBlanks
   COUNT TO NumFB
   DEFINE WINDOW OUTPUT FROM 0,0 TO 35,160 ;
      TITLE STR(NumFB) + ' Carbon Field Blanks - Sort by: F1-o1, F2-O2, F3-O3, F4-O4,
   F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending' ;
      CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
   ACTIVATE WINDOW OUTPUT
   INDEX ON O1TC TAG O1
   INDEX ON O2TC TAG O2
   INDEX ON O3TC TAG O3
   INDEX ON O4TC TAG O4
   INDEX ON OPTC TAG OP
   INDEX ON E1TC TAG E1
   INDEX ON E2TC TAG E2
   INDEX ON E3TC TAG E3
   PUSH KEY
   ON KEY LABEL F1 DO O1OrderD
   ON KEY LABEL F2 DO O2OrderD
   ON KEY LABEL F3 DO O3OrderD
   ON KEY LABEL F4 DO O4OrderD
   ON KEY LABEL F5 DO OPOrderD
   ON KEY LABEL F6 DO E1OrderD
   ON KEY LABEL F7 DO E2OrderD
   ON KEY LABEL F8 DO E3OrderD
   ON KEY LABEL F9 SKIP ROUND(NumFB/2,0)-1
   ON KEY LABEL SHIFT+F1 DO O1Order
   ON KEY LABEL SHIFT+F2 DO O2Order
   ON KEY LABEL SHIFT+F3 DO O3Order
   ON KEY LABEL SHIFT+F4 DO O4Order
   ON KEY LABEL SHIFT+F5 DO OPOrder
   ON KEY LABEL SHIFT+F6 DO E1Order
   ON KEY LABEL SHIFT+F7 DO E2Order
   ON KEY LABEL SHIFT+F8 DO E3Order
   ON KEY LABEL ESC DO FBStop
   lEndFB=.F.
   DO WHILE NOT lEndFB
      BROWSE SAVE ;
            FIELDS site:R, samdat:R, strtim:R, STATUS, o1TC:R, o2TC:R, o3TC:R,
   o4TC:R, opTC:R, e1TC:R, e2TC:R, e3TC:R, comment;
            WINDOW OUTPUT
   ENDDO
   POP KEY
*            HIDE WINDOW OUTPUT
*            RETURN
ENDIF
```

```
RETURN

PROCEDURE O1OrderD
SET ORDER TO o1 DESCENDING   && O1
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by O1.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE O2OrderD
SET ORDER TO o2 DESCENDING   && O2
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by O2.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE O3OrderD
SET ORDER TO o3 DESCENDING   && O3
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by O3.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE O4OrderD
SET ORDER TO o4 DESCENDING   && O4
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by O4.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE OPOrderD
SET ORDER TO OP DESCENDING   && OP
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by OP.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE E1OrderD
SET ORDER TO E1 DESCENDING   && E1
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by E1.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE E2OrderD
SET ORDER TO E2 DESCENDING   && E1
```

```
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by E2.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE E3OrderD
SET ORDER TO E3 DESCENDING   && E3
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by E3.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE O1Order
SET ORDER TO O1   && O1
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by Cl.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE O2Order
SET ORDER TO o2   && O2
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by O2.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE O3Order
SET ORDER TO o3   && O3
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by O3.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE O4Order
SET ORDER TO o4   && O4
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by O4.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE OPOrder
SET ORDER TO OP && OP
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by OP.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
```

```
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE E1Order
SET ORDER TO E1 && E1
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by E1.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE E2Order
SET ORDER TO E2 && E1
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by E2.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE E3Order
SET ORDER TO E3 && E3
DEACTIVATE WINDOW OUTPUT
MODIFY WINDOW OUTPUT TITLE STR(NumFB) + " Field Blanks sorted by E3.  F1-o1, F2-O2,
   F3-O3, F4-O4, F5-OP, F6-E1, F7-E2, F8-E3, F9-Median SHIFT F1-F8 for ascending"
GO TOP
ACTIVATE WINDOW OUTPUT
RETURN

PROCEDURE FBStop
DEACTIVATE WINDOW OUTPUT
POP KEY
USE
DELETE FILE CarbonBlanks.DBF
SELECT Carbon
USE
lEndFB=.T.
RETURN
EditXRF
PROCEDURE EditXRF
EditFile = mXRFPath + mSeason + "ele.dbf"
USE &EditFile IN 0 ALIAS XRF
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,110 TITLE 'XRF/PESA - Press F1 to create
   XLS file' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      PUSH KEY
      ON KEY LABEL F1 DO XRFout
      SELECT XRF
      SET FILTER TO XRF.site=m.mSite
      IF XRF.samdat<{12/1/2001}
             BROWSE FIELDS site:W=.F., samdat, pesstat:P="!!", xrmstat:P="!!",
   pixstat:P="!!",;
                    h:14:W=.F., s:14:W=.F., ps:14:W=.F., fe:14:W=.F., pfe:14:W=.F.;
                    WINDOW OUTPUT
```

```
      ELSE
            BROWSE FIELDS site:W=.F., samdat, pesstat:P="!!", xrmstat:P="!!",
   xrcstat:P="!!",;
                  h:14:W=.F., s:14:W=.F., ys:14:W=.F., fe:14:W=.F., yfe:14:W=.F.;
                  WINDOW OUTPUT
      ENDIF
      POP KEY
      HIDE WINDOW OUTPUT
      SELECT XRF
      USE
   ENDIF
ENDIF
RETURN

PROCEDURE XRFout
outname = mPathtemp + ALLTRIM(XRF.site) + mSeason + "XRF.xls"
IF XRF.samdat<{12/1/2001}
   COPY TO &outname FIELDS site, samdat, pesstat, xrmstat, pixstat,;
      h, s, ps, fe, pfe XLS
ELSE
   COPY TO &outname FIELDS site, samdat, pesstat, xrmstat, xrcstat,;
      h, s, ys, fe, yfe XLS
ENDIF
RETURN
```

## D.17. EditLaser

```
PROCEDURE EditLaser
EditFile = mLaserPath + mSeason + "laser.dbf"
USE &EditFile IN 0 ALIAS Laser
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,67 TITLE 'Laser' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT Laser
      SET FILTER TO Laser.site=m.mSite
      BROWSE FIELDS site:W=.F., samdat, STATUS:8:P="!!",;
             t1:W=.F., r1:W=.F.,;
             Laser=10000 * LOG((1000-Laser.r1)/Laser.t1):12:W=.F.:P="#####.#";
             WINDOW OUTPUT
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.18. EditSO2

```
PROCEDURE EditSO2
EditFile = mSO2path + mSeason + "so2.dbf"
USE &EditFile IN 0 ALIAS SO2
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,85 TITLE 'SO2 data (Multiply SO4 by 2/3)' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT SO2
      SET FILTER TO SO2.site=m.mSite
      BROWSE FIELDS site:W=.F., samdat, STATUS:P="!!",;
             so4:W=.F.:P="#####.##";
             WINDOW OUTPUT
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.19. EditProblems

```
PROCEDURE EditProblems
EditFile = mSuppPath + "Problms.dbf"
USE &EditFile IN 0 ALIAS Problems SHARED
IF RIGHT(m.msite,1)="X"
   m.msite=LEFT(m.msite,4)+"1"
ENDIF
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 35,145 TITLE 'Problems File for &msite' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Courier New', 11
*            ACTIVATE WINDOW output
      SELECT Problems
      SET FILTER TO Problems.site=m.mSite
      GO TOP
      SET CENTURY ON
      SET FUNCTION 3 TO DTOC(DATE())+"   "+TIME()+"           LLA"
*            BROWSE
      MODIFY MEMO memtext WINDOW OUTPUT RANGE 99999,99999
      SET FUNCTION 3 TO
*            IN WINDOW output
*            HIDE WINDOW output
      USE
   ENDIF
ENDIF
```

## D.20. EditHolds

```
PROCEDURE EditHolds
EditFile = mHoldPath + "Holdsite.dbf"
USE &EditFile IN 0 ALIAS Holds SHARED
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 35,47 TITLE 'Sites Held Back' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT Holds
      SET ORDER TO sitemon
      SET FILTER TO Holds.QTR=m.mSeason
*                  BROWSE IN WINDOW output FOR NOT DELETED()
      ON ERROR
      BROWSE FIELDS site:P='!!!!N', QTR:P='!NN',;
             mon, reason, cleared;
             WINDOW OUTPUT
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.21. EditFlash

```
PROCEDURE EditFlash
EditFile = mFlashPath + mSite + mSeason + ".dbf"
USE &EditFile IN 0 ALIAS Flash
IF NOT mBadLog
   IF NOT nofile
*            DEFINE WINDOW output FROM 0,0 TO 51,130 TITLE 'Flash Data' ;
SYSTEM CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
*            ACTIVATE WINDOW output
      SELECT Flash
      BROWSE &&;
             IN WINDOW OUTPUT
*            HIDE WINDOW output
      USE
   ENDIF
ENDIF
```

## D.22. EditMag

```
PROCEDURE EditMag
EditFile = mCalPath + "IMPMGCAL.DBF"
USE &EditFile IN 0 ALIAS MagFile
SELECT MagFile
COPY TO mag
USE Mag
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 35,120 TITLE 'Mag Cal' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT Mag
      SET FILTER TO ALLTRIM(Mag.sitecode)=m.mSite
      GO BOTTOM
      BROWSE LOCK -2 WINDOW OUTPUT
      SET FILTER TO
      COPY TO &EditFile FOX2X
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.23. EditVac

```
PROCEDURE EditVac
EditFile = mCalPath + "IMPPSCAL.DBF"
IF NOT mBadLog
   USE &EditFile IN 0 ALIAS VacFile
   SELECT VacFile
   COPY TO vac
   USE vac
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 35,120 TITLE 'Vac Cal' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT Vac
      SET FILTER TO Vac.sitecode=m.mSite
      GO BOTTOM
      BROWSE LOCK -2 WINDOW OUTPUT
      SET FILTER TO
      COPY TO &EditFile FOX2X
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.24. EditBal

```
PROCEDURE EditBal
mBadLog=.F.
USE &EditFile IN 0 ALIAS BalEq
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 35,85 TITLE "&cTitle" ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT BalEq
      GO BOTTOM
      BROWSE WINDOW OUTPUT NOEDIT NODELETE
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.25. FlowRSD

```
PROCEDURE FLOWRSD

PARAMETERS mSwap && this is true if FLOWRSD is called from SWAP
PUBLIC mSite, mSeason, mVolsummary, mFile, mThisSeason, mLogFile, mBadLog, mHigh
DIMENSION QTR(4)

ON ERROR DO errhand WITH ;
   ERROR( ), MESSAGE( ), MESSAGE(1), PROGRAM( ), LINENO( )

SET TALK OFF
SET SAFETY OFF  && Make this active to remove dialog box on overwriting site and
   sites.

QTR(1) = "A"
QTR(2) = "B"
QTR(3) = "C"
QTR(4) = "D"
iSeason=mSeason

CLEAR
IF NOT mSwap
   CLOSE DATABASES ALL
   STORE SYS(5)+SYS(2003) TO DefaultDir
   mGETENV = 'M:\zDEFAULT\FOXPRO\'
   mVolsummary = mGETENV + "volsummary.dbf"
   mRootPath = "U:\IMPROVE\"
   mLogsPath = mRootPath + "logs\"
   mCalPath = mRootPath + "SiteCal\"
   mSiteFile = mCalPath + "sitefile.dbf"
   mLogFile = "u:\improve\logs\logs.dbf"
ENDIF

*SET DEFAULT TO M:\IMPROVE\Temp
SET DEFAULT TO &mGETENV
ON ERROR DO QLOGSERR
GO TOP
IF NOT mSwap
   USE &mLogFile IN 0 ALIAS logs
   mSite = logs.site
   mDate = logs.samdat
   USE
ENDIF

IF SELECT("Site")>0
   SELECT site
   USE
ENDIF
IF FILE("site.dbf")
   DELETE FILE "site.dbf")
ENDIF
SELECT DISTINCT LogSites.site;
   FROM LogSites;
   ORDER BY LogSites.site;
   INTO TABLE Site
SELECT site
```

```
INDEX ON site TAG site
GO TOP
IF site<>"  ALL"
   INSERT INTO Site (site) VALUES ("  ALL")
ENDIF
SELECT site
LOCATE FOR site.site=mSite

*mMonth = MONTH(mDate)
*mYear = YEAR(mDate)
*mQtr = QTR(mMonth/3) + RIGHT(STR(mYear),2)
IF NOT mSwap
   mSeason = mQtr
   CurrSeas = mSeason
ENDIF
STORE "U:\IMPROVE\FLASHDBF\" TO mFlashDir
IF SELECT("volsummary")>0
   SELECT volsummary
   USE
ENDIF
IF FILE('&mvolsummary')
   DELETE FILE &mVolsummary.DBF
ENDIF

DO WHILE .T.
   SELECT site
   LOCATE FOR site.site=msite
   IF mSite = "  ALL"
      WAIT WINDOW AT 15,30 NOWAIT "Please wait..."
      DO ALLSITES
      SET DEFAULT TO &DefaultDir
      SELECT site
      GO top
      mSite=site.site
*CANCEL
   ELSE
      mSite = IIF(RIGHT(mSite,1) = "X", LEFT(mSite,4) + "1", mSite)
*     RELEASE mfile
      mFile = mFlashDir + mSite + mSeason + ".dbf"
      IF SELECT("Flash")>0
            SELECT Flash
            USE
      ENDIF
      IF NOT FILE("&mFile")      && Display message if Flashcard file does not exist
            WAIT WINDOW AT 11, 80 NOWAIT TIMEOUT 5 "File &mFile does not exist"
*     LOOP
*  ENDIF
      ELSE
            USE "&mFile" IN 0 ALIAS Flash
            DO SQLSel
*     Zero Channel E readings if there is no X site to correspond with this one.
            SELECT site
            STORE RECNO() TO mRecord
            IF NOT SEEK(LEFT(mSite,4) + "X")
                  SELECT volsummary
                  REPLACE ALL EMagRSD WITH 0
                  REPLACE ALL EVacRSD WITH 0
```

```
*            DELETE ALL FOR AMagRSd<5 AND BMagRSd<5 AND CMagRSd<5 AND DVacRSd<5 AND
   EMagRSd<5 AND EVacRSd<5
                  PACK
            ENDIF
            SELECT site
            GOTO mRecord
            SELECT volsummary
            REPLACE ALL RECNO WITH RECNO()
            GO TOP
            SELECT Flash
            USE
      ENDIF
   ENDIF
   SELECT site
   LOCATE FOR site.site=msite

   frmInput = CREATEOBJECT('Form')
   frmInput.CLOSABLE = .F.
   frmInput.MOVABLE = .T.
   frmInput.BORDERSTYLE = 3
   frmInput.MOVE(0,0,820,680)
   frmInput.CAPTION = "Check Flow Transducer Variability - Percent Relative Standard
   Deviation"
   frmInput.NAME = "Form1"
   frmInput.ADDOBJECT('Label2', 'SeasonLabel')
   frmInput.ADDOBJECT('mSeason', 'SeasonBox')
   frmInput.ADDOBJECT('Label1', 'SiteLabel')
   frmInput.ADDOBJECT('mSite', 'SiteBox')
   frmInput.ADDOBJECT('Command1', 'ContinueBtn')
   frmInput.ADDOBJECT('QuitBtn', 'QuitBtn1')
   frmInput.ADDOBJECT('Grid1', '1stGrid')
   frmInput.Label1.VISIBLE = .T.
   frmInput.mSite.VISIBLE = .T.
   frmInput.Label2.VISIBLE = .T.
   frmInput.mSeason.VISIBLE = .F.
   ON KEY LABEL F2 DO SeasonChange
   frmInput.Label2.CAPTION = "Season:         " + m.mSeason + CHR(13) + "F2 to change
   "
*frmInput.Label2.refresh
   frmInput.Command1.VISIBLE = .T.
   frmInput.QuitBtn.VISIBLE = .T.
   frmInput.Grid1.VISIBLE = .T.
   mHigh = 3
   frmInput.Grid1.COLUMNS(5).DYNAMICFORECOLOR = ;
      "IIF(volsummary.number > 96, RGB(255,0,0), IIF(volsummary.number < 96,
   RGB(0,128,0), RGB(96,96,96)))"
   frmInput.Grid1.COLUMNS(6).DYNAMICFORECOLOR = ;
      "IIF(volsummary.amagrsd >= mHigh, RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(7).DYNAMICFORECOLOR = ;
      "IIF(volsummary.avacrsd >= mHigh, RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(8).DYNAMICFORECOLOR = ;
      "IIF(volsummary.bmagrsd >= mHigh, RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(9).DYNAMICFORECOLOR = ;
      "IIF(volsummary.bvacrsd >= mHigh, RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(10).DYNAMICFORECOLOR = ;
      "IIF(volsummary.cmagrsd >= mHigh, RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(11).DYNAMICFORECOLOR = ;
      "IIF(volsummary.cvacrsd >= mHigh, RGB(0,0,255), RGB(96,96,96))"
```

```
frmInput.Grid1.COLUMNS(12).DYNAMICFORECOLOR = ;
   "IIF(volsummary.dvacrsd >= 2, RGB(0,0,255), RGB(96,96,96))"
frmInput.Grid1.COLUMNS(13).DYNAMICFORECOLOR = ;
   "IIF(volsummary.emagrsd < .005, RGB(255,255,255), IIF(volsummary.emagrsd >=
mHigh, RGB(0,0,255), RGB(96,96,96)))"
frmInput.Grid1.COLUMNS(14).DYNAMICFORECOLOR = ;
   "IIF(volsummary.emagrsd < .005, RGB(255,255,255), IIF(volsummary.emagrsd >=
mHigh, RGB(0,0,255), RGB(96,96,96)))"
frmInput.Grid1.COLUMNS(15).DYNAMICFORECOLOR = ;
   "IIF(volsummary.Temprsd >= 7, RGB(0,0,255), RGB(96,96,96))"
frmInput.Grid1.COLUMNS(16).DYNAMICFORECOLOR = ;
   "IIF(volsummary.TempC >= 30, RGB(0,0,255), RGB(96,96,96))"
frmInput.Grid1.COLUMNS(5).DYNAMICFONTBOLD = "IIF(volsummary.number <> 96, .T.,
.F.)"
frmInput.Grid1.COLUMNS(6).DYNAMICFONTBOLD = "IIF(volsummary.amagrsd >= mHigh, .T.,
.F.)"
frmInput.Grid1.COLUMNS(7).DYNAMICFONTBOLD = "IIF(volsummary.avacrsd >= mHigh, .T.,
.F.)"
frmInput.Grid1.COLUMNS(8).DYNAMICFONTBOLD = "IIF(volsummary.bmagrsd >= mHigh, .T.,
.F.)"
frmInput.Grid1.COLUMNS(9).DYNAMICFONTBOLD = "IIF(volsummary.bvacrsd >= mHigh, .T.,
.F.)"
frmInput.Grid1.COLUMNS(10).DYNAMICFONTBOLD = "IIF(volsummary.cmagrsd >= mHigh,
.T., .F.)"
frmInput.Grid1.COLUMNS(11).DYNAMICFONTBOLD = "IIF(volsummary.cvacrsd >= mHigh,
.T., .F.)"
frmInput.Grid1.COLUMNS(12).DYNAMICFONTBOLD = "IIF(volsummary.dvacrsd >= 2, .T.,
.F.)"
frmInput.Grid1.COLUMNS(13).DYNAMICFONTBOLD = "IIF(volsummary.emagrsd >= mHigh,
.T., .F.)"
frmInput.Grid1.COLUMNS(14).DYNAMICFONTBOLD = "IIF(volsummary.evacrsd >= mHigh,
.T., .F.)"
frmInput.Grid1.COLUMNS(15).DYNAMICFONTBOLD = "IIF(volsummary.Temprsd >= 7, .T.,
.F.)"
frmInput.Grid1.COLUMNS(16).DYNAMICFONTBOLD = "IIF(volsummary.TempC >= 30, .T.,
.F.)"
frmInput.Grid1.COLUMNS(6).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(7).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(8).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(9).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(10).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(11).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(12).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(13).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(14).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(15).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(16).INPUTMASK="###.##"
frmInput.Grid1.COLUMNS(1).Header1.CAPTION = "Record"
frmInput.Grid1.COLUMNS(2).Header1.CAPTION = "Site"
frmInput.Grid1.COLUMNS(3).Header1.CAPTION = "Date"
frmInput.Grid1.COLUMNS(4).Header1.CAPTION = "Solenoid"
frmInput.Grid1.COLUMNS(5).Header1.CAPTION = "Number"
frmInput.Grid1.COLUMNS(6).Header1.CAPTION = "A Mag "
frmInput.Grid1.COLUMNS(7).Header1.CAPTION = "A Vac "
frmInput.Grid1.COLUMNS(8).Header1.CAPTION = "B Mag "
frmInput.Grid1.COLUMNS(9).Header1.CAPTION = "B Vac "
frmInput.Grid1.COLUMNS(10).Header1.CAPTION = "C Mag "
frmInput.Grid1.COLUMNS(11).Header1.CAPTION = "C Vac "
```

```
    frmInput.Grid1.COLUMNS(12).Header1.CAPTION = "D Vac "
    frmInput.Grid1.COLUMNS(13).Header1.CAPTION = "E Mag "
    frmInput.Grid1.COLUMNS(14).Header1.CAPTION = "E Vac "
    frmInput.Grid1.COLUMNS(15).Header1.CAPTION = "Temp RSD "
    frmInput.Grid1.COLUMNS(16).Header1.CAPTION = "Temp C "
    frmInput.Grid1.COLUMNS(1).Header1.ALIGNMENT = 2
    frmInput.Grid1.COLUMNS(2).Header1.ALIGNMENT = 2
    frmInput.Grid1.COLUMNS(3).Header1.ALIGNMENT = 2
    frmInput.Grid1.COLUMNS(4).Header1.ALIGNMENT = 2
    frmInput.Grid1.COLUMNS(5).Header1.ALIGNMENT = 2
    frmInput.Grid1.COLUMNS(6).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(7).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(8).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(9).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(10).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(11).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(12).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(13).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(14).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(15).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(16).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(1).WIDTH = 55
    frmInput.Grid1.COLUMNS(2).WIDTH = 45
    frmInput.Grid1.COLUMNS(3).WIDTH = 70
    frmInput.Grid1.COLUMNS(4).WIDTH = 45
    frmInput.Grid1.COLUMNS(5).WIDTH = 45
    frmInput.Grid1.COLUMNS(6).WIDTH = 40
    frmInput.Grid1.COLUMNS(7).WIDTH = 40
    frmInput.Grid1.COLUMNS(8).WIDTH = 40
    frmInput.Grid1.COLUMNS(9).WIDTH = 40
    frmInput.Grid1.COLUMNS(10).WIDTH = 40
    frmInput.Grid1.COLUMNS(11).WIDTH = 40
    frmInput.Grid1.COLUMNS(12).WIDTH = 40
    frmInput.Grid1.COLUMNS(13).WIDTH = 40
    frmInput.Grid1.COLUMNS(14).WIDTH = 40
    frmInput.Grid1.COLUMNS(15).WIDTH = 65
    frmInput.Grid1.COLUMNS(16).WIDTH = 60

    frmInput.mSite.VISIBLE = .T.
    SELECT site
    LOCATE FOR site.site=mSite
    frmInput.mSite.VALUE = mSite
    frmInput.SHOW
    READ EVENTS

ENDDO
ON ERROR  && restore system error handler
SET DEFAULT TO &DefaultDir
SELECT site
USE

* Object definitions for display form follow
DEFINE CLASS SeasonLabel AS LABEL
    AUTOSIZE = .F.
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    CAPTION = "Season:         " + m.mSeason + CHR(13) + "F2 to change        "
```

```
    LEFT = 50
    TOP = 25
    HEIGHT = 30
    WIDTH = 98
    NAME = "Label2"
ENDDEFINE

DEFINE CLASS SeasonBox AS TEXTBOX
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    VALUE = m.mSeason
    SELSTART = 0
    SELLENGTH = 3
    SELECTONENTRY = .T.
    CONTROLSOURCE = "m.mSeason"
    FORMAT = "!"
    TOP = 24
    LEFT = 126
    HEIGHT = 25
    WIDTH = 44
    MAXLENGTH = 3
    SPECIALEFFECT = 0
    NAME = "mSeason"
    PROCEDURE VALID
    IF mSeason<>iSeason
        IF mSeason = CurrSeas
               mLogFile = mLogsPath + "logs.dbf"
        ELSE
               mLogFile = mLogsPath + mSeason + "logs.dbf"
        ENDIF
        mBadLog = .F.
        ON ERROR DO QLOGSERR
        IF SELECT("logs")<>0
               SELECT logs
               USE
        ENDIF
        USE &mLogFile IN 0 ALIAS logs
*       On Error
        IF NOT mBadLog
               IF SELECT("site")<>0
                      SELECT site
                      USE
               ENDIF
               SET DEFAULT TO &mGETENV

               SELECT DISTINCT logs.site;
                      FROM logs;
                      ORDER BY logs.site;
                      INTO TABLE Site
               SELECT Site
               INDEX ON site TAG site
               GO TOP
               IF site<>"  ALL"
                      INSERT INTO Site (site) VALUES ("  ALL")
               ENDIF
               LOCATE FOR Site.site = mSite
               SELECT logs
```

```
            USE
            SELECT site
            SET DEFAULT TO &DefaultDir
      ENDIF
   ENDIF
   frmInput.mSite.VISIBLE = .T.
   frmInput.REFRESH
   frmInput.mSeason.VISIBLE = .F.
   frmInput.Label2.CAPTION = "Season:         " + m.mSeason + CHR(13) + "F2 to change
   "
   ENDPROC
ENDDEFINE

DEFINE CLASS SiteLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 9
   ALIGNMENT = 1
   CAPTION = "Site Name:"+CHR(13)+"('ALL' for report)"
   TOP = 28
   LEFT = 190
   HEIGHT = 30
   WIDTH = 88
   NAME = "Label1"
ENDDEFINE

DEFINE CLASS SiteBox AS LISTBOX
   FONTBOLD = .T.
   FONTSIZE = 8
   VALUE = mSite
   CONTROLSOURCE = Site.site
   TOP = 10
   LEFT = 290
   WIDTH = 75
   HEIGHT = 50
   MAXLENGTH = 5
   SPECIALEFFECT = 0
   COLUMNCOUNT = 1
   NAME = "mSite"
   SELSTART = 1
   SELLENGTH = 5
   SELECTONENTRY = .T.
   ROWSOURCETYPE = 2
   ROWSOURCE = "site"
   DISPLAYVALUE = 1
   NUMBEROFELEMENTS = 180
   INPUTMASK = "!!!!!"
   READONLY = .F.
   INCREMENTALSEARCH = .T.
   PROCEDURE VALID
      m.mSite = site.site
      CLEAR EVENTS
      THISFORM.RELEASE
      WAIT CLEAR
      IF SELECT("Flash")>0
            SELECT Flash
            USE
      ENDIF
```

```
   ENDPROC
ENDDEFINE

DEFINE CLASS ContinueBtn AS COMMANDBUTTON
   TOP = 24
   LEFT = 390
   HEIGHT = 25
   WIDTH = 121
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "\<Continue"
   DEFAULT = .T.
   TERMINATEREAD = .F.
   NAME = "Command1"

   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = Site.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   IF SELECT("Flash")>0
      SELECT Flash
      USE
   ENDIF
   ENDPROC
ENDDEFINE

DEFINE CLASS QuitBtn1 AS COMMANDBUTTON
   TOP = 24
   LEFT = 540
   HEIGHT = 25
   WIDTH = 121
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .T.
   CAPTION = "\<Quit"
   TERMINATEREAD = .F.
   NAME = "QuitBtn"
   PROCEDURE CLICK
   IF SELECT("Flash")>0
      SELECT Flash
      USE
   ENDIF
   ON ERROR
   SET DEFAULT TO &DefaultDir
   SET SAFETY ON
   DEACTIVATE WINDOW ALL
*      cancel
   SET SAFETY OFF
   RETURN TO MASTER
   ENDPROC
ENDDEFINE

DEFINE CLASS 1stGrid AS GRID
   TOP = 70
   LEFT = 12
```

```
    HEIGHT = 600
    WIDTH = 800
    RECORDSOURCE = "Volsummary"
    NAME = "Grid1"
    COLUMNCOUNT = 16
    Column1.ALIGNMENT = 2
    Column2.ALIGNMENT = 2
    Column3.ALIGNMENT = 2
    Column4.ALIGNMENT = 2
    Column5.ALIGNMENT = 2
ENDDEFINE

PROCEDURE SeasonChange
mSite = IIF(RIGHT(mSite,1) = "X", LEFT(mSite,4) + "1", mSite)
mFile = mFlashDir + mSite + mSeason + ".dbf"
frmInput.mSite.VISIBLE = .T.
frmInput.mSeason.VISIBLE = .T.
frmInput.mSeason.SETFOCUS
frmInput.REFRESH
RETURN
```

## D.26. AllSites

```
PROCEDURE AllSites
PUBLIC MissData(15)

mRootPath = "U:\IMPROVE\"
mCalPath = mRootPath + "SiteCal\"
mSiteFile = mCalPath + "sitefile.dbf"
mOutPath = mRootPath + "FlashDBF\Reports\"
mOutFile = mOutPath + "&mSeason" + "Flows.dbf"
Tempout = "m:\improve\temp\tOutfile.dbf"

* Set up output file and initialize array for scatter data
IF SELECT("Out")>0
   SELECT Out
   USE
ENDIF
SELECT 0
*CREATE &mOutFile
CREATE TABLE &mOutFile (Recno I,Site C(5), Date D, Solenoid I, Number I, ;
   AMagRsd N(20,5), AVacRsd N(20,5),;
   BMagRsd N(20,5), BVacRsd N(20,5),;
   CMagRsd N(20,5), CVacRsd N(20,5),;
   DVacRsd N(20,5),;
   EMagRsd N(20,5), EVacRsd N(20,5),;
   TempRsd N(20,5), TempC N(20,5))
APPEND BLANK
COPY TO &Tempout FOX2X
USE &Tempout ALIAS out
GO BOTTOM
SCATTER TO MissData
DELETE
PACK

SELECT site
DO WHILE NOT EOF('site')
   mSite = site.Site
   IF RIGHT(mSite,1)="X"
      SKIP IN site
      LOOP
   ENDIF
   mFile = mFlashDir + mSite + mSeason + ".dbf"
   IF SELECT("Flash")>0
      SELECT Flash
      USE
   ENDIF
   IF NOT FILE("&mFile")
      Missdata(1) = 0
      MissData(2) = mSite
      MissData(4) = 0
      MissData(5) = 0
      MissData(6) = -99
      MissData(7) = -99
      MissData(8) = -99
      MissData(9) = -99
      MissData(10) = -99
      MissData(11) = -99
```

```
       MissData(12) = -99
       MissData(13) = -99
       MissData(14) = -99
       MissData(15) = -99
       SELECT out
       APPEND BLANK
       GO BOTTOM
       GATHER FROM MissData
*      SELECT site
*      SKIP
*      LOOP
*   ENDIF
   ELSE
       USE "&mFile" IN 0 ALIAS Flash
       DO SQLSel
*      Zero Channel E readings if there is no X site to correspond with this one.
       SELECT site
       STORE RECNO() TO mRecord
       IF NOT SEEK(LEFT(mSite,4) + "X")
              SELECT Volsummary
              REPLACE ALL EMagRSD WITH 0
              REPLACE ALL EVacRSD WITH 0
       ENDIF
       SELECT site
       GOTO mRecord
       SELECT Volsummary
       REPLACE ALL Recno with Recno()
       USE
       SELECT out
       APPEND FROM &mVolsummary
       SELECT Flash
       USE
   ENDIF
   SELECT site
   SKIP
ENDDO
USE &mOutFile in 0 Alias Keep
SELECT Keep
DELETE ALL
PACK
APPEND FROM &Tempout
USE
SELECT out
*SET FILTER TO date>={8/1/2004}
WAIT clear
REPORT FORM Flow for (AMagRSd>mhigh OR AVacRsd>mhigh OR BMagRSd>mhigh OR BVacRSD>mhigh
   OR CMagRSd>mhigh OR CVacRsd>mhigh OR DVacRSd>3 OR EMagRSd>mhigh OR EVacRSd>mhigh
   OR Number<72 OR Number>104) Preview
USE
DELETE FILE &Tempout
SELECT site

RETURN
```

## D.27. SQLSel

```
PROCEDURE SQLSEL
* Extracts data from FlashCard on daily variability

   IF RIGHT(mSite,1)="9"
      SELECT recno() AS RecNo, Flash.Site AS Site, Flash.samdat AS Date, Flash.sol AS
   Solenoid,;
        COUNT(Flash.af1m) AS Number,;
        0 AS AMagRSd,;
        100*SQRT((SUM(Flash.af1g*Flash.af1g)-
   SUM(Flash.af1g)^2/COUNT(Flash.af1g))/COUNT(Flash.af1g))/AVG(Flash.af1g) AS
   AVacRSd,;
        0 AS BMagRSd,;
        100*SQRT((SUM(Flash.bf1g*Flash.bf1g)-
   SUM(Flash.bf1g)^2/COUNT(Flash.bf1g))/COUNT(Flash.bf1g))/AVG(Flash.bf1g) AS
   BVacRSd,;
        0 AS CMagRSd,;
        100*SQRT((SUM(Flash.cf1g*Flash.cf1g)-
   SUM(Flash.cf1g)^2/COUNT(Flash.cf1g))/COUNT(Flash.cf1g))/AVG(Flash.cf1g) AS
   CvacRSd,;
        100*SQRT((SUM(Flash.df1g*Flash.df1g)-
   SUM(Flash.df1g)^2/COUNT(Flash.df1g))/COUNT(Flash.df1g))/AVG(Flash.df1g) AS
   DVacRSd,;
        100*SQRT((SUM(Flash.ef1g*Flash.ef1g)-
   SUM(Flash.ef1g)^2/COUNT(Flash.ef1g))/COUNT(Flash.ef1g))/AVG(Flash.ef1g) AS
   EvacRSd,;
        0 AS EMagRSd,;
        100*SQRT((SUM(Flash.Temp*Flash.Temp)-
   SUM(Flash.Temp)^2/COUNT(Flash.Temp))/COUNT(Flash.Temp))/AVG(Flash.Temp) AS
   TempRSd,;
        AVG(Flash.Temp)*0.1141-85.024 AS TempC;
       INTO TABLE &mVolSummary;
       HAVING Number>15;
       FROM &mFile AS Flash;
       GROUP BY Flash.samdat, Flash.sol, Flash.site;
       ORDER BY Flash.samdat
   ELSE
      SELECT recno() AS RecNo, Flash.Site AS Site, Flash.samdat AS Date, Flash.sol AS
   Solenoid,;
        COUNT(Flash.af1m) AS Number,;
        100*SQRT((SUM(Flash.af1m*Flash.af1m)-
   SUM(Flash.af1m)^2/COUNT(Flash.af1m))/COUNT(Flash.af1m))/AVG(Flash.af1m) AS
   AMagRSd,;
        100*SQRT((SUM(Flash.af1g*Flash.af1g)-
   SUM(Flash.af1g)^2/COUNT(Flash.af1g))/COUNT(Flash.af1g))/AVG(Flash.af1g) AS
   AVacRSd,;
        100*SQRT((SUM(Flash.bf1m*Flash.bf1m)-
   SUM(Flash.bf1m)^2/COUNT(Flash.bf1m))/COUNT(Flash.bf1m))/AVG(Flash.bf1m) AS
   BMagRSd,;
        100*SQRT((SUM(Flash.bf1g*Flash.bf1g)-
   SUM(Flash.bf1g)^2/COUNT(Flash.bf1g))/COUNT(Flash.bf1g))/AVG(Flash.bf1g) AS
   BVacRSd,;
        100*SQRT((SUM(Flash.cf1m*Flash.cf1m)-
   SUM(Flash.cf1m)^2/COUNT(Flash.cf1m))/COUNT(Flash.cf1m))/AVG(Flash.cf1m) AS
   CMagRSd,;
```

```
        100*SQRT((SUM(Flash.cf1g*Flash.cf1g)-
    SUM(Flash.cf1g)^2/COUNT(Flash.cf1g))/COUNT(Flash.cf1g))/AVG(Flash.cf1g) AS
    CvacRSd,;
        100*SQRT((SUM(Flash.df1g*Flash.df1g)-
    SUM(Flash.df1g)^2/COUNT(Flash.df1g))/COUNT(Flash.df1g))/AVG(Flash.df1g) AS
    DVacRSd,;
        100*SQRT((SUM(Flash.ef1m*Flash.ef1m)-
    SUM(Flash.ef1m)^2/COUNT(Flash.ef1m))/COUNT(Flash.ef1m))/AVG(Flash.ef1m) AS
    EMagRSd,;
        100*SQRT((SUM(Flash.ef1g*Flash.ef1g)-
    SUM(Flash.ef1g)^2/COUNT(Flash.ef1g))/COUNT(Flash.ef1g))/AVG(Flash.ef1g) AS
    EVacRSd,;
        100*SQRT((SUM(Flash.Temp*Flash.Temp)-
    SUM(Flash.Temp)^2/COUNT(Flash.Temp))/COUNT(Flash.Temp))/AVG(Flash.Temp) AS
    TempRSd,;
         AVG(Flash.Temp)*0.1141-85.024 AS TempC;
        INTO TABLE &mVolSummary;
        HAVING Number>15;
        FROM &mFile AS Flash;
        GROUP BY Flash.samdat, Flash.sol, Flash.site;
        ORDER BY Flash.samdat
    ENDIF
RETURN
```

## D.28. FlowRate

```
PROCEDURE FLOWRATE

PARAMETERS mSwap
PUBLIC mSite, mSeason, mVolsummary, mFile, mThisSeason, mLogFile, mhigh, mFlashDir
PUBLIC xSite
DIMENSION QTR(4)

ON ERROR DO errhand WITH ;
   ERROR( ), MESSAGE( ), MESSAGE(1), PROGRAM( ), LINENO( )

SET TALK OFF
SET SAFETY OFF

QTR(1) = "A"
QTR(2) = "B"
QTR(3) = "C"
QTR(4) = "D"
iSeason=mSeason
mhigh=0

CLEAR
IF NOT mSwap
   CLOSE DATABASES ALL
   STORE SYS(5)+SYS(2003) TO DefaultDir
   mGETENV = 'M:\zDEFAULT\FOXPRO\'
   mVolsummary = mGETENV + "volsummary.dbf"
   mRootPath = "U:\IMPROVE\"
   mLogPath = mRootPath + "logs\"
   mCalPath = mRootPath + "SiteCal\"
   mSiteFile = mCalPath + "sitefile.dbf"
   mLogFile = "M:\IMPROVE\LOGS\logs.dbf"
ENDIF

*SET DEFA TO M:\IMPROVE\PROGRAMS
SET DEFAULT TO &mGETENV
*ON ERROR DO QLOGSERR
GO TOP
IF NOT mSwap
   USE &mLogFile IN 0 ALIAS logs
   mSite = logs.site
   mDate = logs.samdat
   USE
ENDIF

IF SELECT("Site")>0
   SELECT site
   USE
ENDIF
IF FILE("site.dbf")
   DELETE FILE "site.dbf")
ENDIF
SELECT DISTINCT LogSites.site;
   FROM LogSites;
   ORDER BY LogSites.site;
   INTO TABLE site
```

```
SELECT site
INDEX ON site TAG site
GO TOP
IF site<>"  ALL"
   INSERT INTO site (site) VALUES ("  ALL")
ENDIF
SELECT site
LOCATE FOR site.site=mSite

mMonth = MONTH(mDate)
mYear = YEAR(mDate)
mQtr = QTR(mMonth/3) + RIGHT(STR(mYear),2)
IF NOT mSwap
   mSeason = mQtr
   CurrSeas = mSeason
ENDIF
STORE "U:\IMPROVE\FLASHDBF\" TO mFlashDir
IF SELECT("volsummary")>0
   SELECT volsummary
   USE
ENDIF
IF FILE('&mvolsummary')
   DELETE FILE &mVolsummary.DBF
ENDIF

DO WHILE .T.
   SELECT site
   LOCATE FOR site.site=msite
   IF mSite = "  ALL"
      WAIT WINDOW AT 15,30 NOWAIT "Please wait..."
      DO ALLFLOWS
      SET DEFAULT TO &DefaultDir
      SELECT site
      GO top
      mSite=site.site
*CANCEL
   ELSE
      xSite = IIF(RIGHT(mSite,1) = "X", mSite, " ")
      mSite = IIF(RIGHT(mSite,1) = "X", LEFT(mSite,4) + "1", mSite)
      mFile = mFlashDir + mSite + mSeason + ".dbf"
      IF SELECT("Flash")>0
            SELECT Flash
            USE
      ENDIF
      IF NOT FILE("&mFile")      && Display message if Flashcard file does not exist
            WAIT WINDOW AT 11, 80 NOWAIT TIMEOUT 5 "File &mFile does not exist"
*     LOOP
*  ENDIF
      ELSE
            USE "&mFile" IN 0 ALIAS Flash
            DO sqlflow
*     Zero Channel E readings if there is no X site to correspond with this one.
            SELECT site
            STORE RECNO() TO mRecord
            IF NOT SEEK(LEFT(mSite,4) + "X")
                  SELECT volsummary
                  REPLACE ALL Emagrsd WITH 0
                  REPLACE ALL Evacrsd WITH 0
```

```
*            DELETE ALL FOR Amagrsd<5 AND Bmagrsd<5 AND Cmagrsd<5 AND Dvacrsd<5 AND
   Emagrsd<5 AND Evacrsd<5
                  PACK
            ENDIF
            SELECT site
            GOTO mRecord
            SELECT volsummary
            REPLACE ALL RECNO WITH RECNO()
            GO TOP
            DO FlowCalc
            SELECT Flash
            USE
      ENDIF
   ENDIF
   SELECT site
   LOCATE FOR site.site=msite

   frmInput = CREATEOBJECT('Form')
   frmInput.CLOSABLE = .F.
   frmInput.MOVABLE = .T.
   frmInput.BORDERSTYLE = 3
   frmInput.MOVE(100,10,820,780)
   frmInput.CAPTION = "Flow Transducer Daily Average"
   frmInput.NAME = "Form1"
   frmInput.ADDOBJECT('Label2', 'SeasonLabel')
   frmInput.ADDOBJECT('mSeason', 'Seasonbox')
   frmInput.ADDOBJECT('Label1', 'SiteLabel')
   frmInput.ADDOBJECT('mSite', 'Sitebox')
   frmInput.ADDOBJECT('Command1', 'ContinueBtn')
   frmInput.ADDOBJECT('QuitBtn', 'QuitBtn1')
   frmInput.ADDOBJECT('Grid1', '1stGrid')
   frmInput.Label1.VISIBLE = .T.
   frmInput.mSite.VISIBLE = .T.
   frmInput.Label2.VISIBLE = .T.
   frmInput.mSeason.VISIBLE = .F.
   ON KEY LABEL F2 DO SeasonChange
   frmInput.Label2.CAPTION = "Season:         " + m.mSeason + CHR(13) + "F2 to change
   "
*frmInput.Label2.refresh
   frmInput.Command1.VISIBLE = .T.
   frmInput.QuitBtn.VISIBLE = .T.
   frmInput.Grid1.VISIBLE = .T.
   mhigh = 5
   frmInput.Grid1.COLUMNS(6).DYNAMICFORECOLOR = ;
      "IIF(volsummary.amagrsd >= mHigh , RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(7).DYNAMICFORECOLOR = ;
      "IIF(volsummary.avacrsd >= mHigh , RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(8).DYNAMICFORECOLOR = ;
      "IIF(volsummary.bmagrsd >= mHigh , RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(9).DYNAMICFORECOLOR = ;
      "IIF(volsummary.bvacrsd >= mHigh , RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(10).DYNAMICFORECOLOR = ;
      "IIF(volsummary.cmagrsd >= mHigh , RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(11).DYNAMICFORECOLOR = ;
      "IIF(volsummary.cvacrsd >= mHigh , RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(12).DYNAMICFORECOLOR = ;
      "IIF(volsummary.dvacrsd >= 2, RGB(0,0,255), RGB(96,96,96))"
   frmInput.Grid1.COLUMNS(13).DYNAMICFORECOLOR = ;
```

```
   "IIF(volsummary.emagrsd < .005, RGB(255,255,255), IIF(volsummary.emagrsd >= 5,
RGB(0,0,255), RGB(96,96,96)))"
frmInput.Grid1.COLUMNS(14).DYNAMICFORECOLOR = ;
   "IIF(volsummary.evacrsd < .005, RGB(255,255,255), IIF(volsummary.evacrsd >= 5,
RGB(0,0,255), RGB(96,96,96)))"
frmInput.Grid1.COLUMNS(15).DYNAMICFORECOLOR = ;
   "IIF(volsummary.TempC >30, RGB(255,0,0), IIF(volsummary.TempC <5, RGB(0,128,0),
RGB(0,0,255)))"
frmInput.Grid1.COLUMNS(6).DYNAMICFONTBOLD = "IIF(volsummary.amagrsd >= 40, .T.,
.F.)"
frmInput.Grid1.COLUMNS(7).DYNAMICFONTBOLD = "IIF(volsummary.avacrsd >= 40, .T.,
.F.)"
frmInput.Grid1.COLUMNS(8).DYNAMICFONTBOLD = "IIF(volsummary.bmagrsd >= 40, .T.,
.F.)"
frmInput.Grid1.COLUMNS(9).DYNAMICFONTBOLD = "IIF(volsummary.bvacrsd >= 40, .T.,
.F.)"
frmInput.Grid1.COLUMNS(10).DYNAMICFONTBOLD = "IIF(volsummary.cmagrsd >= 40, .T.,
.F.)"
frmInput.Grid1.COLUMNS(11).DYNAMICFONTBOLD = "IIF(volsummary.cvacrsd >= 40, .T.,
.F.)"
frmInput.Grid1.COLUMNS(12).DYNAMICFONTBOLD = "IIF(volsummary.dvacrsd >= 40, .T.,
.F.)"
frmInput.Grid1.COLUMNS(13).DYNAMICFONTBOLD = "IIF(volsummary.emagrsd >= 40, .T.,
.F.)"
frmInput.Grid1.COLUMNS(14).DYNAMICFONTBOLD = "IIF(volsummary.evacrsd >= 40, .T.,
.F.)"
frmInput.Grid1.COLUMNS(15).DYNAMICFONTBOLD = "IIF(volsummary.TempC < 5 OR
volsummary.TempC >= 30, .T., .F.)"
frmInput.Grid1.COLUMNS(6).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(7).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(8).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(9).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(10).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(11).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(12).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(13).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(14).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(15).INPUTMASK="###.#"
frmInput.Grid1.COLUMNS(1).Header1.CAPTION = "Record"
frmInput.Grid1.COLUMNS(2).Header1.CAPTION = "Site"
frmInput.Grid1.COLUMNS(3).Header1.CAPTION = "Date"
frmInput.Grid1.COLUMNS(4).Header1.CAPTION = "Solenoid"
frmInput.Grid1.COLUMNS(5).Header1.CAPTION = "Number"
frmInput.Grid1.COLUMNS(6).Header1.CAPTION = "A Mag "
frmInput.Grid1.COLUMNS(7).Header1.CAPTION = "A Vac "
frmInput.Grid1.COLUMNS(8).Header1.CAPTION = "B Mag "
frmInput.Grid1.COLUMNS(9).Header1.CAPTION = "B Vac "
frmInput.Grid1.COLUMNS(10).Header1.CAPTION = "C Mag "
frmInput.Grid1.COLUMNS(11).Header1.CAPTION = "C Vac "
frmInput.Grid1.COLUMNS(12).Header1.CAPTION = "D Vac "
frmInput.Grid1.COLUMNS(13).Header1.CAPTION = "E Mag "
frmInput.Grid1.COLUMNS(14).Header1.CAPTION = "E Vac "
frmInput.Grid1.COLUMNS(15).Header1.CAPTION = "Temp C"
frmInput.Grid1.COLUMNS(1).Header1.ALIGNMENT = 2
frmInput.Grid1.COLUMNS(2).Header1.ALIGNMENT = 2
frmInput.Grid1.COLUMNS(3).Header1.ALIGNMENT = 2
frmInput.Grid1.COLUMNS(4).Header1.ALIGNMENT = 2
frmInput.Grid1.COLUMNS(5).Header1.ALIGNMENT = 2
```

```
    frmInput.Grid1.COLUMNS(6).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(7).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(8).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(9).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(10).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(11).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(12).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(13).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(14).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(15).Header1.ALIGNMENT = 1
    frmInput.Grid1.COLUMNS(1).WIDTH = 55
    frmInput.Grid1.COLUMNS(2).WIDTH = 45
    frmInput.Grid1.COLUMNS(3).WIDTH = 65
    frmInput.Grid1.COLUMNS(4).WIDTH = 45
    frmInput.Grid1.COLUMNS(5).WIDTH = 45
    frmInput.Grid1.COLUMNS(6).WIDTH = 40
    frmInput.Grid1.COLUMNS(7).WIDTH = 40
    frmInput.Grid1.COLUMNS(8).WIDTH = 40
    frmInput.Grid1.COLUMNS(9).WIDTH = 40
    frmInput.Grid1.COLUMNS(10).WIDTH = 40
    frmInput.Grid1.COLUMNS(11).WIDTH = 40
    frmInput.Grid1.COLUMNS(12).WIDTH = 40
    frmInput.Grid1.COLUMNS(13).WIDTH = 40
    frmInput.Grid1.COLUMNS(14).WIDTH = 40
    frmInput.Grid1.COLUMNS(15).WIDTH = 65

    frmInput.mSite.VISIBLE = .T.
    SELECT site
    LOCATE FOR site.site=mSite
    frmInput.mSite.VALUE = mSite
    frmInput.SHOW
    READ EVENTS

ENDDO
ON ERROR  && restore system error handler
SET DEFAULT TO &DefaultDir
SELECT site
USE

* Object definitions for display form follow
DEFINE CLASS SeasonLabel AS LABEL
    AUTOSIZE = .F.
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    CAPTION = "Season:         " + m.mSeason + CHR(13) + "F2 to change        "
    LEFT = 50
    TOP = 25
    HEIGHT = 30
    WIDTH = 98
    NAME = "Label2"
ENDDEFINE

DEFINE CLASS SeasonBox AS TEXTBOX
    FONTBOLD = .T.
    FONTSIZE = 9
    ALIGNMENT = 1
    VALUE = m.mSeason
```

```
   SELSTART = 0
   SELLENGTH = 3
   SELECTONENTRY = .T.
   CONTROLSOURCE = "m.mSeason"
   FORMAT = "!"
   TOP = 24
   LEFT = 126
   HEIGHT = 25
   WIDTH = 44
   MAXLENGTH = 3
   SPECIALEFFECT = 0
   NAME = "mSeason"
   PROCEDURE VALID
   IF mSeason<>iSeason
      IF mSeason = CurrSeas
            mLogFile = mLogsPath + "logs.dbf"
      ELSE
            mLogFile = mLogsPath + mSeason + "logs.dbf"
      ENDIF
      mBadLog = .F.
*     ON ERROR DO QLOGSERR
      IF SELECT("logs")<>0
            SELECT logs
            USE
      ENDIF
      USE &mLogFile IN 0 ALIAS logs
*     On Error
      IF NOT mBadLog
            IF SELECT("site")<>0
                  SELECT site
                  USE
            ENDIF
            SET DEFAULT TO &mGETENV

            SELECT DISTINCT logs.site;
                  FROM logs;
                  ORDER BY logs.site;
                  INTO TABLE site
            SELECT Site
            INDEX ON site TAG site
            GO TOP
            IF site<>"  ALL"
                  INSERT INTO site (site) VALUES ("  ALL")
            ENDIF
            LOCATE FOR site.site = mSite
            SELECT logs
            USE
            SELECT site
            SET DEFAULT TO &DefaultDir
      ENDIF
   ENDIF
   frmInput.mSite.VISIBLE = .T.
   frmInput.REFRESH
   frmInput.mSeason.VISIBLE = .F.
   frmInput.Label2.CAPTION = "Season:         " + m.mSeason + CHR(13) + "F2 to change
   "
   ENDPROC
ENDDEFINE
```

```
DEFINE CLASS SiteLabel AS LABEL
   AUTOSIZE = .F.
   FONTBOLD = .T.
   FONTSIZE = 9
   ALIGNMENT = 1
   CAPTION = "Site Name:"+CHR(13)+"('ALL' for report)"
   TOP = 28
   LEFT = 190
   HEIGHT = 30
   WIDTH = 88
   NAME = "Label1"
ENDDEFINE

DEFINE CLASS SiteBox AS LISTBOX
   FONTBOLD = .T.
   FONTSIZE = 8
   VALUE = mSite
   CONTROLSOURCE = Site.site
   TOP = 10
   LEFT = 290
   WIDTH = 75
   HEIGHT = 50
   MAXLENGTH = 5
   SPECIALEFFECT = 0
   COLUMNCOUNT = 1
   NAME = "mSite"
   SELSTART = 1
   SELLENGTH = 5
   SELECTONENTRY = .T.
   ROWSOURCETYPE = 2
   ROWSOURCE = "site"
   DISPLAYVALUE = 1
   NUMBEROFELEMENTS = 180
   INPUTMASK = "!!!!!"
   READONLY = .F.
   INCREMENTALSEARCH = .T.
   PROCEDURE VALID
      m.mSite = site.site
      CLEAR EVENTS
      THISFORM.RELEASE
      WAIT CLEAR
      IF SELECT("Flash")>0
            SELECT Flash
            USE
      ENDIF
   ENDPROC
ENDDEFINE

DEFINE CLASS ContinueBtn AS COMMANDBUTTON
   TOP = 24
   LEFT = 390
   HEIGHT = 25
   WIDTH = 121
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .F.
   CAPTION = "\<Continue"
```

```
   DEFAULT = .T.
   TERMINATEREAD = .F.
   NAME = "Command1"

   PROCEDURE CLICK
*      IIF(len(msite)=0, m.msite=" ", m.msite = site.site)
   m.mSite = site.site
   CLEAR EVENTS
   THISFORM.RELEASE
   WAIT CLEAR
   IF SELECT("Flash")>0
      SELECT Flash
      USE
   ENDIF
   ENDPROC
ENDDEFINE


DEFINE CLASS QuitBtn1 AS COMMANDBUTTON
   TOP = 24
   LEFT = 540
   HEIGHT = 25
   WIDTH = 121
   FONTBOLD = .T.
   FONTSIZE = 10
   CANCEL = .T.
   CAPTION = "\<Quit"
   TERMINATEREAD = .F.
   NAME = "QuitBtn"
   PROCEDURE CLICK
   IF SELECT("Flash")>0
      SELECT Flash
      USE
   ENDIF
   ON ERROR
   SET DEFAULT TO &DefaultDir
   SET SAFETY ON
   DEACTIVATE WINDOW ALL
*      cancel
   SET SAFETY OFF
   RETURN TO MASTER
   ENDPROC
ENDDEFINE

DEFINE CLASS 1stGrid AS GRID
   TOP = 70
   LEFT = 12
   HEIGHT = 700
   WIDTH = 800
   RECORDSOURCE = "Volsummary"
   NAME = "Grid1"
   COLUMNCOUNT = 15
   Column1.ALIGNMENT = 2
   Column2.ALIGNMENT = 2
   Column3.ALIGNMENT = 2
   Column4.ALIGNMENT = 2
   Column5.ALIGNMENT = 2
ENDDEFINE
```

```
PROCEDURE SeasonChange
mSite = IIF(RIGHT(mSite,1) = "X", LEFT(mSite,4) + "1", mSite)
mFile = mFlashDir + mSite + mSeason + ".dbf"
frmInput.mSite.VISIBLE = .T.
frmInput.mSeason.VISIBLE = .T.
frmInput.mSeason.SETFOCUS
frmInput.REFRESH
RETURN
```

## D.29. AllFlows

```
PROCEDURE AllFlows
PUBLIC MissData(15)

mRootPath = "U:\IMPROVE\"
mCalPath = mRootPath + "SiteCal\"
mSiteFile = mCalPath + "sitefile.dbf"
mOutPath = mRootPath + "FlashDBF\Reports\"
mOutFile = mOutPath + "&mSeason" + "Flows.dbf"
Tempout = "m:\improve\temp\tOutfile.dbf"

* Set up output file and initialize array for scatter data
IF SELECT("Out")>0
   SELECT Out
   USE
ENDIF
SELECT 0
*CREATE &mOutFile
CREATE TABLE &mOutFile (Recno I,Site C(5), Date D, Solenoid I, Number I, ;
   AMagRsd N(20,5), AVacRsd N(20,5),;
   BMagRsd N(20,5), BVacRsd N(20,5),;
   CMagRsd N(20,5), CVacRsd N(20,5),;
   DVacRsd N(20,5),;
   EMagRsd N(20,5), EVacRsd N(20,5),;
   TempRsd N(20,5), TempC N(20,5))
APPEND BLANK
COPY TO &Tempout FOX2X
USE &Tempout ALIAS out
GO BOTTOM
SCATTER TO MissData
DELETE
PACK

SELECT logsites
DO WHILE NOT EOF('logsites')
   mSite = logsites.Site
   IF RIGHT(mSite,1)="X"
      SKIP IN logsites
      LOOP
   ENDIF
   mFile = mFlashDir + mSite + mSeason + ".dbf"
   IF SELECT("Flash")>0
      SELECT Flash
      USE
   ENDIF
   IF NOT FILE("&mFile")
      Missdata(1) = 0
      MissData(2) = mSite
      MissData(4) = 0
      MissData(5) = 0
      MissData(6) = -99
      MissData(7) = -99
      MissData(8) = -99
      MissData(9) = -99
      MissData(10) = -99
      MissData(11) = -99
```

```
       MissData(12) = -99
       MissData(13) = -99
       MissData(14) = -99
       MissData(15) = -99
       SELECT out
       APPEND BLANK
       GO BOTTOM
       GATHER FROM MissData
*      SELECT sites
*      SKIP
*      LOOP
*   ENDIF
   ELSE
       USE "&mFile" IN 0 ALIAS Flash
       DO SQLflow
*      Zero Channel E readings if there is no X site to correspond with this one.
       SELECT logsites
       STORE RECNO() TO mRecord
       IF NOT SEEK(LEFT(mSite,4) + "X")
              SELECT Volsummary
              REPLACE ALL EMagRSD WITH 0
              REPLACE ALL EVacRSD WITH 0
       ENDIF
       SELECT logsites
       GOTO mRecord
       SELECT Volsummary
       REPLACE ALL Recno with Recno()
       USE
       SELECT out
       APPEND FROM &mVolsummary
       SELECT Flash
       USE
   ENDIF
   SELECT logsites
   SKIP
ENDDO
USE &mOutFile in 0 Alias Keep
SELECT Keep
DELETE ALL
PACK
APPEND FROM &Tempout
USE
*SELECT Sites
*USE
SELECT out
*SET FILTER TO date>={8/1/2004}
*REPORT FORM Flow for (AMagRSd>5 OR AVacRsd>5 OR BMagRSd>5 OR BVacRSD>5 OR CMagRSd>5
   OR CVacRsd>5 OR DVacRSd>3 OR EMagRSd>5 OR EVacRSd>5 OR Number<72 OR Number>104)
   Preview
REPORT FORM Flow for site<>"  ALL" Preview
USE
DELETE FILE &Tempout

RETURN
```

## D.30. SQLFlow

```
PROCEDURE SQLFLOW
* Extracts data from FlashCard on daily variability

   IF RIGHT(mSite,1)="9"
             SELECT recno() AS RecNo, Flash.Site AS Site, Flash.samdat AS Date,
   Flash.sol AS Solenoid,;
        COUNT(Flash.af1m) AS Number,;
        0 AS Amagrsd,;
        AVG(Flash.af1g)/100 AS Avacrsd,;
        0 AS Bmagrsd,;
        AVG(Flash.bf1g)/100 AS Bvacrsd,;
        0 AS Cmagrsd,;
        AVG(Flash.cf1g)/100 AS Cvacrsd,;
        0 AS Dvacrsd,;
        0 AS Emagrsd,;
        0 AS Evacrsd,;
        AVG(Flash.Temp)*0.1141-85.024 AS TempC;
        INTO TABLE &mVolSummary;
       FROM &mFile AS Flash;
       GROUP BY Flash.samdat, Flash.sol, Flash.Site;
       HAVING Number>12;
       ORDER BY Flash.samdat
   ELSE
      SELECT recno() AS RecNo, Flash.Site AS Site, Flash.samdat AS Date, Flash.sol AS
   Solenoid,;
        COUNT(Flash.af1m) AS Number,;
        AVG(Flash.af1m)/100 AS Amagrsd,;
        AVG(Flash.af1g)/100 AS Avacrsd,;
        AVG(Flash.bf1m)/100 AS Bmagrsd,;
        AVG(Flash.bf1g)/100 AS Bvacrsd,;
        AVG(Flash.cf1m)/100 AS Cmagrsd,;
        AVG(Flash.cf1g)/100 AS Cvacrsd,;
        AVG(Flash.df1g)/100 AS Dvacrsd,;
        AVG(Flash.ef1m)/100 AS Emagrsd,;
        AVG(Flash.ef1g)/100 AS Evacrsd,;
        AVG(Flash.Temp)*0.1141-85.024 AS TempC;
       INTO TABLE &mVolSummary;
       HAVING Number>12;
       FROM &mFile Flash;
       GROUP BY Flash.samdat, Flash.sol, Flash.Site;
       ORDER BY Flash.samdat
   ENDIF
* AND (AMagRSd>5 OR BMagRSd>5 OR CMagRSd>5 OR DVacRSd>5 OR EMagRSd>5 OR EVacRSd>5)
RETURN
```

## D.31. FlowCalc

```
PROCEDURE FlowCalc
*
* Calculate flow rates from flashcard averages for display in SWAP
*
SELECT volsummary
GO BOTTOM
STORE DATE TO lastdate

MagCal = mcalpath + "Impmgcal.dbf"
VacCal = mcalpath + "Imppscal.dbf"

USE &MagCal IN 0 ALIAS MagC
SELECT MagC.sitecode, MagC.channel, MagC.elevfact,;
   MagC.tempc, MagC.DATE, MagC.a_davis, MagC.b_davis,;
   MagC.nom_flow, MagC.sampler, MagC.TYPE, MagC.COMMENT;
   FROM MagC;
   WHERE  MagC.sitecode = msite;
   AND  MagC.DATE < lastdate;
   INTO CURSOR Mag
SELECT MagC
USE

USE &VacCal IN 0 ALIAS VacC
SELECT VacC.sitecode, VacC.channel, VacC.elevfact,;
   VacC.tempc, VacC.DATE, VacC.a_davis, VacC.b_davis,;
   VacC.nom_flow, VacC.sampler, VacC.Inlet, VacC.TYPE, VacC.COMMENT;
   FROM VacC;
   WHERE  VacC.sitecode = msite;
   AND  VacC.DATE < lastdate;
   INTO CURSOR Vac
SELECT VacC
USE

SELECT volsummary
GO TOP

TempR = 293

DO WHILE NOT EOF("volsummary")
   SELECT Mag
   SET FILTER TO DATE<volsummary.DATE AND channel="A1"
   GO BOTTOM
   SELECT Vac
   SET FILTER TO DATE<volsummary.DATE AND channel="A1"
   GO BOTTOM
   SELECT volsummary
   magFLOWA = ROUND(10^(Mag.a_davis+Mag.b_davis*LOG10(volsummary.Amagrsd+0.00001))*;
      Mag.elevfact*SQRT((volsummary.tempc+273.)/(TempR)),1)
   vacFLOWA = ROUND((Vac.a_davis+Vac.b_davis*(volsummary.Avacrsd+0.00001))*;
      Vac.elevfact*SQRT((volsummary.tempc+273.)/(TempR)),1)
   REPLACE volsummary.Amagrsd WITH magFLOWA
   REPLACE volsummary.Avacrsd WITH vacFLOWA

   SELECT Mag
   SET FILTER TO DATE<volsummary.DATE AND channel="B1"
```

```
   GO BOTTOM
   SELECT Vac
   SET FILTER TO DATE<volsummary.DATE AND channel="B1"
   GO BOTTOM
   SELECT volsummary
   magFLOWB = ROUND(10^(Mag.a_davis+Mag.b_davis*LOG10(volsummary.Bmagrsd+0.00001))*;
      Mag.elevfact*SQRT((volsummary.tempc+273.)/(TempR)),1)
   vacFLOWB = ROUND((Vac.a_davis+Vac.b_davis*(volsummary.Bvacrsd+0.00001))*;
      Vac.elevfact*SQRT((volsummary.tempc+273.)/(TempR)),1)
   REPLACE volsummary.Bmagrsd WITH magFLOWB
   REPLACE volsummary.Bvacrsd WITH vacFLOWB

   SELECT Mag
   SET FILTER TO DATE<volsummary.DATE AND channel="C1"
   GO BOTTOM
   SELECT Vac
   SET FILTER TO DATE<volsummary.DATE AND channel="C1"
   GO BOTTOM
   SELECT volsummary
   magFLOWC = ROUND(10^(Mag.a_davis+Mag.b_davis*LOG10(volsummary.Cmagrsd+0.00001))* ;
      Mag.elevfact*SQRT((volsummary.tempc+273.)/(TempR)),1)
   vacFLOWC = ROUND((Vac.a_davis+Vac.b_davis*(volsummary.Cvacrsd+0.00001))* ;
      Vac.elevfact*SQRT((volsummary.tempc+273.)/(TempR)),1)
   REPLACE volsummary.Cmagrsd WITH magFLOWC
   REPLACE volsummary.Cvacrsd WITH vacFLOWC

   SELECT Vac
   SET FILTER TO DATE<volsummary.DATE AND channel="D1"
   GO BOTTOM
   SELECT volsummary
   vacFLOWD = ROUND((Vac.a_davis+Vac.b_davis*(volsummary.Dvacrsd+0.00001))*;
      Vac.elevfact*SQRT((volsummary.tempc+273.)/(TempR)),1)
   REPLACE volsummary.Dvacrsd WITH vacFLOWD

   SKIP IN volsummary
ENDDO

IF xSite<>" "
   USE &MagCal IN 0 ALIAS MagC
   SELECT MagC.sitecode, MagC.channel, MagC.elevfact,;
      MagC.tempc, MagC.DATE, MagC.a_davis, MagC.b_davis,;
      MagC.nom_flow, MagC.sampler, MagC.TYPE, MagC.COMMENT;
      FROM MagC;
      WHERE  MagC.sitecode = xSite;
      AND  MagC.DATE < lastdate;
      INTO CURSOR Mag
   SELECT MagC
   USE

   USE &VacCal IN 0 ALIAS VacC
   SELECT VacC.sitecode, VacC.channel, VacC.elevfact,;
      VacC.tempc, VacC.DATE, VacC.a_davis, VacC.b_davis,;
      VacC.nom_flow, VacC.sampler, VacC.Inlet, VacC.TYPE, VacC.COMMENT;
      FROM VacC;
      WHERE  VacC.sitecode = xSite;
      AND  VacC.DATE < lastdate;
      INTO CURSOR Vac
   SELECT VacC
```

```
   USE

   SELECT volsummary
   GO TOP

   DO WHILE NOT EOF("volsummary")
      SELECT Mag
      SET FILTER TO DATE<volsummary.DATE
      GO BOTTOM
      SELECT Vac
      SET FILTER TO DATE<volsummary.DATE
      GO BOTTOM
      SELECT volsummary
*     IF vac.channel="D1"
*           REPLACE volsummary.Emagrsd WITH 0
*     ELSE
           magFLOWE =
   ROUND(10^(Mag.a_davis+Mag.b_davis*LOG10(volsummary.Emagrsd+0.00001))*;
           Mag.elevfact*SQRT((volsummary.tempc+273.)/(TempR)),1)
           REPLACE volsummary.Emagrsd WITH magFLOWE
*     ENDIF
      vacFLOWE = ROUND((Vac.a_davis+Vac.b_davis*(volsummary.Evacrsd+0.00001))*;
      Vac.elevfact*SQRT((volsummary.tempc+273.)/(TempR)),1)
      REPLACE volsummary.Evacrsd WITH vacFLOWE
      SKIP
   ENDDO
ENDIF
GO TOP
SELECT Mag
USE
SELECT Vac
USE

RETURN
```

## D.32. SwapCheck

```
PROCEDURE swapcheck && Checks output files for potential filter swaps

PARAMETERS mSwap
PUBLIC mCalled
mCalled = mSwap
SET DEFAULT TO M:\IMPROVE\Programs
IF NOT mCalled
   CLOSE DATABASES ALL
ENDIF
*USE m:\improve\temp\d04qa12.DBF ALIAS out
*GO TOP

DO GetMonth
outfile = "m:\improve\temp\" + mSeason + "QA" + mMonth
IndexFile = outfile + ".cdx"
IF FILE('&IndexFile')
   USE &OutFile IN 0 ALIAS out
   REINDEX
ELSE
   USE &OutFile IN 0 ALIAS out
   INDEX ON site + DTOC(samdat) TAG sitdat
ENDIF

IF SELECT('swaps')>0
   SELECT swaps
   USE
ENDIF
IF FILE("m:\improve\temp\swaps.dbf")
   DELETE FILE M:\IMPROVE\temp\swaps.DBF
ENDIF
CREATE TABLE M:\IMPROVE\temp\swaps (site c(5), samdat d, ;
   Prev_Ratio N(6,2), This_Ratio N(6,2), SwIn1 N(6,2), SwIn2 N(6,2), MODULE c(3))
SELECT out
*INDEX ON site+DTOC(samdat) TAG sitdat
SET ORDER TO sitdat
GO TOP

* For A-B mods, set index1<-.05 and ABS(index2)>.05
mIndex1 = -.03
mIndex2 = .05
LowRatio = .667
HiRatio = 1.5
mPar1 = "out.s3"
mPar2 = "out.so4"
mPar1a = "0"
mPar2a = "0"
mModule = "A-B"
FOR nTimes = 1 TO 2
   SELECT out
   GO TOP
   DO WHILE NOT EOF('out')
      msite=out.site
      Var1_1 = IIF(&mPar1>0 .and. &mPar1a>=0, &mPar1 + &mPar1a, -999)
      Var2_1 = IIF(&mPar2>0 .and. &mPar2a>=0, &mPar2 + &mPar2a, -999)
      SKIP
```

```
      DO WHILE out.site=msite
            Var1_2 = IIF(&mPar1>0 .and. &mPar1a>=0, &mPar1 + &mPar1a, -999)
            Var2_2 = IIF(&mPar2>0 .and. &mPar2a>=0, &mPar2 + &mPar2a, -999)
            sRatio_1 = IIF(Var1_1>0 AND Var2_1>0, Var1_1/Var2_1, 1)
            sRatio_2 = IIF(Var1_2>0 AND Var2_2>0, Var1_2/Var2_2, 1)
            lratio = NOT (BETWEEN(sRatio_1, LowRatio, HiRatio) .AND.
   BETWEEN(sRatio_2, LowRatio, HiRatio))
            SwIndex1 = (sRatio_1-1)*(sRatio_2-1)
*     SwIndex = (sRatio_1-1)*(sRatio_2-1)
*     IF SwIndex < -.05
            sRatio_3 = IIF(Var1_1>0 AND Var2_2>0, Var1_1/Var2_2, 1)
            sRatio_4 = IIF(Var1_2>0 AND Var2_1>0, Var1_2/Var2_1, 1)
            SwIndex2 = (sRatio_3-1)*(sRatio_4-1)
            IF (SwIndex1 < mIndex1 AND ABS(SwIndex2) < mIndex2) OR lratio
                  SELECT swaps
                  APPEND BLANK
                  GO BOTTOM
                  REPLACE site WITH out.site, samdat WITH out.samdat, MODULE WITH
   mModule
                        IF sRatio_1<>1
                              REPLACE Prev_Ratio WITH sRatio_1
                        ENDIF
                        IF sRatio_2<>1
                              REPLACE This_Ratio WITH sRatio_2
                        ENDIF
                        IF SwIndex1<>0
                              REPLACE SwIn1 WITH SwIndex1
                              REPLACE SwIn2 WITH SwIndex2
                        ENDIF
                  SELECT out
            ENDIF
            Var1_1 = Var1_2
            Var2_1 = Var2_2
            SKIP
      ENDDO
   ENDDO
* For A-C mods, set index1<-1 and ABS(index2)>.05
mIndex1 = -1
mIndex2 = .05
LowRatio = .5
HiRatio = 4
*mPar1 = "out.omh"
*mPar2 = "out.omcn"
mPar1 = "out.omh"
mPar1a = "out.lrnc"
mPar2 = "out.omcn"
mpar2a = "out.lacn"
mModule = "A-C"
ENDFOR

*RETURN
SELECT swaps
*BROWSE LAST
REPORT FORM swaps PREVIEW
RETURN
```

## D.33. GetMonth

```
* This procedure displays a window to select a month and year to build
* the IMPROVE database.
*
* Parameters returned:
*  mMonth:   Character (width 2) e.g. "12" for December
*  mQTR:           Character (width 1) e.g. "B" for summer season
*  mSeason:  Character (width 3) e.b. "B03" for summer 2003
*

PROCEDURE getmonth

**CLEAR

PUBLIC mMonth, mQtr, mSeason, aMonth, mYear
PUBLIC mPMonth, mYearMonth
STORE "00" to mMonth
STORE "000" to mSeason
DIMENSION gaMonth(12), gaYear(20), cQtr(12)
STORE "0000" TO mYear

cQtr(12) = "D"
cQtr( 1) = "D"
cQtr( 2) = "D"
cQtr( 3) = "A"
cQtr( 4) = "A"
cQtr( 5) = "A"
cQtr( 6) = "B"
cQtr( 7) = "B"
cQtr( 8) = "B"
cQtr( 9) = "C"
cQtr(10) = "C"
cQtr(11) = "C"
FOR gnCount = 1 to 12  && Fill the month array
   STORE cmonth(date(year(date()),gncount,1)) TO gaMonth(gnCount)
NEXT
FOR gnCount = 1 to 20  && Fill the year array
   STORE str(1987+gncount,4,0) TO gaYear(gnCount)
NEXT

frmMyForm = CREATEOBJECT('Form')  && Create a Form
frmMyForm.Caption = "Build data for month"
frmMyForm.Closable = .f.  && Disable the Control menu box
frmMyForm.Move(150,10,550,400)  && Move the form
frmMyForm.AddObject('ListBox1','lstMyListBox')  && Add ListBox control
frmMyForm.AddObject('ListBox2','2ndMyListBox')  && Add ListBox control
frmMyForm.AddObject('cmbCommand1','cmdMyCmdBtn')  && Add "Continue" Command button
frmMyForm.AddObject('cmbCommand2','QuitBtn')  && Add "Quit" Command button
frmMyForm.AddObject('MyLabel', 'Caution')
*frmMyForm.AddObject('Label1', 'SiteLabel')
*frmMyForm.AddObject('mSite', 'SiteBox')

frmMyForm.ListBox1.RowSourceType = 5  && Specifies an array
frmMyForm.ListBox1.RowSource = 'gaMonth' && Array containing listbox items
frmMyForm.ListBox2.RowSourceType = 5  && Specifies an array
frmMyForm.ListBox2.RowSource = 'gaYear' && Array containing listbox items
```

```
*frmMyForm.cmbCommand1.Visible =.T.  && "Continue" Command button visible
frmMyForm.cmbCommand2.Visible =.T.  && "Quit" Command button visible
frmMyForm.ListBox1.Visible =.T.  && "List Box visible
frmMyForm.MyLabel.Visible = .T.
*frmMyForm.ListBox2.Visible =.F.  && "List Box not visible

frmMyForm.SHOW  && Display the form
frmMyForm.ListBox2.Visible =.F.  && "List Box not visible
READ EVENTS         && Start event processing


DEFINE CLASS Caution AS Label
   Caption = "   Be sure the following files are up to date" ;
   + CHR(13) + CHR(10) + "            -  Elements" ;
   + CHR(13) + CHR(10) + "            -  Ions" ;
   + CHR(13) + CHR(10) + "            -  Carbon" ;
   + CHR(13) + CHR(10) + "            -  Laser"
   Left = 270
   Top = 20
   Height = 80
   Width = 240
   BorderStyle = 1
   BackStyle = 1
   FontBold = .T.
   BackColor = RGB(128, 255, 255)
   ForeColor = RGB(128, 0, 0)
ENDDEFINE

DEFINE CLASS cmdMyCmdBtn AS CommandButton  && Create Command button
   Caption = '\<Continue'  && Caption on the Command button
   Cancel = .T.  && Default Cancel Command button (Esc)
   Left = 10  && Command button column
   Top = 310  && Command button row
   Height = 25  && Command button height

   PROCEDURE Click
     IF mMonth = "00" OR mSeason = "000"
**         CLEAR
      ? 'Select MONTH and YEAR'
      Wait
**           CLEAR
      frmMyForm.cmbCommand1.Visible =.T.  && "Continue" Command button visible
      frmMyForm.cmbCommand2.Visible =.T.  && "Quit" Command button visible
      frmMyForm.ListBox1.Visible =.T.  && "List Box visible
      frmMyForm.ListBox2.Visible =.F.  && "List Box visible
      frmMyForm.SHOW
     ELSE
      CLEAR EVENTS  && Stop event processing, close Form
*           CLEAR  && Clear main Visual FoxPro window
      RELEASE gaMonth, gaYear, cQtr
     ENDIF
   WAIT CLEAR
ENDDEFINE

DEFINE CLASS QuitBtn AS CommandButton  && Create Command button
   Caption = '\<Quit'  && Caption on the Command button
   Cancel = .T.  && Default Cancel Command button (Esc)
```

```
   Left = 10  && Command button column
   Top = 260  && Command button row
   Height = 25  && Command button height

   PROCEDURE Click
      WAIT CLEAR
    SET SAFETY ON
    POP KEY ALL
    IF INLIST(mUser, "ashbaugh", "sengupta")
        IF mCalled
              RETURN TO master
        ENDIF
        CANCEL
    ENDIF
    QUIT
    ENDPROC
ENDDEFINE

DEFINE CLASS lstMyListBox AS ListBox  && Create ListBox control
   Left = 10  && List Box column
   Top = 25  && List Box row
   MultiSelect = .F.  && Don't allow selecting more than 1 item
   Height = 210

PROCEDURE Click
   ACTIVATE SCREEN
**   CLEAR
   FOR nCnt = 1 TO ThisForm.ListBox1.ListCount
      IF ThisForm.ListBox1.Selected(nCnt)  && Is item selected?
         aMonth = gaMonth(nCnt)
         mMonth = IIF(nCnt<10,"0"+str(nCnt,1,0),str(nCnt,2,0))
         mYearMonth = mYear + mMonth
         mQtr = cQtr(nCnt)
         mPMonth = IIF(nCnt=1,"12", IIF(nCnt<11,"0"+str(nCnt-1,1,0),str(nCnt-1,2,0)))
        frmMyForm.ListBox2.Visible =.T.  && "List Box visible
      ENDIF
   ENDFOR
ENDDEFINE

DEFINE CLASS 2ndMyListBox AS ListBox  && Create ListBox control
   Left = 140                    && List Box column
   Top = 25               && List Box row
   MultiSelect = .F.      && Don't allow selecting more than 1 item
   Height = 355

PROCEDURE Click
   ACTIVATE SCREEN
**   CLEAR
   FOR mCnt = 1 TO ThisForm.ListBox2.ListCount
      IF ThisForm.ListBox2.Selected(mCnt)  && Is item selected?
         ? aMonth+" "+GaYear(mCnt)
         STORE GaYear(mCnt) TO mYear
         mYearMonth = mYear + mMonth
         mSeason = mQtr + IIF(val(mMonth)>2,;
         right(ThisForm.ListBox2.List(mCnt),2),;
         right(ThisForm.ListBox2.List(mCnt-1),2))
         frmMyForm.cmbCommand1.Visible =.T.  && "Continue" Command button visible
      ENDIF
```

```
   ENDFOR
ENDDEFINE
```

## D.34. ArtHist

```
PROCEDURE ArtHist
EditFile = mSuppPath + "arthist.dbf"
USE &EditFile IN 0 ALIAS Arthist
IF NOT mBadLog
   IF NOT nofile
      DEFINE WINDOW OUTPUT FROM 0,0 TO 40,190 TITLE 'Artifacts History' ;
             CLOSE FLOAT GROW ZOOM MDI FONT 'Arial', 9
      ACTIVATE WINDOW OUTPUT
      SELECT Arthist
      LOCATE FOR arthist.qtr=mSeason
      BROWSE NOEDIT ;
             WINDOW OUTPUT
      HIDE WINDOW OUTPUT
      USE
   ENDIF
ENDIF
```

## D.35. ClearQD

```
* This program clears all remaining QDs from the logs file for a given month.
* It does not clear them if the site is in the HOLDS file.
*

DO getmonth

SELECT site FROM U:\IMPROVE\QAPlots\Holds\holdsite WHERE qtr=mSeason AND
   mon=VAL(mMonth) INTO ARRAY holdsites
LogFile = "m:\IMPROVE\LOGS\" + mSeason + "Logs.dbf"

IF SELECT("logs")>0
   SELECT logs
   USE
ENDIF
USE &LogFile ALIAS logs

SELECT logs
SET FILTER TO ASCAN(holdsites, site)=0 AND MONTH(samdat)=VAL(mMonth)
REPLACE ALL af1nm WITH "NM" FOR af1nm="QD"
REPLACE ALL bf1nm WITH "NM" FOR bf1nm="QD"
REPLACE ALL cf1nm WITH "NM" FOR cf1nm="QD"
REPLACE ALL df1nm WITH "NM" FOR df1nm="QD"
SET FILTER to

RETURN
```

## D.36. OutCheck

```
* Program OutCheck
*
* This routine opens the output file as alias out using the getmonth screen as input
* It then runs through a series of checks on the file to be wure it's ready to deliver
* to CIRA.
PROCEDURE outcheck

PUBLIC mcalled
mcalled=.T.

DO WHILE .T.

   DO getmonth
   TotPath = "u:\improve\TotalDBF\"

   IF SELECT("OUT")>0
      SELECT out
      USE
   ENDIF

   OutFile = TotPath + mSeason + "tot" + mMonth + ".dbf"
   USE &OutFile IN 0 ALIAS out

   SELECT out
   SET FILTER TO MF>MT AND MT>-999
   COUNT TO num
   GO TOP
   BROWSE TITLE STR(Num) + " Records with MF>MT" FIELDS site:10, samdat, ;
      Flow_A, Flow_D, Time_A, Time_D, Flag_A, Flag_D, ;
      Ratio=1.41*(MF-MT)/SQRT(MT_ERR^2+MF_ERR^2):H="Difference/Error":20, ;
      MF, MF_ERR, MF_MDL, MT, MT_ERR, MT_MDL
   SET FILTER TO

   SET FILTER TO Flag_A="RF" OR FLAG_B="RF" OR FLAG_C="RF" OR Flag_D="RF"
   COUNT TO num
   GO TOP
   BROWSE TITLE STR(Num) + " Records with RF Flag"
   SET FILTER TO

*  SET FILTER TO Flag_A="LF" OR FLAG_B="LF" OR FLAG_C="LF" OR Flag_D="LF"
*  BROWSE TITLE "Sites with LF Flag"
*  SET FILTER TO

   SET FILTER TO Flag_A="CG" OR FLAG_B="CG" OR FLAG_C="CG" OR Flag_D="CG"
   COUNT TO num
   GO TOP
   BROWSE TITLE STR(Num) + " Records with CG Flag"
   SET FILTER TO

   SET FILTER TO Flag_A="CL" OR FLAG_B="CL" OR FLAG_C="CL" OR Flag_D="CL"
   COUNT TO num
   GO TOP
   BROWSE TITLE STR(Num) + " Records with CL Flag"
   SET FILTER TO
```

```
   SET FILTER TO Flag_A="QD" OR FLAG_B="QD" OR FLAG_C="QD" OR Flag_D="QD"
   COUNT TO num
   GO TOP
   BROWSE TITLE STR(Num) + " Records with QD Flag"
   SET FILTER TO

   SET FILTER TO Flag_A="SA" OR FLAG_B="SA" OR FLAG_C="SA" OR Flag_D="SA"
   COUNT TO num
   GO TOP
   BROWSE TITLE STR(Num) + " Records with SA Flag"
   SET FILTER TO

   SET FILTER TO Flag_A="QA" OR FLAG_B="QA" OR FLAG_C="QA" OR Flag_D="QA"
   COUNT TO num
   GO TOP
   BROWSE TITLE STR(Num) + " Records with QA Flag"
   SET FILTER TO

   USE u:\improve\qaplots\holds\holdsite.dbf IN 0 ALIAS holds
   SELECT holds
   SET FILTER TO holds.qtr=mSeason AND holds.mon=VAL(mMonth)
   COUNT TO num
   GO TOP
   BROWSE TITLE STR(Num) + " Sites held for further review"
   USE
   SELECT out

*  SET FILTER TO Flag_A="SW" OR FLAG_B="SW" OR FLAG_C="SW" OR Flag_D="SW"
*  BROWSE TITLE "Sites with SW Flag"
*  SET FILTER TO
*
*  SET FILTER TO Flag_A="SP" OR FLAG_B="SP" OR FLAG_C="SP" OR Flag_D="SP"
*  BROWSE TITLE "Sites with SP Flag"
*  SET FILTER TO
*
*  SET FILTER TO Flag_A="OL" OR FLAG_B="OL" OR FLAG_C="OL" OR Flag_D="OL"
*  BROWSE TITLE "Sites with OL Flag"
*  SET FILTER TO
*
   SELECT out.site, COUNT(out.site);
      FROM out;
      GROUP BY out.site;
      HAVING  COUNT(out.site) > 11;
      OR  COUNT(out.site) < 10;
      ORDER BY out.site;
      INTO CURSOR Oddsites

   SELECT Oddsites
   COUNT TO num
   GO TOP
   BROWSE TITLE STR(Num) + " Records with less than 10 or more than 11 records"

*SELECT out.site, COUNT(out.site);
FROM out;
GROUP BY out.site;
HAVING  COUNT(out.site) > 31;
OR  COUNT(out.site) < 30;
ORDER BY out.site;
```

```
INTO CURSOR Oddsites

*SELECT Oddsites
*BROWSE TITLE "Sites with less than 30 or more than 31 records"

   USE
   SELECT out
   USE
ENDDO
RETURN TO MASTER
```

## APPENDIX E. NETWORK_METRIC_CHECKS CODE

# Table of Contents

## E.1. NETWORK_METRIC_CHECKS

```
****** * M:\IMPROVE\NETWORK_METRICS\SOURCE_CODE\NETWORK_METRIC_CHECKS.PRG
*:*********************************************************************************
*:
*: Procedure File M:\IMPROVE\NETWORK_METRICS\NETWORK_METRIC_CHECKS.PRG
*:
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*:
*: Documented using Visual FoxPro Formatting wizard version  .05
*:*********************************************************************************
*:   NETWORK_METRIC_CHECKS
* PROGRAM network_metric_checks
* This program calculates the network metrics for the month and year requested
* by the user and compares the metrics to tables of acceptance criteria.  Any
* metrics that are outside the acceptance criteria are reported in the results.dbf
* table.
Public mOutput1, mOutput2

Set Default To m:\improve\programs\network_metrics\
Set Path To m:\improve\programs\flow_rate\
On Error Do errhand With ;
    ERROR( ), Message( ), Message(1), Program( ), Lineno( )

Do While .T.
    Wait Window At 45, 45 "Make sure the following files have been updated:" ;
        +  Chr(13) + Chr(10) + "- Elements" ;
        +  Chr(13) + Chr(10) + "- Ions" ;
        +  Chr(13) + Chr(10) +  "- Carbon" ;
        +  Chr(13) + Chr(10) +  "- Laser" ;
        NOWAIT Timeout(5) Noclear

    Do nmc_openfiles
    Do nmc_userinput

    * Allow chance to bail out of program
    Wait Window At 10, 40 "Press 'C' to continue" + Chr(13) + Chr(10) To mcont
    If Not Inlist (mcont, "c", "C")
        Cancel
    Endif

    *run the procedures to calculate and check the metrics
    Do carbon_metric_checks
    Do ion_metric_checks
    Do element_metric_checks

    Use &mOutput1 In 25
    Select 25
    *   SET FILTER TO month = themonth and year = theyear
    Delete For Month = themonth And Year = theyear
```

```
    Pack
    Append From &c_out
    Append From &e_out
    Append From &i_out
    Browse

    Select network_metric_limits
    Use
    Select artifact_metric_limits
    Use

Enddo
Cancel
```

## E.2. CARBON_METRIC_CHECKS

```
****** * M:\IMPROVE\NETWORK_METRICS\SOURCE_CODE\CARBON_METRIC_CHECKS.PRG
*:**********************************************************************
*:
*: Procedure File M:\IMPROVE\NETWORK_METRICS\CARBON_METRIC_CHECKS.PRG
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*: Documented using Visual FoxPro Formatting wizard version  .05
*:**********************************************************************
*:   carbon_metric_checks
*:   carbon_metric_checks
*!**********************************************************************
*!
*! Procedure CARBON_METRIC_CHECKS
*!
*!  Calls
*!      c_artifacts
*!      c_metrics
*!
*!**********************************************************************
Procedure carbon_metric_checks

    Public martifact, mcount, mmin, mmax, mmedian, mavg, c_var, c_param, mmonthy, myear
    Public mmyy_var, mOutPath, themonth, theyear, c_out, c_artout
    char_year = Transform(theyear)
    char_month = Transform(themonth)
    *c_out = mOutPath + "c_metricchecks" + char_month + char_year + ".dbf"
    c_out = mOutPath + "c_metricchecks.dbf"
    c_artout = mOutPath + "c_artifactchecks.dbf"

    * this query cleans up the carbon data by eliminating duplicate records
    * and records that are not from sites in the site table
    Select Distinct c_rawdata.*;
        FROM  c_rawdata INNER Join sites ;
        ON  c_rawdata.site = sites.site;
        WHERE c_rawdata.qid Is Not Null And Year(c_rawdata.samdat) > 0 And;
        right(sites.site,1) <> "9";
        INTO Table c_data
    *close the raw data file
    Select c_rawdata
    Use

    * set indices on the cleaned data file
    Select c_data
    Index On Trim(site) + Dtoc(samdat) + strtim Tag sitdatim
    Index On Octc Tag Octc
    Index On Ectc Tag Ectc
    Index On Tctc Tag Tctc
    Index On O1tc Tag O1tc
    Index On O2tc Tag O2tc
```

```
Index On O3tc Tag O3tc
Index On O4tc Tag O4tc
Index On Optc Tag Optc
Index On E1tc Tag E1tc
Index On E2tc Tag E2tc
Index On E3tc Tag E3tc

* create and fill an array for the OCEC parameter names
Public c_param(11)
c_param(1) = "octc"
c_param(2) = "ectc"
c_param(3) = "tctc"
c_param(4) = "o1tc"
c_param(5) = "o2tc"
c_param(6) = "o3tc"
c_param(7) = "o4tc"
c_param(8) = "optc"
c_param(9) = "e1tc"
c_param(10)= "e2tc"
c_param(11)= "e3tc"

*delete the existing records in c_metrics for the months/years that will be
* processed by this run of the program
For Each mmyy_var In amonthyr
    Select monthyr
    Set Filter To monthyr.Number = mmyy_var
    Go Top
    mmonth = monthyr.Month
    myear = monthyr.Year
    Select c_artifacts
    Set Filter To Month = mmonth And Year = myear
    Delete All
    Select c_metrics
    Set Filter To Month = mmonth And Year = myear
    Delete All
Endfor
Select c_artifacts
Pack
Select c_metrics
Pack

* This FOR EACH...ENDFOR loop executes for each variable in the c_param matrix
For Each c_var In c_param
    * This FOR EACH...ENDFOR loop executes for the requested month/year and the
    * two prior month/years
    For Each mmyy_var In amonthyr
            * Display parameter being processed
            Wait Window At 10,50 "Processing &c_var artifact data" Nowait
            Select monthyr
            Set Filter To monthyr.Number = mmyy_var
            Go Top
            mmonth = monthyr.Month
            myear = monthyr.Year
            Select c_data
            Set Filter To &c_var > -99 And Month(samdat) = mmonth And;
                    STATUS = "CS" And Year(samdat) = myear
            Set Order To c_var
            Count To mcount
            If mcount > 0
                    Calculate Std(&c_var) To mstdev
                    * following code finds the median value
                    Go Top
                    n50 = Round(mcount*0.5,0)
                    Skip (n50-1)
                    mmedian = &c_var
```

```
            Else
                    mstdev = -999
                    mmedian = -999
            Endif
            Insert Into c_artifacts (Parameter, Year, Month, Count, median, stdev) ;
                    VALUE (c_var, myear, mmonth, mcount, mmedian, mstdev)
    Endfor
Endfor

* This FOR EACH...ENFOR loop executes for each variable in the c_param matrix
For Each c_var In c_param
    * This FOR EACH...ENDFOR loop executes for the requested month/year and the
    * two prior month/years
    For Each mmyy_var In amonthyr
            * Display parameter being processed
            Wait Window At 10,50 "Processing &c_var data" Nowait
            Select monthyr
            Set Filter To monthyr.Number = mmyy_var
            Go Top
            mmonth = monthyr.Month
            myear = monthyr.Year
            Select c_data
            Set Filter To &c_var > -99 And Month(samdat) = mmonth And;
                    STATUS = "CP" And Year(samdat) = myear
            Set Order To &c_var
            Count To mcount
            If mcount > 0
                    Calculate Min(&c_var), Max(&c_var) To m_min, m_max
                    Calculate Std(&c_var), Avg(&c_var) To m_stdev, m_avg
                    * following code finds the 10th, 50th, and 90th percentiles
                    Go Top
                    n10 = Round(mcount*0.1,0)
                    Skip (n10-1)
                    m_10percent = &c_var
                    Go Top
                    n50 = Round(mcount*0.5,0)
                    Skip (n50-1)
                    m_median = &c_var
                    Go Top
                    n90 = Round(mcount*0.9,0)
                    Skip (n90-1)
                    m_90percent = &c_var
                    Select c_artifacts
                    Set Filter To Parameter = c_var And Year = myear And Month = mmonth
                    Go Top
                    martifact = c_artifacts.median
                    If martifact > -99
                            mmin = m_min - martifact
                            mmax = m_max - martifact
                            mstdev = m_stdev - martifact
                            mavg = m_avg - martifact
                            m10percent = m_10percent - martifact
                            mmedian = m_median - martifact
                            m90percent = m_90percent - martifact
                    Else
                            mmin = m_min
                            mmax = m_max
                            mstdev = m_stdev
                            mavg = m_avg
                            m10percent = m_10percent
                            mmedian = m_median
                            m90percent = m_90percent
                    Endif
            Else
                    Select c_artifacts
```

```
                    Set Filter To Parameter = c_var And Year = myear And Month = mmonth
                    Go Top
                    martifact = c_artifacts.median
                    mmin = -999
                    mmax = -999
                    mstdev = -999
                    mavg = -999
                    m10percent = -999
                    mmedian = -999
                    m90percent = -999
            Endif
            Insert Into c_metrics (Parameter, Year, Month, Count, artifact, Min, ;
                    max, stdev, Avg, percent10, median, percent90) ;
                    VALUE (c_var, myear, mmonth, mcount, martifact, mmin, mmax, mstdev, mavg,
;
                    m10percent, mmedian, m90percent)
    Endfor
Endfor

*close the carbon data file
Select c_data
Set Filter To
Use
Select c_artifacts
Set Filter To
Use
Select c_metrics
Set Order To paramyymm

*extract only the current month from the metrics file
Select *;
    FROM c_metrics;
    WHERE c_metrics.Month = themonth And c_metrics.Year = theyear;
    INTO Table temp.Dbf

*compare the current month metrics to the metric limits determined from
* previous months
Select network_metric_limits.Parameter, network_metric_limits.Month,;
    temp.Year, temp.median, network_metric_limits.l_low50,;
    network_metric_limits.l_high50, temp.percent90,;
    network_metric_limits.l_low90, network_metric_limits.l_high90,;
    temp.Max, network_metric_limits.l_max;
    FROM  network_metric_limits INNER Join temp ;
    ON  network_metric_limits.Parameter = temp.Parameter;
    WHERE (network_metric_limits.Month = temp.Month) And ;
    (temp.Max > network_metric_limits.l_max Or ;
    temp.median < network_metric_limits.l_low50 Or ;
    (temp.median > network_metric_limits.l_high50 And ;
    network_metric_limits.l_high50 > 0.0) Or ;
    temp.percent90 < network_metric_limits.l_low90 Or ;
    (temp.percent90 > network_metric_limits.l_high90 And ;
    network_metric_limits.l_high90 > 0.0));
    INTO Table &c_out

Select temp
Use

*extract only the current month from the metrics file
Select *;
    FROM c_artifacts;
    WHERE c_artifacts.Month = themonth And c_artifacts.Year = theyear;
    INTO Table temp.Dbf

*compare the current month artifacts values to the artifact limits determined from
* previous months
```

```
Select artifact_metric_limits.Parameter, artifact_metric_limits.Month,;
    temp.Year, temp.Count, temp.median, artifact_metric_limits.l_low50,;
    artifact_metric_limits.l_high50, temp.stdev,;
    artifact_metric_limits.l_stdev;
    FROM  artifact_metric_limits INNER Join temp ;
    ON  artifact_metric_limits.Parameter = temp.Parameter;
    WHERE ((artifact_metric_limits.Month = temp.Month) And ;
    (temp.stdev > artifact_metric_limits.l_stdev Or ;
    temp.median < artifact_metric_limits.l_low50 Or ;
    temp.median > artifact_metric_limits.l_high50)) Or;
    (temp.Count < artifact_metric_limits.Count);
    INTO Table &c_artout

Select temp
Use
```

## E.3. ELEMENT_METRIC_CHECKS

```
****** * M:\IMPROVE\NETWORK_METRICS\SOURCE_CODE\ELEMENT_METRIC_CHECKS.PRG
*:*********************************************************************************
*:
*: Procedure File M:\IMPROVE\NETWORK_METRICS\ELEMENT_METRIC_CHECKS.PRG
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*:
*: Documented using Visual FoxPro Formatting wizard version  .05
*:*********************************************************************************
*:   element_metric_checks
*:   element_metric_checks
*!*********************************************************************************
*!
*! Procedure ELEMENT_METRIC_CHECKS
*!
*!  Calls
*!      e_metrics
*!
*!*********************************************************************************
Procedure element_metric_checks

    Public mcount, mmin, mmax, mmedian, mavg, e_var, e_param
    Public mmyy_var, mOutPath, themonth, theyear, e_out
    char_year = Transform(theyear)
    char_month = Transform(themonth)
    *e_out = mOutPath + "e_metricchecks" + char_month + char_year + ".dbf"
    e_out = mOutPath + "e_metricchecks.dbf"

    * this query cleans up the carbon data by eliminating duplicate records
    * and records that are not from sites in the site table
    Select Distinct e_rawdata.*;
        FROM  e_rawdata INNER Join sites ;
        ON  e_rawdata.site = sites.site;
        WHERE Year(e_rawdata.samdat) > 0 And Right(sites.site,1) <> "9";
        INTO Table e_data
    *close the raw data file
    Select e_rawdata
    Use

    * open the cleaned data file
    Select e_data
    Index On Trim(site) + Dtoc(samdat) + strtim Tag sitdatim
    Index On H Tag H
    Index On YNA Tag YNA
    Index On YMG Tag YMG
    Index On YAL Tag YAL
    Index On YSI Tag YSI
    Index On YP Tag YP
    Index On YS Tag YS
    Index On YCL Tag YCL
```

```
Index On YK Tag YK
Index On YCA Tag YCA
Index On YTI Tag YTI
Index On YV Tag YV
Index On YCR Tag YCR
Index On YMN Tag YMN
Index On YFE Tag YFE
Index On NI Tag NI
Index On CU Tag CU
Index On ZN Tag ZN
Index On As Tag As
Index On PB Tag PB
Index On SE Tag SE
Index On BR Tag BR
Index On RB Tag RB
Index On SR Tag SR
Index On ZR Tag ZR
Index On PNA Tag PNA
Index On PMG Tag PMG
Index On PAL Tag PAL
Index On PSI Tag PSI
Index On PS Tag PS
Index On PCL Tag PCL
Index On PK Tag PK
Index On PCA Tag PCA
Index On PTI Tag PTI
Index On Pv Tag Pv
Index On PCR Tag PCR
Index On PMN Tag PMN
Index On PFE Tag PFE

* save the earliest year and latest year into variables
Calculate Min(Year(samdat)) To min_yr
Calculate Max(Year(samdat)) To max_yr

* create and fill matrices for the parameter names.  one matrix is created
* for each type of analysis b/c each analysis has a separate status flag
* and later the statistics queries use the status flags
Public CuXRF_param(14)
CuXRF_param(1) = "YNa"
CuXRF_param(2) = "YMg"
CuXRF_param(3) = "YAl"
CuXRF_param(4) = "YSi"
CuXRF_param(5) = "YP"
CuXRF_param(6) = "YS"
CuXRF_param(7) = "YCl"
CuXRF_param(8) = "YK"
CuXRF_param(9)= "YCa"
CuXRF_param(10)= "YTi"
CuXRF_param(11)= "YV"
CuXRF_param(12)= "YCr"
CuXRF_param(13)= "YMn"
CuXRF_param(14)= "YFe"
Public MoXRF_param(10)
MoXRF_param(1)= "Ni"
MoXRF_param(2)= "Cu"
MoXRF_param(3)= "Zn"
MoXRF_param(4)= "As"
MoXRF_param(5)= "Pb"
MoXRF_param(6)= "Se"
MoXRF_param(7) = "Br"
MoXRF_param(8) = "Rb"
MoXRF_param(9) = "Sr"
MoXRF_param(10) = "Zr"
Public PIXE_param(13)
```

```
PIXE_param(1) = "PNa"
PIXE_param(2) = "PMg"
PIXE_param(3) = "PAl"
PIXE_param(4) = "PSi"
PIXE_param(5)= "PS"
PIXE_param(6)= "PCl"
PIXE_param(7)= "PK"
PIXE_param(8)= "PCa"
PIXE_param(9)= "PTi"
PIXE_param(10)= "PV"
PIXE_param(11)= "PCr"
PIXE_param(12)= "PMn"
PIXE_param(13)= "PFe"

*delete the existing records in e_metrics for the months/years that will be
* processed by this run of the program
For Each mmyy_var In amonthyr
    Select monthyr
    Set Filter To monthyr.Number = mmyy_var
    Go Top
    mmonth = monthyr.Month
    myear = monthyr.Year
    Select e_metrics
    Set Filter To Month = mmonth And Year = myear
    Delete All
Endfor
Select e_metrics
Pack

* This set of loops executes on the H data, which is the only PESA parameter
Mvar = "H"
For Each mmyy_var In amonthyr
    * Display parameter being processed
    Wait Window At 10,50 "Processing H data" Nowait
    Select monthyr
    Set Filter To monthyr.Number = mmyy_var
    Go Top
    mmonth = monthyr.Month
    myear = monthyr.Year
    Select e_data
    Set Filter To H > -99 And Month(samdat) = mmonth And;
            PESSTAT = "NM" And Year(samdat) = myear
    Set Order To H
    Count To mcount
    If mcount > 0
            Calculate Min(H), Max(H) To mmin, mmax
            Calculate Std(H), Avg(H) To mstd, mavg
            * following code finds the 10th, 50th, and 90th percentiles
            Go Top
            n10 = Round(mcount*0.1,0)
            Skip (n10-1)
            m10percent = H
            Go Top
            n50 = Round(mcount*0.5,0)
            Skip (n50-1)
            mmedian = H
            Go Top
            n90 = Round(mcount*0.9,0)
            Skip (n90-1)
            m90percent = H
    Else
            mmin = -999
            mmax = -999
            mstd = -999
            mavg = -999
```

```
            m10percent = -999
            mmedian = -999
            m90percent = -999
        Endif
        Insert Into e_metrics (Parameter, Year, Month, Count, Min, Max, Std,;
            avg, percent10, median, percent90) ;
            VALUE (Mvar, myear, mmonth, mcount, mmin, mmax, mstd, mavg, m10percent,;
            mmedian, m90percent)
    Endfor

    * This FOR...ENDFOR loop executes for each of the Copper XRF parameters
    For Each e_var In CuXRF_param
        * This FOR EACH...ENDFOR loop executes for the requested month/year and the
        * two prior month/years
        For Each mmyy_var In amonthyr
            * Display parameter being processed
            Wait Window At 10,50 "Processing &e_var data" Nowait
            Select monthyr
            Set Filter To monthyr.Number = mmyy_var
            Go Top
            mmonth = monthyr.Month
            myear = monthyr.Year
            Select e_data
            Set Filter To &e_var > -99 And Month(samdat) = mmonth And;
                Xrcstat = "NM" And Year(samdat) = myear
            Set Order To e_var
            Count To mcount
            If mcount > 0
                Calculate Min(&e_var), Max(&e_var) To mmin, mmax
                Calculate Std(&e_var), Avg(&e_var) To mstd, mavg
                * following code finds the 10th, 50th, and 90th percentiles
                Go Top
                n10 = Round(mcount*0.1,0)
                Skip (n10-1)
                m10percent = &e_var
                Go Top
                n50 = Round(mcount*0.5,0)
                Skip (n50-1)
                mmedian = &e_var
                Go Top
                n90 = Round(mcount*0.9,0)
                Skip (n90-1)
                m90percent = &e_var
                Insert Into e_metrics (Parameter, Year, Month, Count, Min, Max, Std,;
                    avg, percent10, median, percent90) ;
                    VALUE (e_var, myear, mmonth, mcount, mmin, mmax, mstd, mavg,
m10percent,;
                    mmedian, m90percent)
            Endif
        Endfor
    Endfor

    * This FOR...ENDFOR loop executes for every Molybdenum XRF parameter
    For Each e_var In MoXRF_param
        * This FOR EACH...ENDFOR loop executes for the requested month/year and the
        * two prior month/years
        For Each mmyy_var In amonthyr
            * Display parameter being processed
            Wait Window At 10,50 "Processing &e_var data" Nowait
            Select monthyr
            Set Filter To monthyr.Number = mmyy_var
            Go Top
            mmonth = monthyr.Month
            myear = monthyr.Year
            Select e_data
```

```
            Set Filter To &e_var > -99 And Month(samdat) = mmonth And;
                   Xrmstat = "NM" And Year(samdat) = myear
            Set Order To e_var
            Count To mcount
            If mcount > 0
                   Calculate Min(&e_var), Max(&e_var) To mmin, mmax
                   Calculate Std(&e_var), Avg(&e_var) To mstd, mavg
                   * following code finds the 10th, 50th, and 90th percentiles
                   Go Top
                   n10 = Round(mcount*0.1,0)
                   Skip (n10-1)
                   m10percent = &e_var
                   Go Top
                   n50 = Round(mcount*0.5,0)
                   Skip (n50-1)
                   mmedian = &e_var
                   Go Top
                   n90 = Round(mcount*0.9,0)
                   Skip (n90-1)
                   m90percent = &e_var
            Else
                   mmin = -999
                   mmax = -999
                   mstd = -999
                   mavg = -999
                   m10percent = -999
                   mmedian = -999
                   m90percent = -999
            Endif
            Insert Into e_metrics (Parameter, Year, Month, Count, Min, Max, Std,;
                   avg, percent10, median, percent90) ;
                   VALUE (e_var, myear, mmonth, mcount, mmin, mmax, mstd, mavg, m10percent,;
                   mmedian, m90percent)
    Endfor
Endfor

If (theyear < 2001) Or (themonth < 12 And theyear = 2001)
    * This FOR...ENDFOR loop executes for each PIXE parameter
    For Each e_var In PIXE_param
            * This FOR EACH...ENDFOR loop executes for the requested month/year and the
            * two prior month/years
            For Each mmyy_var In amonthyr
                   * Display parameter being processed
                   Wait Window At 10,50 "Processing &e_var data" Nowait
                   Select monthyr
                   Set Filter To monthyr.Number = mmyy_var
                   Go Top
                   mmonth = monthyr.Month
                   myear = monthyr.Year
                   Select e_data
                   Set Filter To &e_var > -99 And Month(samdat) = mmonth And;
                          Pixstat = "NM" And Year(samdat) = myear
                   Set Order To e_var
                   Count To mcount
                   If mcount > 0
                          Calculate Min(&e_var), Max(&e_var) To mmin, mmax
                          Calculate Std(&e_var), Avg(&e_var) To mstd, mavg
                          * following code finds the 10th, 50th, and 90th percentiles
                          Go Top
                          n10 = Round(mcount*0.1,0)
                          Skip (n10-1)
                          m10percent = &e_var
                          Go Top
                          n50 = Round(mcount*0.5,0)
                          Skip (n50-1)
```

```
                        mmedian = &e_var
                        Go Top
                        n90 = Round(mcount*0.9,0)
                        Skip (n90-1)
                        m90percent = &e_var
                Else
                        mmin = -999
                        mmax = -999
                        mstd = -999
                        mavg = -999
                        m10percent = -999
                        mmedian = -999
                        m90percent = -999
                Endif
                Insert Into e_metrics (Parameter, Year, Month, Count, Min, Max, Std,;
                        avg, percent10, median, percent90) ;
                        VALUE (e_var, myear, mmonth, mcount, mmin, mmax, mstd, mavg,
m10percent,;
                        mmedian, m90percent)
        Endfor
    Endfor
Endif

* close the PIXE/XRF/PESA data file
Select e_data
Set Filter To
Use
Select e_metrics
Set Order To paramyymm

*extract only the current month from the metrics file
Select *;
    FROM e_metrics;
    WHERE e_metrics.Month = themonth And e_metrics.Year = theyear;
    INTO Table temp.Dbf

*compare the current month metrics to the metric limits determined from
* previous months
Select network_metric_limits.Parameter, network_metric_limits.Month,;
    temp.Year, temp.median, network_metric_limits.l_low50,;
    network_metric_limits.l_high50, temp.percent90,;
    network_metric_limits.l_low90, network_metric_limits.l_high90,;
    temp.Max, network_metric_limits.l_max;
    FROM  network_metric_limits INNER Join temp ;
    ON  network_metric_limits.Parameter = temp.Parameter;
    WHERE (network_metric_limits.Month = temp.Month) And ;
    (temp.Max > network_metric_limits.l_max Or ;
    temp.median < network_metric_limits.l_low50 Or ;
    (temp.median > network_metric_limits.l_high50 And ;
    network_metric_limits.l_high50 > 0.0) Or ;
    temp.percent90 < network_metric_limits.l_low90 Or ;
    (temp.percent90 > network_metric_limits.l_high90 And ;
    network_metric_limits.l_high90 > 0.0));
    INTO Table &e_out

Select temp
Use
```

## E.4. ION_METRIC_CHECKS

```
****** * M:\IMPROVE\NETWORK_METRICS\SOURCE_CODE\ION_METRIC_CHECKS.PRG
*:*********************************************************************************
*:
*: Procedure File M:\IMPROVE\NETWORK_METRICS\ION_METRIC_CHECKS.PRG
*:
*:
*:
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*:
*:
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*:
*:
*:
*: Documented using Visual FoxPro Formatting wizard version  .05
*:*********************************************************************************
*:   ion_metric_checks
*:   ion_metric_checks
*!*********************************************************************************
*!
*! Procedure ION_METRIC_CHECKS
*!
*!  Calls
*!       i_artifacts
*!       i_metrics
*!
*!*********************************************************************************
Procedure ion_metric_checks

    Public martifact, mcount, mmin, mmax, mmedian, mavg, i_var, i_param, mmonth, myear
    Public mmyy_var, mOutPath, themonth, theyear, i_out, i_artout
    char_year = Transform(theyear)
    char_month = Transform(themonth)
    *i_out = mOutPath + "i_metricchecks" + char_month + char_year + ".dbf"
    i_out = mOutPath + "i_metricchecks.dbf"
    i_artout = mOutPath + "i_artifactchecks.dbf"

    * this query cleans up the ion data by eliminating duplicate records
    * and records that are not from sites in the site table
    Select Distinct i_rawdata.*;
        FROM  i_rawdata INNER Join sites ;
        ON  i_rawdata.site = sites.site;
        WHERE Year(i_rawdata.samdat) > 0 And Right(sites.site,1) <> "9";
        INTO Table i_data
    *close the raw data file
    Select i_rawdata
    Use

    * open the cleaned data file
    Select i_data
    * replace the 0.000 nh4 values with missing values (Lowell's program
    *  incorrectly replaced null values in the RTI files with 0.000 values
    *  for several months)
    Replace nh4 With -999 For nh4 = 0.000
    *set indices
    Index On Trim(site) + Dtoc(samdat) + strtim Tag sitdatim
    Index On cl Tag cl
```

```
Index On no2 Tag no2
Index On no3 Tag no3
Index On so4 Tag so4
Index On nh4 Tag nh4

* create and fill a matrix for the OCEC parameter names
Public i_param(5)
i_param(1) = "cl"
i_param(2) = "no2"
i_param(3) = "no3"
i_param(4) = "so4"
i_param(5) = "nh4"

*delete the existing records in i_metrics for the months/years that will be
* processed by this run of the program
For Each mmyy_var In amonthyr
    Select monthyr
    Set Filter To monthyr.Number = mmyy_var
    Go Top
    mmonth = monthyr.Month
    myear = monthyr.Year
    Select i_artifacts
    Set Filter To Month = mmonth And Year = myear
    Delete All
    Select i_metrics
    Set Filter To Month = mmonth And Year = myear
    Delete All
Endfor
Select i_artifacts
Pack
Select i_metrics
Pack

* This FOR EACH...ENFOR loop executes for each variable in the i_param matrix
For Each i_var In i_param
    * This FOR EACH...ENDFOR loop executes for the requested month/year and the
    * two prior month/years
    For Each mmyy_var In amonthyr
            * Display parameter being processed
            Wait Window At 10,50 "Processing &i_var artifact data" Nowait
            Select monthyr
            Set Filter To monthyr.Number = mmyy_var
            Go Top
            mmonth = monthyr.Month
            myear = monthyr.Year
            Select i_data
            Set Filter To &i_var > -99 And Month(samdat) = mmonth And;
                    STATUS = "FB" And Year(samdat) = myear
            Set Order To i_var
            Count To mcount
            If mcount > 0
                    Calculate Std(&i_var) To mstdev
                    * following code finds the median value
                    Go Top
                    n50 = Round(mcount*0.5,0)
                    Skip (n50-1)
                    mmedian = &i_var
            Else
                    mstdev = -999
                    mmedian = -999
            Endif
            Insert Into i_artifacts (Parameter, Year, Month, Count, median, stdev) ;
                    VALUE (i_var, myear, mmonth, mcount, mmedian, mstdev)
    Endfor
Endfor
```

```
* This FOR EACH...ENFOR loop executes for each variable in the i_param matrix
For Each i_var In i_param
    * This FOR EACH...ENDFOR loop executes for the requested month/year and the
    * two prior month/years
    For Each mmyy_var In amonthyr
            * Display parameter being processed
            Wait Window At 10,50 "Processing &i_var data" Nowait
            Select monthyr
            Set Filter To monthyr.Number = mmyy_var
            Go Top
            mmonth = monthyr.Month
            myear = monthyr.Year
            Select i_data
            Set Filter To &i_var > -99 And Month(samdat) = mmonth And;
                   STATUS = "NM" And Year(samdat) = myear
            Set Order To i_var
            Count To mcount
            If mcount > 0
                   Calculate Min(&i_var), Max(&i_var) To m_min, m_max
                   Calculate Std(&i_var), Avg(&i_var) To m_stdev, m_avg
                   * following code finds the 10th, 50th, and 90th percentiles
                   Go Top
                   n10 = Round(mcount*0.1,0)
                   Skip (n10-1)
                   m_10percent = &i_var
                   Go Top
                   n50 = Round(mcount*0.5,0)
                   Skip (n50-1)
                   m_median = &i_var
                   Go Top
                   n90 = Round(mcount*0.9,0)
                   Skip (n90-1)
                   m_90percent = &i_var
                   Select i_artifacts
                   Set Filter To Parameter = i_var And Year = myear And Month = mmonth
                   Go Top
                   martifact = i_artifacts.median
                   If martifact > -99
                          mmin = m_min - martifact
                          mmax = m_max - martifact
                          mstdev = m_stdev - martifact
                          mavg = m_avg - martifact
                          m10percent = m_10percent - martifact
                          mmedian = m_median - martifact
                          m90percent = m_90percent - martifact
                   Else
                          mmin = m_min
                          mmax = m_max
                          mstdev = m_stdev
                          mavg = m_avg
                          m10percent = m_10percent
                          mmedian = m_median
                          m90percent = m_90percent
                   Endif
            Else
                   Select i_artifacts
                   Set Filter To Parameter = i_var And Year = myear And Month = mmonth
                   Go Top
                   martifact = median
                   mmin = -999
                   mmax = -999
                   mstdev = -999
                   mavg = -999
                   m10percent = -999
```

```
                    mmedian = -999
                    m90percent = -999
            Endif
            Insert Into i_metrics (Parameter, Year, Month, Count, artifact, Min, ;
                    max, stdev, Avg, percent10, median, percent90);
                    VALUE (i_var, myear, mmonth, mcount, martifact, mmin, mmax, mstdev, mavg,
;
                    m10percent, mmedian, m90percent)
    Endfor
Endfor

Select i_data
Set Filter To
Use
Select i_artifacts
Set Filter To
Use
Select i_metrics
Set Order To paramyymm

*extract only the current month from the metrics file
Select *;
    FROM i_metrics;
    WHERE i_metrics.Month = themonth And i_metrics.Year = theyear;
    INTO Table temp.Dbf

*compare the current month metrics to the metric limits determined from
* previous months
Select network_metric_limits.Parameter, network_metric_limits.Month,;
    temp.Year, temp.median, network_metric_limits.l_low50,;
    network_metric_limits.l_high50, temp.percent90,;
    network_metric_limits.l_low90, network_metric_limits.l_high90,;
    temp.Max, network_metric_limits.l_max;
    FROM  network_metric_limits INNER Join temp ;
    ON  network_metric_limits.Parameter = temp.Parameter;
    WHERE (network_metric_limits.Month = temp.Month) And ;
    (temp.Max > network_metric_limits.l_max Or ;
    temp.median < network_metric_limits.l_low50 Or ;
    (temp.median > network_metric_limits.l_high50 And ;
    network_metric_limits.l_high50 > 0.0) Or ;
    temp.percent90 < network_metric_limits.l_low90 Or ;
    (temp.percent90 > network_metric_limits.l_high90 And ;
    network_metric_limits.l_high90 > 0.0));
    INTO Table &i_out

Select temp
Use

Select *;
    FROM i_artifacts;
    WHERE i_artifacts.Month = themonth And i_artifacts.Year = theyear;
    INTO Table temp.Dbf

*compare the current month artifacts values to the artifact limits determined from
* previous months
Select artifact_metric_limits.Parameter, temp.Month, temp.Year,;
    temp.Count, temp.median, artifact_metric_limits.l_low50,;
    artifact_metric_limits.l_high50, temp.stdev,;
    artifact_metric_limits.l_stdev;
    FROM  artifact_metric_limits INNER Join temp ;
    ON  artifact_metric_limits.Parameter = temp.Parameter;
    WHERE (temp.stdev > artifact_metric_limits.l_stdev) Or ;
    (temp.median < artifact_metric_limits.l_low50) Or ;
    (temp.median > artifact_metric_limits.l_high50) Or;
    (temp.Count < artifact_metric_limits.Count);
```

```
        INTO Table &i_artout

    Select temp
    Use
```

## E.5. ERRHAND

```
****** * M:\IMPROVE\PROGRAMS\ERRHAND.PRG
*:*********************************************************************************
*:
*: Procedure File M:\IMPROVE\NETWORK_METRICS\ERRHAND.PRG
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*: Documented using Visual FoxPro Formatting wizard version  .05
*:*********************************************************************************
*:   errhand
*:   errhand
*!*********************************************************************************
*!
*! Procedure ERRHAND
*!
*!*********************************************************************************
Procedure errhand
    Parameter merror, Mess, mess1, mprog, mlineno
    Clear
    Set Alternate To m:\improve\temp\errorlog.txt Additive
    Set Alternate On
    ? Datetime()
    ? 'Error number: ' + Ltrim(Str(merror))
    ? 'Error message: ' + Mess
    ? 'Line of code with error: ' + mess1
    ? 'Line number of error: ' + Ltrim(Str(mlineno))
    ? 'Program with error: ' + mprog
    Set Alternate Off
    Set Alternate To
    *CLOSE DATABASES ALL
    Wait
    On Error  && restore system error handler
    Cancel
```

## E.6. NMC_OPENFILES

```
****** * M:\IMPROVE\NETWORK_METRICS\SOURCE_CODE\NMC_OPENFILES.PRG
*:*********************************************************************************
*:
*: Procedure File M:\IMPROVE\NETWORK_METRICS\NMC_OPENFILES.PRG
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*: Documented using Visual FoxPro Formatting wizard version  .05
*:*********************************************************************************
*:   nmc_openfiles
*:   nmc_openfiles
*!*********************************************************************************
*!
*! Procedure NMC_OPENFILES
*!
*!*********************************************************************************
Procedure nmc_openfiles
    * Written Nov 2004 by Nicole to calculate network-wide metrics on
    * raw ions, carbon, and PESA/XRF/HIPS data for data validation

    Public mmonth, myear, mOutPath, mOutput1, mOutput2

    Set Talk Off
    Close Databases All

    * set paths
    mCalPath = "U:\improve\sitecal\"
    mSiteFile = mCalPath + "sitefile.dbf"
    mOutPath = "m:\improve\programs\network_metrics\output\"
    *e_out = mOutPath + "e_outoflimits" + themonth + theyear + ".dbf"
    *i_out = mOutPath + "i_outoflimits" + themonth + theyear + ".dbf"
    mOutput1 = mOutPath + "metric_checks.dbf"
    mOutput2 = mOutPath + "artifact_checks.dbf"

    If File('c_data.dbf')
        Delete File c_data.Dbf
    Endif
    If File('i_data.dbf')
        Delete File i_data.Dbf
    Endif
    If File('e_data.dbf')
        Delete File e_data.Dbf
    Endif
    If File('tsites.dbf')
        Delete File tsites.Dbf
    Endif

    *open the current site file, copy it, and close it
    Use &mSiteFile In 0 Alias sitefile
    Select sitefile
```

```
Copy All To tsites
Use
Use tsites In 0 Alias sites
Index On site Tag site
Set Order To site
Go Top
Use monthyr.Dbf In 0

*open the data files
Use Carbon_a97onward.Dbf In 0 Alias c_rawdata
Use ions_a95onward.Dbf In 0 Alias i_rawdata
Use Elements_a95onward.Dbf In 0 Alias e_rawdata

Use c_metrics.Dbf In 0
Select c_metrics
Index On (c_metrics.Parameter + Str(c_metrics.Year,4,0) + Str(c_metrics.Month,2,0)) Tag
paramyymm Candidate
Use c_artifacts.Dbf In 0
Select c_artifacts
Index On (c_artifacts.Parameter + Str(c_artifacts.Year,4,0) + Str(c_artifacts.Month,2,0)) Tag
paramyymm Candidate
Use i_metrics.Dbf In 0
Select i_metrics
Index On (Parameter + Str(Year,4,0) + Str(Month,2,0)) Tag paramyymm Candidate
Use i_artifacts.Dbf In 0
Select i_artifacts
Index On (Parameter + Str(Year,4,0) + Str(Month,2,0)) Tag paramyymm Candidate
Use e_metrics.Dbf In 0
Select e_metrics
Index On (Parameter + Str(Year,4,0) + Str(Month,2,0)) Tag paramyymm Candidate
```

## E.7. NMC_USERINPUT

```
****** * M:\IMPROVE\NETWORK_METRICS\SOURCE_CODE\NMC_USERINPUT.PRG
*:*********************************************************************************
*:
*: Procedure File M:\IMPROVE\NETWORK_METRICS\NMC_USERINPUT.PRG
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*:
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*:
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*:
*:
*: Documented using Visual FoxPro Formatting wizard version  .05
*:*********************************************************************************
*:   nmc_userinput
*:   nmc_userinput
*!*********************************************************************************
*!
*! Procedure NMC_USERINPUT
*!
*!  Calls
*!       aYear
*!       amonthyr
*!
*!*********************************************************************************
Procedure nmc_userinput
    * This procedure displays a window to select a month and year.
    * Parameters returned:
    *   theMonth:      Integer (e.g., "12" for December)
    *   theYear:       Integer

    Clear
    Public themonth, theyear, themonthyr
    Public Array amonthyr(3)
    Dimension aMonth(12), aYear(20)
    themonth = 0
    theyear = 0
    themonthyr = 0

    For mcount = 1 To 12  && Fill the month array
        aMonth(mcount) = mcount
    Next
    For mcount = 1 To 20  && Fill the year array
        aYear(mcount) = 1987 + mcount
    Next

    frmMyForm = Createobject('Form')  && Create a Form
    frmMyForm.Closable = .F.  && Disable the Control menu box

    frmMyForm.Move(150,10,500,400)  && Move the form
    frmMyForm.Caption = 'Select Month & Year for Network Metrics Check'  && Caption on the form

    frmMyForm.AddObject('ListBox1','lstMyListBox')   && Add ListBox control
    frmMyForm.AddObject('ListBox2','2ndMyListBox')  && Add ListBox control
    frmMyForm.AddObject('cmbCommand1','cmdMyCmdBtn')  && Add "Continue" Command button
```

```
    frmMyForm.AddObject('cmbCommand2','QuitBtn')  && Add "Quit" Command button

    frmMyForm.AddObject('Label1', 'Textbox')         && Add label to listbox
    frmMyForm.Label1.Visible = .T.  && Make textbox visible
    frmMyForm.Label1.Value = 'Select Month'
    frmMyForm.Label1.Left = 10  && Specify textbox row
    frmMyForm.Label1.Top = 10  && Specify textbox column

    frmMyForm.AddObject('Label2', 'Textbox')         && Add label to listbox
    frmMyForm.Label2.Visible = .T.  && Make textbox visible
    frmMyForm.Label2.Value = 'Select Year'
    frmMyForm.Label2.Left = 140  && Specify textbox row
    frmMyForm.Label2.Top = 10  && Specify textbox column

    frmMyForm.ListBox1.RowSourceType = 5  && Specifies an array
    frmMyForm.ListBox1.RowSource = 'aMonth' && Array containing listbox items
    frmMyForm.ListBox1.ControlSource = 'theMonth'
    frmMyForm.ListBox2.RowSourceType = 5  && Specifies an array
    frmMyForm.ListBox2.RowSource = 'aYear' && Array containing listbox items
    frmMyForm.ListBox2.ControlSource = 'theYear'

    frmMyForm.cmbCommand2.Visible =.T.  && "Quit" Command button visible
    frmMyForm.ListBox1.Visible =.T.  && "List Box visible

    frmMyForm.Show  && Display the form
    frmMyForm.ListBox2.Visible =.F.  && "List Box not visible
    Read Events        && Start event processing

    Select monthyr
    Locate For Month = themonth And Year = theyear
    *GO TOP
    themonthyr = monthyr.Number
    amonthyr(1) = themonthyr
    amonthyr(2) = (themonthyr - 1)
    amonthyr(3) = (themonthyr - 2)

*:*********************************************************************************
*:
*: Class:cmdMyCmdBtn  BaseClass: CommandButton
*:
*:*********************************************************************************
Define Class cmdMyCmdBtn As CommandButton  && Create Command button
    Caption = '\<Continue'  && Caption on the Command button
    Cancel = .T.  && Default Cancel Command button (Esc)
    Left = 10  && Command button column
    Top = 310  && Command button row
    Height = 25  && Command button height

    Procedure Click
        If themonth = 0 Or theyear = 0
                Clear
                ? 'Select MONTH and YEAR'
                Wait
                Clear
                frmMyForm.cmbCommand1.Visible =.T.  && "Continue" Command button visible
                frmMyForm.cmbCommand2.Visible =.T.  && "Quit" Command button visible
                frmMyForm.ListBox1.Visible =.T.  && "List Box visible
                frmMyForm.ListBox2.Visible =.F.  && "List Box visible
                frmMyForm.Show
        Else
                Clear Events  && Stop event processing, close Form
                Release aMonth, aYear
                theyear = theyear + 1987
        Endif
        Wait Clear
```

```
Enddefine

*:*********************************************************************************
*:
*: Class:QuitBtn  BaseClass: CommandButton
*:
*:*********************************************************************************
Define Class QuitBtn As CommandButton  && Create Command button
    Caption = '\<Quit'  && Caption on the Command button
    Cancel = .T.  && Default Cancel Command button (Esc)
    Left = 10  && Command button column
    Top = 260  && Command button row
    Height = 25  && Command button height

    Procedure Click
        Wait Clear
        Select c_rawdata
        Use
        Select i_rawdata
        Use
        Select e_rawdata
        Use
        Cancel
Enddefine

*:*********************************************************************************
*:
*: Class:lstMyListBox  BaseClass: ListBox
*:
*:*********************************************************************************
Define Class lstMyListBox As ListBox  && Create ListBox control
    *   Caption = 'Select Month'  && Caption on the 1st listbox
    Left = 10  && List Box column
    Top = 30  && List Box row
    MultiSelect = .F.  && Don't allow selecting more than 1 month
    Height = 210

    Procedure Click
        Activate Screen
        Clear
        frmMyForm.ListBox2.Visible =.T.  && "List Box visible
Enddefine

Define Class 2ndMyListBox As ListBox  && Create ListBox control
    Left = 140                && List Box column
    Top = 30                  && List Box row
    MultiSelect = .F.         && Don't allow selecting more than 1 year
    Height = 355

    Procedure Click
        Activate Screen
        Clear
        frmMyForm.cmbCommand1.Visible =.T.  && "Continue" Command button visible
Enddefine
```

## APPENDIX F. MEASUREMENT OF IMPROVE FLOW RATE

# Table of Contents

## F.1. Introduction

The IMPROVE sampler measures pressure drops to determine flow rate. Both pressure transducers and Magnehelic® gauges are used to measure pressure drops across flow restrictions. The pressure drop is proportional to the mass flow rate. The three instances of this measurement technique in the IMPROVE sampler are

1. A transducer monitors the pressure drop across the cyclone. The size-selective $PM_{2.5}$ cyclone serves as a *de facto* orifice. This is the primary flow measurement for the $PM_{2.5}$ modules.
2. A needle valve serves as a critical orifice just upstream of the pump on all the $PM_{2.5}$ and $PM_{10}$ modules. The valve is adjusted just prior to each calibration to achieve the desired flow rate. A transducer monitors the differential between atmospheric pressure and the pressure just upstream of the critical orifice. This is the primary flow measurement for the $PM_{10}$ modules and a backup flow measurement for the $PM_{2.5}$ modules.
3. An audit device is used to calibrate the sampler flow rate. The pressure drop across this orifice is measured using a Magnehelic® gauge associated with the audit device.

## F.2. Flow through an Orifice

The mass flow rate through an orifice depends on the square root of the density of the air and the square root of the pressure drop across the orifice. The basic equation for mass flow through an orifice is (Baker, 1989)

$$Q_m = K\sqrt{\rho}\sqrt{\delta P} \qquad \text{F-1}$$

where $Q_m$ is the mass flow rate, K is a constant representing the physical dimensions of the orifice, ρ is the density of the air just upstream of the orifice, and δP is the pressure drop across the orifice. IMPROVE defines standard reference conditions as pressure at sea level ($P_o$) and temperature at 20ºC or 293 K ($T_o$). At these standard conditions the air density can be incorporated into the constant, K, to define a new constant, $Q_1$:

$$Q_{m,STD} = Q_1\sqrt{\delta P} \qquad \text{F-2}$$

where $Q_{m,STD}$ is the mass flow rate at sea level and 293 K. At any other pressure (P) and temperature (T, expressed here in ºC), the new mass flow rate due to the change in air density can be expressed in terms of the square roots of T and P relative to standard conditions as

$$Q_m = Q_1\sqrt{\delta P}\sqrt{\frac{P}{P_0}}\sqrt{\frac{T_0}{T+273.15}} \qquad \text{F-3}$$

The volumetric flow rate, Q, can be calculated from the mass flow rate by applying the temperature (T) and pressure (P) under the conditions of the measurement:

$$Q = Q_m\left(\frac{P_0}{P}\right)\left(\frac{T+273.15}{T_0}\right) = Q_1\sqrt{\delta P}\sqrt{\frac{P_0}{P}}\sqrt{\frac{T+273.15}{T_0}} \qquad \text{F-4}$$

We will write the pressure and temperature functions as F(elev) and f(T):

$$F(elev) = \sqrt{\frac{P_o}{P}} \qquad \text{F-5}$$

Because we do not measure atmospheric pressure at IMPROVE sites, we have chosen to use an average pressure based on the elevation of each site as an approximation for the site pressure. Based on the 1954 tables of Trewartha, the elevation (i.e., pressure) factor at an elevation Z in meters is

$$F(elev) = \sqrt{\frac{P_o}{P}} = \exp\left[\frac{Z}{16874} + \left(\frac{Z}{37648}\right)^2\right] \qquad \text{F-6}$$

An elevation factor for each site is tabulated in the IMPROVE database. The same fixed elevation factor is used for all calculations at a given site.

## F.3. Flow Rate Equation for the Cyclone Transducer

The primary flow rate measurement for the $PM_{2.5}$ module is made with a transducer measuring the pressure drop across the cyclone, which acts as a *de facto* orifice. The volumetric flow rate, Q, is calculated according to equation F-7, which is an analogue of equation F-4:

$$Q = 10^a M^b \sqrt{\frac{P_0}{P}} \sqrt{\frac{T + 273.15}{293.15}} = 10^a (M)^b * F(elev) * f(T) \qquad \text{F-7}$$

where M is the transducer reading of the pressure drop. The term $10^a$ is a parameterized form of the orifice constant $Q_1$ in equation F-4. The constant b is typically around 0.5, reflecting the square root dependence of the pressure drop across the orifice (δP) in the theoretical orifice equation. The coefficients a and b are empirically determined constants established during calibrations performed at least annually using an independent flow device. The values of a and b are unique to each sampler module at each calibration. If the cyclone transducer reading is taken from the controller screen, it can be plugged into equation F-7 directly; if the cyclone transducer reading is taken from the flashcard file, it must be divided by 100 before being plugged into equation F-7.

By IMPROVE's definition of standard conditions, the parameters a and b are always calculated relative to 293 K and sea level. One advantage of expressing the parameters relative to sea level is that all modules should have parameters with similar values independent of the site elevation.

## F.4. Flow Rate Equation for the Critical Orifice Transducer

The critical orifice is designed to ensure stable flow rates by shielding the flow from vacuum pump fluctuations, but it also provides another opportunity for measuring the flow rate based on the pressure drop across the orifice. Because the downstream side of the critical orifice is at the pump, the downstream pressure can be approximated as zero. Thus, the pressure drop across the critical orifice, δP in equations F-1 through F-4, is simply the pressure just upstream of the orifice.

The mass flow rate at any atmospheric pressure, P, and temperature, T, can be expressed for the critical orifice using a form of equation F-3:

$$Q_m = Q_1\sqrt{\delta P}\sqrt{\frac{P'}{P_0}}\sqrt{\frac{T_0}{T+273.15}} \equiv Q_1\sqrt{P-\Delta P}\sqrt{\frac{P-\Delta P}{P_0}}\sqrt{\frac{T_0}{T+273.15}} \quad \text{F-8}$$

where P' is the pressure at the critical orifice entrance and ΔP represents the pressure drop across all components of the flow system upstream of the critical orifice (principally across the filter). Thus, (P – ΔP) is the pressure just upstream of the critical orifice, P'. Equation F-8 can be rearranged to give

$$Q_m = Q_1 * P\left(1-\frac{\Delta P}{P}\right)\sqrt{\frac{1}{P_0}}\sqrt{\frac{T_0}{T+273.15}} \quad \text{F-9}$$

Using an analogue of equation F-4, the volumetric flow rate, Q, can be calculated as

$$Q = Q_m\left(\frac{P_0}{P}\right)\left(\frac{T+273.15}{T_0}\right) = Q_1\sqrt{P}\left(1-\frac{\Delta P}{P}\right)\sqrt{\frac{P_0}{P}}\sqrt{\frac{T+273.15}{T_0}} \quad \text{F-10}$$

We can redefine the $Q_1$ constant to include the local pressure:

$$Q = Q_3\left(1-\frac{\Delta P}{P}\right) * F(elev) * f(T), \quad \text{F-11}$$

where $Q_3$ is another constant.

The primary flow rate measurement for the $PM_{10}$ module and the secondary measurement for the $PM_{2.5}$ module are made with a transducer that measures ΔP, the differential between atmospheric pressure and the pressure just upstream of the critical orifice. The volumetric flow rate, Q, is calculated from the critical orifice transducer reading, G, according to equation F-12, which is an analogue of equation F-11:

$$Q = (c + d * G) * F(elev) * f(T) \quad \text{F-12}$$

where c and d are constants empirically determined at calibration. The constant d is almost always negative, yielding a relationship similar to that expressed in equation F-11, in which the volumetric flow rate, Q, decreases as the differential pressure reading, G, increases. If the orifice transducer reading is taken from the controller screen, it can be plugged into equation F-12 directly; if the orifice transducer reading is taken from the flashcard file, it must be divided by 100 before being plugged into equation F-12.

Because the constant $Q_3$ in equation F-11 incorporates the ambient pressure, the constants c and d will be independent of temperature, but not independent of pressure. That is, they would change if the sampler were moved to a new location. In practice, however, any sampler that is moved is also recalibrated, so there is no practical ramification.

## F.5. Flow rate Equation for the Audit Devices

The audit device consists of a probe that is inserted into the sampler inlet, diverting the inlet flow through a calibrated orifice. A Magnehelic® gauge measures the pressure drop across the

orifice. Each audit device is calibrated in Davis prior to being taken to the field. The reference flow rate for calibrating the audit device is provided by a BIOS DryCal meter located in the sampler laboratory at UC Davis. Taking the log of equation F-7, the volumetric flow rate equation for the audit device is

$$\log(Q) = a_o + \log\sqrt{\left(\frac{29.92}{P}\right)\left(\frac{T+273}{293}\right)} + b_o * \log(M_o) \quad . \qquad \text{F-13}$$

where T and P are the actual temperature and pressure in the laboratory in Davis at the time of the calibration. Applying this pressure and temperature correction ensures that the resulting audit device constants, $a_0$ and $b_0$, will always be referenced to standard conditions.

The log of the magnehelic gauge reading, $M_O$, is regressed against the log of the flow rate from the BIOS DryCal meter, Q, for a set of four flow rates covering the normal range of the audit device. The constants relative to the nominal sea level pressure (29.92 in Hg) and 20°C are calculated using

$$a_0 = \text{intercept} - \log\sqrt{\left(\frac{29.92}{P}\right)\left(\frac{T+273}{293}\right)} \qquad b_0 = \text{slope}. \qquad \text{F-14}$$

Once calibrated, the audit device is used in the field during sampler calibration to determine volumetric flow rates referenced to 20°C and sea level. Hence, the audit flow rate in the field, $Q_0$, is calculated using a version of equation F-7 that does not require the elevation and temperature factors:

$$Q_0 = 10^{a_0} M^{b_0} \qquad \text{F-15}$$

## F.6. References

Baker, Roger C., *An Introductory Guide to Flow Measurement*, 1989 (Mechanical Engineering Publications Limited, London)

Trewartha, Glenn T., *An Introduction to Climate*, 1954 (McGraw-Hill, New York)