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**MODIFICATIONS OF ALPHA PROCESSING
SOFTWARE TO IMPROVE CALCULATION
OF LIMITS FOR QUALITATIVE
DETECTION**

J. R. Kirkpatrick

MASTER *JB*

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**MODIFICATIONS OF ALPHA PROCESSING SOFTWARE
TO IMPROVE CALCULATION OF LIMITS
FOR QUALITATIVE DETECTION**

J. R. Kirkpatrick

Computational Physics and Engineering Division
Oak Ridge National Laboratory

This report
[Alpha Management Software (AMS)]
has been prepared for submission to

R. J. Schlossmann
Canberra Nuclear
150 Spring Lake Drive
Itasca, Illinois 60143

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EXECUTIVE SUMMARY

The work described in this report was done for the Bioassay Counting Laboratory (BCL) of the Center of Excellence for Bioassay of the Analytical Services Organization at the Oak Ridge Y-12 Plant. BCL takes urine and fecal samples and tests for alpha radiation. An automated system, supplied by Canberra Industries, counts the activities in the samples and processes the results. The Canberra system includes hardware and software.

The managers of BCL want to improve the accuracy of the results they report to their final customers. The desired improvements are of particular interest to the managers of BCL because the levels of alpha-emitting radionuclides in samples measured at BCL are usually so low that a significant fraction of the measured signal is due to background and to the reagent material used to extract the radioactive nuclides from the samples. Also, the background and reagent signals show a significant level of random variation. There are two aspects to improved accuracy. The first is improving the estimates of the signals from background and from the reagent. If one subtracts the background and reagent signals from the total signal in a measurement, the remainder is presumably due to actual sample activity. The second improvement desired is in the estimates of minimum values for detection. In a measurement process that is subject to statistical variations, there are signal levels that are so low that one may not be able to say with sufficient confidence that the signal is due to sample activity rather than to random variations. It is important that these minimum signal levels be calculated.

Statistical analyses of spectra have yielded signal levels that represent important thresholds. Two of these are L_c , which is defined by Currie¹ as "the net signal level (instrument response) above which an *observed* signal may be reliably recognized as *detected*," and L_D , also known as minimum detectable activity (MDA), which is defined as "the "true" net signal level which may be *a priori* expected to lead to detection."

The customers at BCL requested four major modifications of the software. First, they requested that activities from many background and reagent blank measurements be kept and that the standard deviations used for MDA be based on results from these multiple measurements. Next, the calculation for MDA was modified to include a sum of standard deviations of both backgrounds and reagent blanks. This second change replaced the previous scheme for calculating MDA, which used the number of counts from the most recent background measurement to estimate the standard deviation of the extraneous signal. Next, a calculation for L_c was added. Last, an average reagent blank activity was subtracted from the sample activity in addition to the background to get an improved net signal. Formerly, only the background had been subtracted.

The requested software changes have been made and tested. The present report is in two parts. The first part describes what the modifications were supposed to accomplish. The second part describes the changes on a line-by-line basis. The second part includes listings of the changed software and discusses possible steps to correct a particular error condition. Last, the second part describes the effect of truncation errors on the standard deviations calculated from samples whose signals are very nearly the same.

1. MODIFICATIONS OF ALPHA PROCESSING SOFTWARE TO IMPROVE CALCULATION OF LIMITS FOR QUALITATIVE DETECTION PART 1

1.1 INTRODUCTION

A major mission of the Bioassay Counting Laboratory (BCL) of the Center of Excellence for Bioassay (CEB) of the Analytical Services Organization at the Oak Ridge Y-12 Plant is determining the levels of radioactive nuclides in urine and fecal samples. The laboratory has an automated system, supplied by Canberra Industries, that includes hardware and software for measuring alpha emissions from the samples. The hardware produces alpha spectra that are passed to the software. The software identifies the nuclides in the samples and determines the levels of activity. If desired, some of the software can be modified at Lockheed Martin Energy Systems.

The levels of activity in almost all samples processed at BCL are quite low. As a result, a significant part of the measured signal is due to counts from the background and from the reagent material. The most accurate determination of activity levels would require that the signals from both the background and the reagent be subtracted from the measured signal. The remainder of the signal would presumably be due to sample activity.

Another consequence of the low levels of activity is that the measured signals from reagent blanks and backgrounds are subject to statistical variation. The noise can be a significant fraction of the total signal. As a result, it is important to discriminate between signals that are high enough to be statistically significant and those that are so low that they may be caused solely by random variations. Statistical analyses have yielded expressions for signal levels that represent important thresholds. Two of these are L_c , which is defined by Currie¹ as "the net signal level (instrument response) above which an *observed* signal may be reliably recognized as *detected*," and L_D , also known as minimum detectable activity (MDA), which is defined as "the 'true' net signal level which may be *a priori* expected to lead to detection."

In the alpha processing software as it was previously written, the activity from the most recent background measurement for that counter was subtracted from the sample measured signal to get a first estimate of the net signal. Also, a first-order approximation of MDA was calculated using the square root of the background signal as an estimate for the standard deviation of the background. No calculation of L_c was done. The customers at CEB wanted the new software to do three additional things. First, they wanted a reagent blank signal to be subtracted from the sample signal, in addition to the background signal that was already being subtracted. To improve the statistics, they wanted this reagent blank signal to be an average from several reagent blanks. Second, they wanted a more accurate value for MDA to be calculated by using a combination of standard deviations from several background measurements and several reagent blanks. This change represents two improvements in MDA: (1) a better approximation of the signal that would be measured in the absence of sample activity using the combination of reagent blank and background standard deviations rather than just the background and (2) more accurate statistics, made possible by using actual standard deviations calculated from several measurements rather than approximating the standard deviation from the results of a single measurement. The third improvement desired was a calculation of L_c , to be done using the same background and reagent blank standard deviations as those used for the improved MDA.

A number of steps were needed to make the desired improvements. First, it was necessary to keep "histories" of activities from previous background and reagent blank measurements. Routines were written to create "history" disk files, to add results from most recent measurements to these files, and to remove old results, as needed. Other routines were created to calculate averaged reagent blank activities and to calculate standard deviations for both backgrounds and reagent blanks. Next, code was written to subtract an average reagent blank activity from the sample activity to get a net signal. Then, the calculation for MDA was

modified to include a combination of standard deviations of both background and reagent blanks. Last, a calculation for L_c was added.

One of the desired features of the modifications was that the software be changed as little as possible. A second desired feature was that the code modifications be concentrated in certain areas and be plainly marked. Further, it was desired that the modified code be usable at all locations that have the Canberra software without changing the results for any users except BCL. After the current software was studied and the mission of the changes clearly outlined, it was determined that the changes could be limited to three parts of the software. A few small changes were made in the DCL file NDAL_PROCESS.COM, which runs the software to process the samples. A small number of changes were made in the FORTRAN code Y12.FOR, which creates the flat file that contains results to be reported to the final customer. Note that, in June 1995, R. J. Schlossmann of Canberra changed the NDAL_PROCESS.COM file so that the executable file for the Y12.FOR code is now called using an alias from the LOGIN.COM file called FLAT_FILE_OUTPUT. In other words, the FORTRAN and executables are still called Y12.FOR and Y12.EXE, but the execution uses this alias. Most of the changes that needed to be made were done in the FORTRAN code ALPHA_MDA.FOR. After the initial modifications were done, it was noted that not all the background samples were being included in the histories. To correct this omission, it was necessary to copy the background programming from ALPHA_MDA.FOR into a separate program called BKGD_HIST.FOR and make some further modifications. BKGD_HIST.FOR is executed from a DCL file called NDAL_BKGD_HISTRY.COM, which is executed in a different portion of the NDAL_PROCESS.COM file from ALPHA_MDA.FOR.

The software changes have been made and tested and are being used in normal operation. The present report describes the rationale behind the changes. The second part of the report describes the changes themselves on a line-by-line basis. The second part also includes listings of the changed software and discussion of possible steps to take to correct a particular error condition. Last, the second part contains an analysis of the effect of truncation errors on the standard deviations of samples whose variability is small.

1.2 STRUCTURE OF THE HISTORY FILES

There is a blank history file for each matrix and each library. The name of each file is "dub1:[alpha.alusr.blk]matrix_controllib_blank.his," where "matrix" is a set of characters identifying the material in which the sample was embedded (normally "fecal" or "urine") and "controllib" is the identifier of the library ("UU," "PU," "AM," etc.). In Canberra documentation, the word "library" is used to indicate a set of boundaries that give the regions in alpha energy where the nuclides one is seeking occur. Given these regions and other data about the expected nuclides, the software can determine how much material occurs in each of the regions and eventually determine the activity of each nuclide. The blank history files contain results from up to 20 separate reagent blank measurements for that detector and that library. The most recent measurement is first, followed by the next most recent, and so on. When the reagent blank history file maintenance routines in ALPHA_MDA.FOR determine that the sample being processed is a reagent blank and is not one that is already in the history file, this new blank is added to the file. If there are already 20 blanks in the file, the oldest is removed. The first record in the blank history file gives the batch and sample I.D.'s of the most recent blank sample and the date and time the sample was added to the history file. The last 27 characters of the name of the history file are written at the end of this record. That information is not read when the ALPHA_MDA.FOR code reads the sample history data, but is added so that someone who prints the history file or looks at it on the screen or with an editor can conveniently determine what file he is examining. The next records give the blank activity, six-sample averaged activity (the average is calculated using the most recent samples in the history up to 6), and the 20-sample standard deviation (the standard deviation is calculated using all the samples in the history up to 20) in units of μCi . There is a record for each

nuclide in the sample. The pattern "act,average,std dev(uCi)" is written at the end of each of those records. That information is not read when the ALPHA_MDA.FOR code reads the sample history data, but is added so that someone who prints the file or looks at it on the screen or with an editor can conveniently determine what the entries on the record represent and what the units are. The rest of the file contains the same information for each of the remaining samples in the file.

A recent (January 1996) addition to the blank history area is the blank "archive" file. This file was added so that there would be a record of the blank history information for more than just the last 20 reagent blank samples. The name of each file is "dub1:[alpha.alusr.blnk]matrix_controllib_blank.ark." The structure of the data is identical to that in the blank history files with the ".his" extension. Whenever the ALPHA_MDA.FOR code adds another reagent blank sample to the ".his" history file, it also appends the lines of blank history information for that file to the ".ark" archive file. Thus, the archive files will continue to grow in size until they are transferred to some archival medium and deleted.

There is a background history file for each detector and each library. The name of each file is "dub1:[alpha.alusr.bkgd]chamber_controllib_bkgnd.his," where "chamber" is the detector number (from "001" to "999") and "controllib" is the identifier of the library ("UU," "PU," "AM," etc.). The meaning of "library" in Canberra documentation was explained above. The background history files contain results from up to 20 separate background measurements for that detector and that library. The most recent measurement is first, followed by the next most recent, and so on. When the background history file maintenance routines in ALPHA_MDA.FOR determine that the background specified for the sample being processed is not already in the history file, this new background is added to the file. If there were already 20 backgrounds in the file, the oldest is removed. The first record in the background history gives the batch and sample I.D.s of the most recent background sample, the live time (i.e., time duration of the measurement) for this sample, and the date and time the sample was added to the history file. The last 22 characters of the name of the history file are written at the end of this record. That information is not read when the ALPHA_MDA.FOR code reads the sample history data, but is rather added so that someone who prints the history file or looks at it on the screen or with an editor can conveniently determine what file he is examining. The next records give the background activity and the 20-sample standard deviation (the standard deviation is calculated using all the samples in the history up to 20) in units of counts/time. There is a record for each nuclide in the sample. The pattern "act,std dev(counts/s)" is written at the end of each of those records. That information is not read when the ALPHA_MDA.FOR code reads the sample history data, but is added so that someone who prints the file or looks at it on the screen or with an editor can conveniently determine what the entries on the record represent and what the units are. The rest of the file contains the same information for each of the remaining samples in the file.

Some comments need to be made concerning the "live time" that is stored for each of the background samples in the background history files. At BCL, it is most common for background measurements to be made on the weekends and to be run for approximately 24 h. Other measurements, including both reagent blanks and samples, are usually run for approximately 16.67 h (i.e., about 1000 min). An advantage of the longer time for backgrounds is that the statistics for backgrounds are thereby improved. The background is caused by rather infrequent events that have a random distribution in time. The number of background counts for most nuclides is rather small and shows a large random variation from measurement to measurement. Running background measurements for 24 h rather than 16.67 h increases the number of background events, thereby lowering the variability in the background measurements. However, if one attempts to compare measured background counts to measured sample counts, the number of background counts is overstated because of the longer measurement time. For comparisons to be valid, both kinds of counts must be normalized to the same measurement time. When the Canberra software begins to process a reagent blank or a sample, the software determines which background is appropriate to that measurement. A background may have already been assigned to the sample. If not, the software assigns the most recent background measurement done for that detector. The software then uses the data from the assigned background sample to create a dummy background

sample file. This dummy contains a background spectrum whose counts are those from the real background measurement, normalized to the live time of the sample being processed. In other words, the background sample counts are multiplied by the ratio of the sample live time to the background measurement time (in the usual case, this ratio is approximately 16.67/24), and the result is passed to the dummy background file. It is this dummy whose values are read by ALPHA_MDA.FOR for comparison with the reagent blanks or samples.

The steps leading to a normalized set of background counts described in the previous paragraph were in the Canberra software when the present report's author began working with it and have not been modified. There are two paths through which the results from a background measurement appear in the background history file. One path is that an execution of ALPHA_MDA.FOR determines that the background measurement does not appear in the history file and adds its results. In the modified ALPHA_MDA.FOR, the normalized background count values are passed to the background history file. The live time passed to the history files from ALPHA_MDA.FOR is that for the sample that was being processed when the particular background measurement was first entered into the history file. The alternate path for a background to appear in the history file is that an execution of BKGD_HIST.FOR determines that the background measurement does not appear in the history file and adds its results. In that case, the numbers of background counts passed to the history file represent actual counts without any normalization. The live time passed to the history files by BKGD_HIST.FOR is that of the background measurements.

1.3 CALCULATING MDA AND L_c

Currie¹ shows how to calculate L_c and MDA. A set of equations for L_c and MDA are contained in the letter from M. M. Reichert to M. R. Prochownik^a. The equations in Reichert's letter represent Currie's methods as applied to alpha-emitting radionuclides. A further refinement of the derivation was presented in a FAX from L. A. Lewis to J. Webb^b. Minor additional changes in notation were made by Lewis and Tucker^c and by Lewis^d. The expressions for MDA and L_c are as follows:

$$MDA \equiv 3/ERTA + 4.65 \{ (s_{\text{background}}/ERTA)^2 + s_{\text{interference}}^2 \}^{1/2}, \quad (1)$$

$$L_c \equiv 2.33 \{ (s_{\text{background}}/ERTA)^2 + s_{\text{interference}}^2 \}^{1/2}, \quad (2)$$

where E is the detector efficiency, R is the sample yield, T is the duration of the measurement, and A is the abundance of the nuclide. The notation is that $s_{\text{background}}$ is the standard deviation of the background

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^aM. M. Reichert, Y-12 Analytical Services Organization, "Determination of Detection Limits for Alpha Emitting Radionuclides," letter to M. R. Prochownik, EG&G Rocky Flats, Inc., September 1, 1994.

^bL. A. Lewis, Y-12 Analytical Services Organization, "MDA Derivation," FAX to J. Webb, EG&G Rocky Flats, Inc., November 7, 1994.

^cL. A. Lewis and W. O. Tucker, personal communication to J. R. Kirkpatrick, December 14, 1994.

^dL. A. Lewis, personal communication to J. R. Kirkpatrick, December 29, 1994.

measurements in units of counts. The division by ERTA is a conversion from counts to activity. The term $s_{\text{interference}}$ is the standard deviation of the reagent blank samples in units of activity (normally, the units are μCi).

There are values of MDA and L_c for each detector, matrix (i.e., urine or fecal), and nuclide. Background measurements are done for each detector, but the background is independent of the matrix. The software sorts the background counts into the regions appropriate to the nuclides so that there is a background measurement for each nuclide. Reagent blank measurements are not done for every detector, but the different matrices require different reagents. Thus, there are separate reagent blank samples for each matrix. The software sorts the reagent blank counts into the regions appropriate to the nuclides so that there is a blank measurement for each nuclide. Some assumptions are necessary to combine the background and reagent blank measurements to get MDA and L_c values for all the combinations of detector, matrix, and nuclide. A basic assumption is that the reagent blank activity minus the background activity from its own detector should be independent of the detector. The standard deviation of many measurements of this activity is $s_{\text{interference}}$, which is dependent on the matrix and the nuclide. A second assumption is that the background counts for the nuclide divided by the ERTA of the detector, matrix, and nuclide of the sample currently being analyzed is the background activity for the nuclide. The background activity is independent of the matrix, but not of the detector. Thus, combining the standard deviations of backgrounds and reagent blanks as shown in the equations for MDA and L_c yields a result that is specific to each set of detector, matrix, and nuclide.

As was noted earlier, the average reagent blank activity used to correct the activity from a regular sample uses activities from the most recent up to six reagent blank samples. The number six was chosen by the customers at BCL, L. A. Lewis, and W. O. Tucker, and represents their judgment about how many samples are needed to provide a statistically valid result. If there are not results from six samples available in the history file, the average will be performed using as many samples as are available. If the reagent blank history file contains no sample results, then the average is assumed to be zero. Whenever a sample is corrected for the average reagent blank activity, the reagent activity subtracted is passed to the basic sample data file and stored in a spare data string (variable *dum3*). The average reagent blank activity is not subtracted from samples that are themselves reagent blanks. As was also noted in the previous paragraph, the standard deviation for the reagent blank activities for calculating MDA and L_c uses activities from the most recent up to 20 reagent blank samples. The number was chosen by the customers at BCL and represents their judgment about how many samples are needed to provide a statistically valid result. If results from 20 samples are not available in the history file, the standard deviation will be performed using as many samples as are available. However, if the reagent blank history file contains results from fewer than four blank samples, then the routine returns a zero value for the reagent blank standard deviation.

The calculation of standard deviations for backgrounds is almost identical to that for reagent blanks. Of course, no average sample activity is calculated for backgrounds. The only major difference between the reagent blank standard deviation calculation and that for the background happens if the background history file contains results from fewer than four background measurements. In that eventuality, the software reverts to the model used before these changes were made. That is, the background standard deviation is assumed to be the square root of the number of counts of the most recent background measurement for that detector.

1.4 REFERENCES

1. L. A. Currie, "Limits for Qualitative Detection and Quantitative Determination, Application to Radiochemistry," *Anal. Chem.* **40**, 586-93 (March 1968).

2. MODIFICATIONS OF ALPHA PROCESSING SOFTWARE TO IMPROVE CALCULATION OF LIMITS FOR QUALITATIVE DETECTION PART 2

2.1 INTRODUCTION

This part of the report contains descriptions of the modifications to the FORTRAN codes ALPHA_MDA.FOR and Y12.FOR and to the DCL file NDAL_PROCESS.COM. Listings of the FORTRAN codes ALPHA_MDA.FOR, Y12.FOR, BKGD_HIST.FOR, and FORTOPEN.FOR; and of the DCL files NDAL_PROCESS.COM and NDAL_BKGD_HISTRY.COM follow as Appendixes 2.A, 2.C, 2.D, 2.F, 2.B, and 2.E, respectively). Appendix 2.G describes possible responses to having a reagent blank sample exceed the dpm alarm limit. Last, Appendix 2.H discusses the effect of truncation errors on the standard deviation of samples in a history file.

2.2 ALPHA_MDA CODE

In ALPHA_MDA.FOR, there are a modest number of changes in the main code. In addition, there are some very large new subroutines with several entries each that accomplish the creation and maintenance of the history files and the communication from the history files to the main routine. Last, there are some small new utility subroutines used by the history subroutines. The remainder of this section explains in some detail what is going on in each routine to make future maintenance of the code easier. A listing of the entire ALPHA_MDA.FOR file is included as Appendix 2.A. The line numbers shown at the first of each line in the appendix are referenced in the discussion of the code in this section. All additions and changes by Kirkpatrick are bracketed by comment cards starting with "jxx, which is Kirkpatrick's computer user ID.

I. OPERATIONS IN MAIN ROUTINE

- A. Get value of flag *y12_bioassay_output*, which is used to determine whether any of these modifications will be executed. Lines 163, 165.
- B. Set default for 2nd constant of MDA (*lld_constant*) to 3.0 rather than 2.71. This is done if *y12_bioassay_output* .eq. 'YES' .or. *srs_bioassay(1:1)* .eq. 'Y'. Lines 242 through 246.
- C. Change header of message written after executing ALPHA_MDA to show that last two columns of message line are MDA and *L_c*. This is done if *y12_bioassay_output* .eq. 'YES' .or. *new_reagent_calc(1:1)* .eq. 'Y'. Lines 598 through 606.
- D. Check to see if *y12_bioassay_output* .eq. 'YES' .or. *new_reagent_calc(1:1)* .eq. 'Y'. None of the next lines will be executed if this "if" statement is not true. Lines 634, 651.
  1. Initialization of blank history information—call *hblkini(debug,nbr,batch_id,sident,yield,time_str)*. Line 636.
  2. Find background batch ID field (*bkgbat_id*) and truncate result to 24 rightmost characters. Lines 640 through 643.
  3. Initialization of background history information—call *hbkgini(debug,nbr,bkgbat_id,bkgident,time_str)*. Line 645.
  4. Get dpm alarm threshold (*dpm_alarm*). Lines 648, 649.

E. Check to see if *y12_bioassay_output*.eq. 'YES'.or. *new_reagent_calc(1:1)*.eq. 'Y'. None of the next lines will be executed if this "if" statement is not true. Lines 678, 704.

1. Return blank averaged activity--call *gtrbblk(xnumb,rbblnk,debug)*. Line 680.

a. Check to see if value returned (*rbblnk*) > -10^{25} . Lines 683, 703.

(1) If so, the sample is not a reagent blank and there is a usable value of *rbblnk*.

(a) Subtract the averaged blank activity (*rbblnk*) from the sample activity to correct for blank activity, provided this is not the tracer nuclide (*xnucl.ne. CER_nucl*). Lines 689 through 691.

(b) Pack the averaged blank activity into spare string *dum3* [call *reinpak(rbblnk,dum3)*] so that it can be stored in the sample data [by the *s=cam_pnucl(c,xnumb,hlif,xnucl,sbhdr,hunits)* after statement 9900 on line 975] for later recovery if need be. Line 701.

Note about order of operations: The six-sample averaged blank activity is subtracted from the sample activity at line 689. However, the subtraction will not be done for reagent blank samples. This is before the call to *hblkinf* at line 738, in which the six-sample averaged blank activity is actually calculated. The operations in that order work successfully because reagent blank samples are processed before normal samples. The correction for six-sample blank activity at line 689 is not done for reagent blank samples because *gtrbblk* recognizes blank samples and returns *rbblnk* < -10^{25} , which the "if" statement at line 683 uses as a flag to know that *rbblnk* is not to be subtracted from the activity. For a reagent blank sample, the call to *hblkinf* at line 738 completes the calculation of the six-sample blank averaged activity. When a normal sample is processed, a six-sample averaged activity based upon the most recent reagent blank samples is available because the reagent blank samples were processed first.

F. Check to see if *y12_bioassay_output*.eq. 'YES'.or. *new_reagent_calc(1:1)*.eq. 'Y'. Lines 714, 723.

1. If so, further process background history information to create 20-sample background standard deviation--call *hbkginf(debug,xnumb,bkgcts,bkgtim,bkgbat_id,bkgident)*. Lines 719 through 722.

G. Check to see if *y12_bioassay_output*.eq. 'YES'.or. *new_reagent_calc(1:1)*.eq. 'Y'. Lines 733, 739.

1. If so,

a. Convert weighted mean (*wtmean*) from real*8 to real*4 variable (*wtmn4*). This is done because real*8 variable did not transfer in subroutine calling sequence properly, for no reason that was ever discovered. Line 736.

b. Further process blank history information to create 6-sample blank averaged activity and 20-sample blank standard deviation--call *hblkinf(debug,xnumb,xnucl,wtmn4,actmult,dpm_alarm,cer_nucl)*. Line 738.

H. Check to see if *y12_bioassay_output*.eq. 'YES'.or. *new_reagent_calc(1:1)*.eq. 'Y'. Lines 764, 798.

1. If so, calculate MDA and L_c .

a. Return blank standard deviation--call *gtsbblk(xnumb,sbblnk,debug)*. Convert result to dpm. Lines 766 through 768.

b. Return background standard deviation--call *gtsbbkg(xnumb,bkgtim,sbblnk,debug)*. Line 770.

c. Set $L_c = -1$ as a flag. If the value of L_c is not set ≥ 0 in later steps, that is a flag that no usable value of L_c has been calculated. Line 775.

d. Check to see that usable values were returned for both standard deviations (*sbblnk* > -10^{25} .and. *sbbkgd* > -10^{25}). Lines 776, 797.

(1) If so (i.e. both standard deviations > -10^{25}), calculate MDA and L_c .

(a) Convert background standard deviation in counts/time to counts. Line 778.

- (b) Convert background standard deviation in counts to activity. Lines 781, 782.
  - (c) Sum the squares of the standard deviations. Line 785.
  - (d) Calculate MDA and L_c in activity units. Lines 787 through 790.
- I. Check to see if `y12_bioassay_output.eq. 'YES'.or. new_reagent_calc(1:1).eq. 'Y'`. Lines 808, 815.
  - 1. If so,
    - a. Put L_c into variable *MPC* in place of variable *CRIT* provided that a usable value of L_c has been calculated ($l_{subc} \geq 0$). Lines 810 through 814.
- J. Calculate modified sample error calculation for sample activity ($wtmean = 0$). This branch selected by `if(wtmean.eq. 0) go to 9910` statement at line 823 and `9910 continue` at line 892 in unmodified code. This block is avoided for $wtmean \neq 0$ by `go to 9911` at line 888, which skips to `9911 continue` at line 909, which is below the modified sample error calculation. Lines 768 and 775 through 786.
  - 1. Check to see if `y12_bioassay_output.eq. 'YES'.or. new_reagent_calc(1:1).eq. 'Y'`. Lines 897, 908.
    - a. If so,
      - (1) Sample error ($wtmaer$) approximated by $\sqrt{2} \times$ blank standard deviation. Also, result converted from blank standard deviation units, which were changed from μCi to dpm in line 768, back to μCi . Lines 904 through 906.
- K. Messages written for printing after execution of *ALPHA_MDA* giving information for each nuclide including MDA and L_c , if appropriate. Lines 919 through 935.
  - 1. Check to see if `(y12_bioassay_output.eq. 'YES'.or. new_reagent_calc(1:1).eq. 'Y').and. lsubc.lt.0.`. Lines 919, 920, 924, 935.
    - a. If so,
      - (1) Write line of data including *xnucl,,,MDA*. Lines 921, 922.
    - b. else,
      - (1) Write line of data including *xnucl,,,MDA,mpc* (note addition of *mpc* to output list). Lines 925, 926.
      - (2) If *xnucl.ne. CER_nucl.and. rbblnk.gt. -1.e25* (i.e., if this is not the certificate nuclide and there is a usable value for *rbblnk*), then write additional line of data giving *rbblnk* in dpm. Lines 930 through 933.
- L. Rearrangement of statement 9900 and *cam_pnucl* statement with addition of checks to verify that blank and background files are okay. Lines 961 through 975.
  - 1. Statement 9900 changed to *continue*. Line 961.
  - 2. Check to see if `y12_bioassay_output.eq. 'YES'.or. new_reagent_calc(1:1).eq. 'Y'`. Lines 970, 973.
    - a. If so,
      - (1) Check blank history file to see if it is okay (gives opportunity to stop operation of job)—*call hblkchk(debug)*. Line 971.
      - (2) Check background history file to see if it is okay (gives opportunity to stop operation of job)—*call hbkgchk(debug,bkgbat_id,bkgident)*. Line 972.
    - 3. Call *s=cam_pnucl(c,etc.)* separated from statement 9900. Line 975.
- M. Check to see if `y12_bioassay_output.eq. 'YES'.or. new_reagent_calc(1:1).eq. 'Y'`. Lines 985, 998.
  - 1. If so,
    - a. Write updated information on blank history file—*call hblkwri(debug,nbr)*. Line 990.
    - b. Write updated information on background history file—*call hbkgwri(debug,nbr,bkgbat_id,bkgident)*. Line 996.
- N. Yield maximum of 125% changed to 115% to be consistent with Y12.FOR (125 may be a typographical error). Lines 1021, 1022.

II. SUBROUTINES FOR REAGENT BLANK AND BACKGROUND HISTORY INFORMATION AND OTHER AUXILIARY OPERATIONS

A. Reagent blank information—subroutine **hblank**.

A.1. Initialization of blank information—entry **hblkini**(*debug,nbr,batch_id,sident,yield,time_str*). Lines 1137 through 1469 of subroutine **hblank**.

- a. Initialize flags for file already checked, duplicate sample, and warning counters. Lines 1145 through 1150.
- b. Get character strings representing matrix type and library to construct blank history file name. Lines 1152, 1155.
- c. Get file type and therefore sample type. Lines 1158, 1159. The reason for this is to determine whether the sample is a reagent blank (*xchar.eq. 'R'*).
- d. Check to see if the length of the file type and sample type variables is small enough to construct a usable file name. Line 1169, 1441, 1467.

(1) If so,

- (a) Construct blank history file name. History file name is "dub1:[alpha.alusr.histry.blank]matrix_controllib_blank.his." Lines 1170 through 1178.
- (b) Construct blank archive file name. Archive file name is "dub1:[alpha.alusr.histry.blank]matrix_controllib_blank.ark." Lines 1180 through 1183.
- (c) Set blank history and archive unit numbers and open blank history and archive files. Archive file is opened with 'append' access so that information will be written at end of file. Lines 1184 through 1194.
- (d) Check to see if the sample is not a reagent blank (*xchar.ne. 'R'*). Lines 1197, 1246, 1439.

- i) If so (i.e., sample is not a reagent blank), the 6-sample averaged activity and 20-sample standard deviation calculated from the most recent reagent blank will be used to correct the sample activity for the blank and to calculate MDA and L_c . Information from the most recent reagent blank sample is stored in the first information set in the blank history file.

The structure of the blank history file is as follows:

Record 1: character variables [format (1x,a16,1x,a16,1x,a20)] giving batch ID and sample ID of most recent blank sample, plus date and time sample added to history file.

Records 2 through $nbr+1$: each record is 3 real*4 variables [format (1x,3g15.8)] giving the activity, 6-sample averaged activity, and 20-sample standard deviation for the most recent blank for each nuclide in the sample.

Records $nbr+2$ through $2*(nbr+1)$: sample ID, plus activity, 6-sample averaged activity, and 20-sample standard deviation for the sample before the most recent blank for each nuclide in the sample.

Records $2*(nbr+1)+1$ through $20*(nbr+1)$: additional samples in order of ever-increasing age. Note that the code is set up to count the number of information sets read and stop reading when it encounters an end of file (EOF). Thus, as much information as is available is read. If there are not 20 information sets on the history file, then the calculations will be done with those sets that are available.

- a) Read the batch and sample IDs, plus date and time sample added to history file. Lines 1198 through 1203. An EOF goes to statement 991 [see par. II.A.1.d.(1)(d)i)b)].
  - b) Read the activity, 6-sample averaged activity, and 20-sample standard deviation for the most recent blank. As has already been said, there will be one record of this information for each nuclide. Lines 1211 through 1223. An EOF goes to statement 991 [see par. II.A.1.d.(1)(d)i)b)].
    - 1)) An EOF during the history information read goes to statement 991, which is described here. If an EOF is encountered, set the first blank sample ID and batch ID to EOF indicator fields, set date and time to current date and time, and set the counter for information read (*nisnum*) to 0. Next, write an EOF notice message to TTY. Last, rewind the blank unit and send a notice message to TTY that information in blank history file will be new. Lines 1226 through 1241.
  - c) Initially set flag indicating blank sample is okay (*blsok*) to true. Line 1245.
- ii) Else, if the sample is a reagent blank, the previous up to 20 sets of reagent blank information must be read from the history file. Later, in entry *hblkinf*, a new set of averages and standard deviations will be calculated using the present blank information and that from previous blanks (see par. II.A.2.a.(5)). The information from the present blank sample will be stored in the first information set. Those from previous samples will be stored in memory locations for information sets 2 through 21.
- a) Initialize the running sums for calculating 6-sample averaged activity and 20-sample standard deviation. Lines 1252 through 1258.
  - b) Set the first blank sample ID and batch ID to values for current sample, set date and time to current date and time, and set the counter for information read (*nisnum*) to 1. Set flag indicating blank sample is okay (*blsok*) to true. Set counter saying what memory location to insert values read from history file (*nl*) to 2. Lines 1260 through 1265.
  - c) Check the state of the sample. This set of statements is copied from Y12.FOR with some modifications. Its mission is to find out what is the state of the sample. If the state is anything but "ok," the sample will not be added to the history file. The logic for checking the state for a reagent blank was reproduced in ALPHA_MDA.FOR rather than having the determination of the state left to Y12.FOR because ALPHA_MDA.FOR needs to know whether a reagent blank sample is not "ok" so it can refuse to add a flawed sample to the history file. The state is passed to a disk file to be read by Y12.FOR so that the latter code will not have to ask the operator to give the state of the sample a second time. Later, in *hblkinf*, tests are performed to see if the activity of the sample exceeds the dpm alarm limit [see par. II.A.2.a.(1)(c)].

- 1)) Pass message to TTY indicating that ALPHA_MDA is processing blank sample and giving sample and batch IDs. Lines 1267 through 1269.
- 2)) See if yield is out of range. If so, set state to "unsuport" and write messages to TTY indicating that yield is out of range and that operator will have a chance to say why. Lines 1271 through 1279.
- 3)) Ask operator what is state of sample. Lines 1280 through 1299.
- 4)) Set state to values other than "ok" if operator has given such a response. Lines 1301 through 1307.
- 5)) Check to see if operator said state is "ok" and yield is within range. Lines 1318, 1319, 1323, 1328.
  - a)) If so, set state to "ok." Also, set flag indicating sample is okay (*lblsok*) to true. Lines 1320 through 1322.
  - b)) Else, set the counter for information read (*nisnum*) to 0, set counter saying what memory location to insert values read from history file (*nl*) to 1, and set flag indicating sample is okay (*lblsok*) to false. Lines 1325 through 1327.
- 6)) Open disk file to pass sample state to Y12.FOR (file is "dub1:[alpha.alusr.histry]jxktemp.da"), write state to file, and close file. Lines 1333 through 1348.
- d) Read the batch ID, sample ID, date and time sample was added to history file, activity, 6-sample averaged activity, and 20-sample standard deviation for all the previous blank samples. Increment the counter for information read (*nisnum*) as each sample is read. Lines 1350 through 1378, 1400, and 1460.
  - 1)) An EOF encountered while reading the activity, 6-sample averaged activity, and 20-sample standard deviation goes to statement 1001. After statement 1001, decrement the counter for information sets read (*nisnum*) and go to statement 1009 (line 1418), which is the rest of the end of file logic. Lines 1374 through 1377.
- e) Increment the sums for 6-sample averaged activity and 20-sample standard deviation. Lines 1387 through 1399.
- f) Check to see if batch ID and sample ID of sample just read from history file match those of first sample, sample being read is not the first, and that no sample matches have so far been found [*nisnum.gt.1 .and. blkid(nisnum).eq.blkid(1) .and. blkbid(nisnum).eq.blkbid(1) .and. not.lbldup*]. Lines 1403 through 1405, 1415.

If so,

  - 1)) Set flag that indicates duplicate blank sample (*lbldup*) to true. Line 1406.
- g) An EOF reading the batch and sample IDs goes to statement 1009, whose operations are described here. Also, this statement is executed if the code successfully reads all 20 sets of history information. Line 1418.
  - 1)) If *nisnum* < 1, write a message to TTY saying that "blank history end of file reached before any info sets read," set the counter for

information sets read (*nisnum*) to zero. Lines 1421 through 1425.

- 2)) If current batch and sample IDs duplicate any others (i.e., *lbldup* is true), put all information (i.e., batch ID, sample ID, date and time sample entered into history file, activity, 6-sample averaged activity and 20-sample standard deviation for all nuclides) from memory location 2 into memory location 1. No calculations of 6-sample averaged activity and 20-sample standard deviation will be done. Instead, information from the most recent sample read off the history file will be used as if the current sample did not exist. Lines 1429 through 1438.

- h) Set the flag for a usable blank history file name (*lflblk*) to true. Line 1222.

- e. Else, blank history file name will be too long. Line 1441.
then

- (1) Write a message to TTY stating that no blank history file can be opened. Lines 1444 through 1446.
- (2) Set flag for a usable blank history file name (*lflblk*) to false. Line 1417.
- (3) Send a message to TTY stating that usable history file cannot be created and asking if ALPHA_MDA should be terminated immediately. Lines 1449 through 1463.
- (a) If so, exit with call to SFTEXI. Lines 1464 through 1466.

A.2. Further processing of blank history information to create 6-sample averaged activity and 20-sample standard deviation—entry **hblkinf**(*debug, xnumb, xnucl, wtmn4, actmult, dpm_alarm, cer_nucl*). Lines 1472 through 1640 of subroutine **hblank**.

- a. Check to see if this is a reagent blank sample, that the sample is okay, and the sample does not duplicate one on the history file (*xchar.eq 'R' .and. lblsok .and. .not. lbldup*). Line 1482, 1639.

- (1) If so,

- (a) If this is first nuclide (*xnumb .eq. 1*), set sum of sample activities and number of samples exceeded dpm alarm counter (*nsmplex*) to zero. Lines 1487 through 1490.
- (b) Add activity for this nuclide to sum of sample activities provided that this is not the tracer isotope (*xnucl .ne. cer_nucl*). Line 1492.
- (c) Test to see if the sum of sample activities and the activity for this nuclide both exceed the dpm alarm limit. Lines 1493 through 1494, 1558.

- i) If so,

- a) Set sample is okay flag (*lblsok*) to false. Line 1496.
- b) Write warning messages to TTY stating that sample has exceeded dpm alarm limit and wait for acknowledgement. Lines 1498 through 1533.
- c) Increment number of samples exceeded dpm alarm counter (*nsmplex*). Line 1534.
- d) If counter is greater than 1, write messages to TTY pointing out that this is not the first nuclide to exceed dpm alarm limit. Lines 1535 through 1545.
- e) Send a message to TTY asking if ALPHA_MDA should be terminated immediately. Lines 1549 through 1554.

- 1)) If so, exit with call to SFTEXI. Lines 1555 through 1557.

- (2) Check to see if sample okay flag (*lblsok*) flag has been changed to false. Lines 1561, 1568.
    - (a) If so, return to main routine. Line 1567.
  - (3) Load the activity into the memory location for the most recent sample. Line 1570.
  - (4) Finish the sums for the six-sample averaged activity and standard deviation. The samples-added counters (*ismx6* and *ismx20*) are incremented only for nuclide 1 to avoid counting more than once per sample. Lines 1571 through 1579.
  - (5) Calculate the six-sample averaged activity and standard deviation. Lines 1581 through 1636.
    - (a) Check to see if there is at least one usable sample for the six-sample averaged activity (*ismx6* > 0). Lines 1581, 1588, 1591.
      - i) If so, calculate six-sample averaged activity. Line 1582.
      - ii) Else, set six-sample averaged activity to zero and write a message to that effect to TTY. Lines 1589, 1590.
    - (b) Check to see if there are at least four usable samples for the 20-sample standard deviation (*ismx20* .ge. *nsmpmn* [=4]). Line 1594, 1623, 1636.
      - i) If so,
        - a) Calculate 20-sample standard deviation. Lines 1595, 1596, 1618.
        - b) If result of truncation errors in sum will cause standard deviation to be imaginary, set standard deviation to zero, send a message to TTY saying that standard deviation was not going to be real, and wait for acknowledgement of notice. Lines 1603 through 1616.
      - ii) Else,
        - a) Set 20-sample standard deviation to zero, send notice message to TTY, and wait for acknowledgement. Lines 1624 through 1635.
    - (c) If there were no blank history data lines read, but this sample is okay, set the counter for information sets read (*nisnum*) to one. Line 1638.
- A.3. Return blank standard deviation—entry *gtsbblk*(*numb*,*sbblnk*,*debug*). Lines 1643 through 1677 of subroutine *hblank*.
- a. Set standard deviation (*sbblnk*) to most recently calculated value. Line 1646.
  - b. Check to see if there are no usable blank history data available (*nisnum* < 1 .or. .not.*lflblk*). Lines 1653, 1674.
    - (1) If so, (i.e., no usable data available),
      - (a) Write notice messages to TTY and wait for response (provided that this is the first time such a notice has been needed for this sample). Lines 1654 through 1671.
      - (b) Increment the warning counter. Line 1672.
      - (c) Set *sbblnk* equal to -1.1e25 as a flag. Line 1673.
- A.4. Return blank averaged activity—entry *gtrbblk*(*numb*,*sbblnk*,*debug*). Lines 1680 through 1718 of subroutine *hblank*.
- a. Set averaged activity (*rbblnk*) to most recently calculated value. Line 1683.
  - b. Check to see if this is a blank reagent sample (*xchar* .eq. 'R'). Lines 1686, 1688, 1715.
    - (1) If so, set *rbblnk* equal to -1.1e25, which is a flag to the main routine not to correct for blank averaged activity. Line 1687.
    - (2) Else, check to see if there are no usable blank history data available (*nisnum* < 1 .or. .not.*lflblk*). If so, (i.e., no usable data available), send notice messages to TTY and wait for acknowledgement of notice. Then, set *rbblnk* equal to -1.1e25. Lines 1693 through 1714.

A.5. Check to see if it is okay to write updated information on blank history file—entry **hblkchk(debug)**. Lines 1721 through 1759 of subroutine **hblank**.

- a. Check to see if this file has already been checked (*lflchk* is true). Lines 1723, 1726, 1728.
  - (1) If so, return to main routine. Line 1725.
  - (2) Else, set file checked flag (*lflchk*) to true. Line 1727.
- b. Check to see whether blank history file cannot be opened (*.not.lflblk* is true). Lines 1730, 1732, 1758.
  - (1) If not (i.e., *.not.lflblk* is true), then return to main routine. Line 1731.
  - (2) Else, check to see if this is a blank reagent sample, that the sample is okay, and that the sample does not duplicate one already in the history file (*xchar.eq.'R'.and.lblsok.and.not.lbldup*). Lines 1737, 1757.
    - (a) If so, check to see if no usable blank history data exist (*nisnum < 1*). Lines 1739, 1756.
      - i) If so, (i.e., no usable blank history data available),
        - a) Write a message to TTY stating that no usable blank history data are available and that empty history file will be written. Lines 1741 through 1745.
        - b) Send a message to TTY asking if ALPHA_MDA should be terminated immediately and wait for response. Lines 1746 through 1752.
          - 1)) If so, exit with call to SFTEXI. Lines 1753 through 1755.

A.6. Write updated information on blank history file—entry **hblkwri(debug,nbr)**. Lines 1762 through 1814 of subroutine **hblank**.

- a. Check to see if the blank history file name is not okay and that a history file cannot be opened (*.not.lflblk*). Lines 1764, 1768, 1813.
  - (1) If so (i.e., blank history file is not okay), write a message to TTY to that effect and go to *end if* at line 1813. Lines 1765 through 1767.
  - (2) Else, check to see if this is a blank reagent sample, that the sample is okay, and that the sample does not duplicate one already in the history file (*xchar.eq.'R'.and.lblsok.and.not.lbldup*). Lines 1773, 1812.
    - (a) If so, check to see if no usable blank history data exist (*nisnum < 1*). Lines 1775, 1781.
      - i) If so, (i.e., no usable blank history data available), write a message to that effect to TTY, write an empty file to blank history, and return to main routine. Lines 1776 through 1780.
      - ii) Else, write up to 20 sets of blank history data—batch ID, sample ID, and date sample added to history file; plus activity, 6-sample averaged activity, and 20-sample standard deviation for each nuclide. First line in each set has characters 31 through 57 of the blank history file name written at the end. Lines 1782 through 1811.

B. Background information—subroutine **hbkgnd**.

B.1. Initialization of background information—entry **hbkgini(debug,nbr,bkgident)**. Lines 1863 through 2135 of subroutine **hbkgnd**.

- a. Initialize flags for file already checked, duplicate sample, and warning counters. Lines 1873 through 1877.
- b. Get character strings representing chamber and library to construct background history file name. Construct chamber number string to have three characters with leading zeroes (e.g., chamber 1 has *chamber='001'*). Lines 1879 through 1892.
- c. Check to see if the length of the file type and sample type variables is small enough to

construct a usable file name. If not, skip down to *else* statement at line 1848 (see par. II.B.1.d). Lines 1901, 2133.

- (1) Construct background history file name. History file name is "dub1:[alpha.alusr.bkgd]chamber_controllib_bkgnd.his." Lines 1902 through 1908.
- (2) Define background unit number and open background history file. Lines 1909 through 1917.
- (3) Read batch and sample IDs, live time, and date and time sample added to history file for first background sample on history file. An EOF goes to statement 981 at line 1931 [see par. II.B.1.c.(3)(a)]. Lines 1919 through 1923.
  - (a) An EOF during the read of the first sample ID from the history information goes to statement 981, which is described here.
    - i) Set the first background batch ID (*bkgbid1*), sample ID (*bkgid1*), first line batch ID [*bkgbid(1)*], and background sample ID [*bkgid(1)*] to EOF indicator fields. Set both the counter for information read (*nisnum*) and the live time for line 1 [*ltimbk(1)*] to zero. Set the date and time sample added into history field [*bkgpdat(1)*] to current date and time (*time_str*). Lines 1932 through 1938.
    - ii) Write a notice message to TTY saying that EOF was reached on background history file before first record finished reading and that there is no background history information. Lines 1941 through 1953.
    - iii) Rewind background history file so that either it will be empty or else that information from the current background will be first on the history file and write a message to TTY explaining that new information will go into history file. Lines 1956 through 1960.
- (4) Check to see if batch ID and ID of first sample on history file are same as current background batch ID and background sample ID (*bkgid1.eq.bkgident .and. bkgbid1.eq.bkgbat_id*). Lines 1965, 2005, 2108.
  - (a) If so (i.e., IDs match),
    - i) Read the 20-sample standard deviation calculated from the most recent background. This will be used to calculate MDA and L_c . Information from the most recent background sample is stored in the first information set in the background history file.
 The structure of the background history file is as follows:
 Record 1: character variables [format (1x,a24,1x,a16,g15.8,a20)] giving batch and sample IDs of most recent background sample, Real*4 variable giving live time for this sample, plus character variable giving date and time sample added to history file.
 Records 2 through *nbr*+1: each record is two real*4 variables [format (1x,2g15.8)] giving the background counts/time and 20-sample standard deviation for the most recent background for each nuclide in the sample.
 Records *nbr*+2 through 20*(*nbr*+1): additional samples in order of ever-increasing age. Note that the code is set up to count the number of information sets read and stop reading when it encounters an EOF. Thus, as much information as is available is read. If there are not 20 information sets on the history file, then the calculations will be done with those sets that are available.

- a) Set the counter for information read (*nisnum*) to 1 and set the first line batch and background IDs [*bkgbid(1)* and *bkgid(1)*] to the first line values already read (*bkgbid1* and *bkgid1*). Lines 1966 through 1968.
- b) Read the background counts/time and 20-sample standard deviation for the most recent background. As has already been said, there will be one record of this information for each nuclide. Lines 1969 through 1978. An EOF goes to statement 991 [see par. II.B.1.c.(4)(a)i)b)].
  - 1)) An EOF during the history information read goes to statement 991, which is described here. Set the first background batch and sample IDs (*bkgbid1* and *bkgid1*) and the first line background batch and sample IDs [*bkgbid(1)* and *bkgid(1)*] to EOF indicator fields. Set both the counter for information read (*nisnum*) and the live time for line 1 [*ltimbk(1)*] to zero. Set the date and time sample added to history file [*bkgpdat(1)*] to current date and time. Next, write an EOF notice message to TTY. Last, rewind the background unit and send a notice message to TTY that information in background history will be new. Lines 1982 through 2003.
- (b) Else (background batch and sample IDs do not match the most recent background history batch and sample IDs), the previous up to 20 sets of background history information must be read from the history file. Later, a new set of standard deviations must be calculated using the present background information and that from previous backgrounds [see par. II.B.2.a.(1)(c)]. The information from the present background sample will be stored in the first information set. Those from previous samples will be stored in memory locations for information sets 2 through 21. Line 2005.
  - i) Initialize the running sums for calculating 20-sample standard deviation. Lines 2012 through 2016.
  - ii) Set the first batch and sample IDs to values for current sample. Set first live time to zero (correct live time will be placed in this location by entry *hbkginf*). Set first date and time sample added to history file to current date and time. Set counter for information read (*nisnum*) to 1. Rewind background unit to begin reading again. Lines 2018 through 2025.
  - iii) Read the batch and sample IDs, live time, and date and time sample added to history file; plus background counts/time and 20-sample standard deviation for all the previous background samples. Increment the counter for information read (*nisnum*) as each sample is read. Lines 2026 through 2051, 2068, and 2084.
    - a) An EOF encountered while reading the activity and 20-sample standard deviation goes to statement 1001 at line 2052. At statement 1001, decrement the counter for information sets read (*nisnum*) and go to statement 1009 at line 2086, which is the rest of the EOF logic. Lines 2052 through 2055.
  - iv) Increment the sums for 20-sample standard deviation. Lines 2063 through 2067.
  - v) Compare batch and sample IDs of sample just read from history file with those of first sample. This is to be done provided sample being read is not the first and that no sample matches have so far been found. If patterns

match, set flag that indicates duplicate background sample (*lbkdup*) to true. Lines 2071 through 2080.

- vi) An EOF reading the sample ID goes to statement 1009, whose operations are described here. Also, this statement is executed if the code successfully reads all 20 set of history information. If the counter for information sets read (*nisnum*) is < 1 , this flags that there were no complete information sets read. Line 2086.
    - a) If *nisnum* < 1 , write a message to TTY saying that "background history end of file reached before any info sets read," set the counter for information sets read (*nisnum*) to zero. Lines 2090 through 2095.
    - b) If current batch and sample IDs duplicate any others (i.e., *lbkdup* is true), put all information (i.e., batch ID, sample ID, live time, date and time sample entered into history file, activity, and 20-sample standard deviation for all nuclides) from memory location 2 into memory location 1. No calculations of 20-sample standard deviation will be done. Instead, information from the most recent sample read off the history file will be used as if the current sample did not exist. Lines 2098 through 2107.
  - vii) Set the flag for a usable background history file name (*lflbkg*) to true. Line 2109.
  - d. Else (background history file name will be too long), Line 2110.
    - (1) Write a message to TTY stating that no background history file can be opened. Lines 2113 through 2115.
    - (2) Set flag for a usable background history file name (*lflbkg*) to false. Line 2116.
    - (3) Send a message to TTY asking if ALPHA_MDA should be terminated immediately. Lines 2118 through 2129.
      - (a) If so, exit with call to SFTEXL. Lines 2130 through 2132.
- B.2. Further processing of background history information to create 20-sample standard deviation—entry **hbkginf**(*debug,numb,xnucl,bkgcts,bkgtim,bkgbat_id,bkgident*). Lines 2138 through 2222 of subroutine **hbkgnd**.
- a. Check to see if batch and sample IDs of first sample on history file are not the same as current background batch and sample IDs and that the sample does not duplicate one on the history file ((*bkgidl.ne.bkgident.or.bkgbidl.ne.bkgbat_id*) .and. .not.*lbkdup*). Lines 2151, 2152, 2221.
    - (1) If the batch and sample IDs do not match and sample is not a duplicate, then
      - (a) Load the background counts/time and live time into the memory location for the most recent sample. Lines 2155, 2156.
      - (b) Finish the sums for the standard deviation. The samples added counter (*ismx20*) is incremented only for nuclide 1 to avoid counting more than once per sample. Lines 2157 through 2163.
      - (c) Calculate the standard deviation. Lines 2168 through 2197.
        - i) Check to see if there are at least 4 usable samples for the 20-sample standard deviation (*ismx20 > nsmpmn [=4]*). Lines 2168, 2197, 2218.
          - a) If so,
            - 1)) Calculate the 20-sample standard deviation. Lines 2169, 2170, 2192.
            - 2)) If result of truncation errors in sum will cause standard deviation to be imaginary, set standard deviation to zero, send a message

to TTY saying that standard deviation was not going to be real, and wait for acknowledgement of notice. Lines 2177 through 2190.

- b) Else, the standard deviation is not good enough, so none will be calculated. Line 2197.

- 1)) Save the negative of the square root of the background counts. The minus sign is a flag that the value stored is not a real standard deviation, but is rather this square root. Line 2203.
- 2)) Write message to TTY stating that square root of background counts replaces standard deviation and that number of samples < *nsmpmn* (=4). Wait for acknowledgement. Lines 2204 through 2216.

- ii) If there were no background history data lines read (i.e., *nisnum.lt.1*), set the counter for information sets read (*nišnum*) to one. If the code gets to this point, this sample should be okay. Line 2220.

- (2) If the background batch and sample IDs match or sample is a duplicate, then no further calculations will be done—skip to the *end if* at line 2221 and return to the main routine.

B.3. Return background standard deviation—entry **gtsbbkg**(*numb,bkgtim,sbblnk,debug*). Lines 2225 through 2273 of subroutine **hbkgnd**.

- a. Set standard deviation (*sbblnk*) to most recently calculated value. Line 2228.
- b. Check to see if the standard deviation stored in memory is negative. If so, the value stored is minus the root of the number of counts [see par. II.B.2.a.(1)(c)i)b)]. Set *sbblnk* equal to the root of the counts divided by the live time. Lines 2232 through 2247.
- c. Check to see if there are no usable background history data available (*nisnum* < 1 .or. *.not.lflbkg*). Lines 2250, 2270.
  - (1) If so, (i.e., no usable data available),
    - (a) Write notice messages to TTY and wait for response (provided that this is the first time such a notice has been needed for this sample). Lines 1975 through 2267.
    - (b) Increment the warning counter. Line 2268.
    - (c) Set *sbblnk* equal to -1.1e25 as a flag. Line 2269.

B.4. Check to see if it is okay to write updated information on background history file—entry **hbkgchk**(*debug,bkgbat_id,bkgident*). Lines 2276 through 2323 of subroutine **hbkgnd**.

- a. Check to see if this file has already been checked (*lflchk*). Lines 2285, 2288, 2290.
  - (1) If so, return to main routine. Line 2287.
  - (2) Else, set file checked flag (*lflchk*) to true. Line 2289.
- b. Check to see whether background history file cannot be opened (*.not.lflbkg* is true). Lines 2292, 2294, 2322.
  - (1) If not (i.e., *.not.lflbkg* is true), then return to main routine. Line 2293.
  - (2) Else, check to see if batch and sample IDs of first sample on history file are not the same as current background batch and sample IDs and that the sample does not duplicate one on the history file ((*bkgidl.ne.bkgident .or. bkgbidl.ne.bkgbat_id*) .and. *.not.lbkdup*). Lines 2300, 2301, 2321.
    - (a) If the batch and sample IDs do not match and sample is not a duplicate, then
      - i) Write a message to TTY stating that no usable background history data are available and that empty history file will be written. Lines 2305 through 2309.

- ii) Send a message to TTY asking if ALPHA_MDA should be terminated immediately and wait for response. Lines 2310 through 2316.
    - a) If so, exit with call to SFTEXI. Lines 2317 through 2319.
- B.5. Write updated information on background history file—entry **hbkgwri**(*debug,nbr,bkgbat_id,bkgident*). Lines 2326 through 2382 of subroutine **hbkgnd**.
  - a. Check to see if the background history file name is not okay and that a history file cannot be opened (*.not.lflbkg*). Lines 2335, 2339, 2381.
    - (1) If so (i.e., background history file is not okay), write a message to that effect to TTY and go to end if at line 2381. Lines 2336 through 2338.
    - (2) Else, check to see if batch and sample IDs of first sample on history file are not the same as current background batch and sample IDs and that the sample does not duplicate one on the history file [(*bkgidl.ne.bkgident.or.bkgbidl.ne.bkgbat_id*).and.*.not.lbkdup*]. Lines 2345, 2346, 2380.
      - (a) If so, check to see if no usable background history data exist (*nisnum < 1*). Lines 2348, 2354.
        - i) If so, (i.e., no usable background history data available), write a message to TTY to that effect, write an empty file to background history, and return to main routine. Lines 2349 through 2353.
        - ii) Else, write up to 20 sets of background history data—batch and sample IDs, live time, and date and time sample added to history file; plus activity and 20-sample standard deviation for each nuclide. First line in each set has characters 31 through 52 of the blank history file name written at the end. Lines 2355 through 2379.
- C. Pack real number in coded form into integer—subroutine **reinpak**(*relnum,intnum*). Lines 2387 through 2434. Given a real*4 number (*relnum*), this routine creates a 1pe13.6 format in a particular coded fashion that is returned as an integer (*intnum*). If the number in the 1pe13.6 format is i.jklmnoe+ab, then the routine returns an integer abijklmno. If the number in the 1pe13.6 format is i.jklmnoe-ab, then the routine returns an integer -abijklmno. The number itself (i.jklmno) is placed in the seven rightmost digits with the decimal point suppressed and the exponent is placed in the eighth and higher digits from the right.
- D. Unpack number in integer coded form into real—subroutine **inreupk**(*relnum,intnum*). Lines 2437 through 2471. The integer coded format is explained in the discussion of the packing routine **reinpak** (see par. II.D). Subroutine **inreupk** reverses the process described for subroutine **reinpak** and returns the real*4 number (*relnum*) that is represented by the coded integer number (*intnum*).
- E. Exit and ask whether PROCESS.COM should also be terminated (**soft exit**)—subroutine **sftexi**(*iflexi*). Lines 2474 through 2503.
  - 1. Send a message to TTY saying that ALPHA_MDA is exiting and asking if PROCESS.COM should also terminate. Wait for a response. Lines 2479 through 2489.
  - 2. If response is not 'n' or 'N', send message to TTY saying that operator has told PROCESS.COM to quit. Lines 2492, 2493.
  - 3. Else,
    - a. Send message to TTY saying that operator has told PROCESS.COM to continue. Line 2495.
    - b. Change response message variable (*chyno*) to 'g'. Line 2498.
  - 4. Send response message variable (*chyno*) to system flag variable *alphaerr*. Line 2501.
  - 5. Call exit. Line 2502.
- F. Ring bell on TTY—subroutine **belrng**(*nring*). Ring bell *nring* times pausing about 1 s between each ring. Note that while this is called a bell, the normal sound on a TTY is a beep. Lines 2506 through 2515.

2.3 NDAL_PROCESS.COM

In NDAL_PROCESS.COM, there are a few changes near the call to ALPHA_MDA. There are other changes in the file that make it possible to process the background samples independently of the reagent blank and regular samples. A number of lines were added so that the warning and notice messages from processing the background samples independently could be written to a temporary file and then printed. The reason for this is that, in ALPHA_MDA, a number of messages are written to TTY followed by a halt in the processing until the operator acknowledges the warning. Most of these messages come about because something is "wrong" with the history file being accessed. Usually, what is wrong is that the file is nonexistent or empty or simply does not have enough lines of history information to make a proper standard deviation. This would happen whenever a history file was deleted either accidentally or by some system failure, or if the file was corrupted. The reason for issuing warning messages and stopping the processing is so the operator will be aware that something has gone wrong with the history file and take steps to correct the problem. However, there are instances for which a history file may be deliberately deleted. That should happen whenever a detector is replaced. The reason is that the background count levels based upon the old detector will be different from the new levels and thus the standard deviation will suddenly get large. The history files are missing or too small when the history calculations are first introduced to a new system. When a history file is being reconstructed, the operator must sit at the console reading and acknowledging notice messages. The customers decided that, because the reconstruction of the background history files for a particular detector does happen periodically, they would rather have the processing of backgrounds through NDAL_BKGD_HISTRY.COM and BKGD_HIST.FOR generate warning and notice messages on paper for the operators to read after the background samples had been processed rather than force the operator to sit at the console and watch for messages. This is the reason for the additions that make and print the temporary background processing warning and notice message file.

The remainder of this section explains the changes in some detail to make future maintenance of the code easier. A listing of the entire NDAL_PROCESS.COM file is included as Appendix 2.B. The line numbers shown in the appendix at the first of each line are referenced in the discussion of the code in this section. All additions and changes by Kirkpatrick are bracketed by comment cards starting with "jxk," which is Kirkpatrick's computer user ID.

- A. JXK modifications of the NDAL_PROCESS.COM file to process backgrounds separately are from lines 503 through 507. Modifications for handling of the warning and notice message file from processing backgrounds separately are from lines 147 through 184, 433 through 467, 513 through 545, and 1734 through 1776. Each block of changes is discussed below in turn.
  1. Prepare and initialize a formatted disk file called *[alpha.alusr.histry]jxktempnotemsg.dat*. This file is intended to collect all of the notice messages from all of the background samples processed by this execution of PROCESS.COM.
    - a. Determine whether *y12_bioassay.eqs*. 'Y' or *new_reagent_calc.eqs*. 'Y'. Lines 150 through 152, 183.
      - (1) If so,
        - (a) Construct the file name. Lines 153 through 156.
        - (b) Delete all old copies of the file provided that any exist. Lines 159 through 163.
        - (c) Open a new copy of the file with "append" access. Lines 168 through 174.
        - (d) Write header lines to the file. Set symbol *jxknotehdlncnt* = 2 to indicate that there are two lines of header messages. Lines 178 through 181.
        - (e) Close the file. Line 182.

2. Prepare and initialize a second formatted disk file called *[alpha.alusr.histry]jxktempbkmmsg.dat*. This file is intended to collect all of the notice messages from a single background sample being processed at the present moment.
  - a. Determine whether *y12_bioassay.eqs.* 'Y' or *new_reagent_calc.eqs.* 'Y'. Lines 435 through 437, 466.
    - (1) If so,
      - (a) Construct the file name. Lines 438 through 441.
      - (b) Delete all old copies of the file. Lines 444 through 447.
      - (c) Open a new copy of the file with 'append' access. Lines 452 through 459.
      - (d) Write header lines to the file. Set symbol *jxkbkhdlnent* = 2 to indicate that there are 2 lines of header messages. Lines 462 through 464.
      - (e) Close the file. Line 465.
3. Process backgrounds separately using DCL file NDAL_BKGD_HISTORY.COM. Line 505.
4. Append results from file *jxktempbkmmsg.dat* (from background sample just run) to file *jxktempnotemsg.dat* provided that any notice messages have been written to file *jxktempbkmmsg.dat*.
  - a. Determine whether *y12_bioassay.eqs.* 'Y' or *new_reagent_calc.eqs.* 'Y'. Lines 515 through 517, 544.
    - (1) If so,
      - (a) Set the lines read counter (*jxklinecnt*) to an initial value of 0. Line 523.
      - (b) Open file *jxktempbkmmsg.dat* and attempt to read a line from it three successive times. If an EOF is found, skip to label *jxkbkeof* at Line 533. Otherwise, increment the lines read counter (*jxklinecnt*) by one for each successful read. Lines 524 through 531.
      - (c) Close file *jxktempbkmmsg.dat*. Line 534.
      - (d) If number of lines read (*jxklinecnt*) > number of header lines put into file in the first place (*jxkbkhdlnent*), then append the contents of file *jxktempbkmmsg.dat* to file *jxktempnotemsg.dat*. Lines 537 through 540.
5. Print results from file *jxktempnotemsg.dat* (from all background samples run in this execution of PROCESS.COM) to file *jxktempnotemsg.dat* provided that any notice messages have been written to file.
  - a. Determine whether *y12_bioassay.eqs.* 'Y' or *new_reagent_calc.eqs.* 'Y'. Lines 1741 through 1743, 1772.
    - (1) If so,
      - (a) Set the lines read counter (*jxklinecnt*) to an initial value of zero. Line 1748.
      - (b) Open file *jxktempnotemsg.dat* and attempt to read a line from it three successive times. If an end of file is found, skip to label *jxknoteeof* at Line 1758. Otherwise, increment the lines read counter (*jxklinecnt*) by one 1 for each successful read. Lines 1749 through 1756.
      - (c) Close file *jxktempnotemsg.dat*. Line 1759.
      - (d) If number of lines read (*jxklinecnt*) > number of header lines put into file in the first place (*jxknotehdlnent*), print file *jxktempnotemsg.dat*. Lines 1762 through 1765.
      - (e) Delete all copies of file *jxktempnotemsg.dat*. Lines 1768 through 1771.

- B. So that the notice and error message file from processing backgrounds separately should be printed at the very end of a processing run, the "exit" statements in the PROCESS.COM file ahead of the subroutine for final quality assurance work (subroutine QA_PLOT_PARAM which starts at line 1778) were changed to "goto master_exit." Then, a "master_exit" statement was placed at line 1735, which is ahead of the QA_PLOT_PARAM subroutine). The changes from "exit" to "goto master_exit" occur at the following lines: 258, 1609, 1646, 1667, 1710, and 1730.
- C. JXK modifications of the NDAL_PROCESS.COM file in the region around the execution of ALPHA_MDA are from lines 1285 through 1315.
  - 1. Define *SYS\$INPUT* to be *SYS\$COMMAND* so that requests for a response from the ALPHA_MDA code will wait for a response from TTY rather than expecting to be passed something from the PROCESS.COM file. Line 1297.
  - 2. Set the flag variable *alphaerr* to "n." Line 1298.
  - 3. Check to see if the flag variable *alphaerr* is no longer "n" after ALPHA_MDA. If *alphaerr* has been reset, this is a flag that ALPHA_MDA has terminated by command. Lines 1302, 1303, 1314.
    - a. If so, check to see if the flag variable *alphaerr* has been reset to "g" by ALPHA_MDA. Lines 1306, 1307, 1310.
      - (1) If so, send a message to TTY saying that PROCESS.COM will go to next spectrum and go to label *ask_next_spec*. Lines 1308, 1309.
      - (2) Else, send a message to TTY saying that PROCESS.COM will abort as ordered and go to label *abort_exit*. Lines 1311 through 1313.

2.4 Y12.FOR

In Y12.FOR, there are a modest number of changes in the code. Kirkpatrick combined his changes with others done in January 1995 by J. L. Hilemon (computer user ID "jlh"). The remainder of this section explains each of the changes in some detail to make future maintenance of the code easier. A listing of the entire Y12.FOR file is included as Appendix 2.C. The line numbers shown in the appendix at the first of each line are referenced in the discussion of the code in this section. All additions and changes by Kirkpatrick are bracketed by comment cards starting with "jxk", which is Kirkpatrick's computer user ID.

- A. Read flag to determine whether this sample is a reagent blank (*xchar*). Lines 289, 290.
- B. Preset the state read from disk (*statrd*) to 13 blanks. Line 293.
- C. Check to see if this is a reagent blank sample (*xchar.eq.'R'*). Lines 294, 349.
  - 1. If so,
    - a. Set unit number for reading state from disk. Line 295.
    - b. Open file *dubl:[alpha.alusr.histry]jxktemp.dat*, which contains state for a reagent blank passed from ALPHA_MDA. Lines 300, 301.
    - c. Read state from disk file. EOF goes to statement 181 at line 304. Line 302.
    - d. An EOF reading sample state goes to statement 181, whose operations are described here. Line 304.
      - (1) Send message to TTY saying that EOF was reached while reading state from disk. Line 307.
    - e. Close file from ALPHA_MDA with *status='delete'* to make sure file is deleted. Lines 310, 311.
    - f. Check to see if the state read from disk (*statrd*) is any of eight values that represent a sample that is not okay: *unsuport*, *lost1*, *lost2*, *lost3*, *lost4*, *lost5*, *reproc*, and *recount*. Lines 317 through 324.
      - (1) If any of those "if" statements is true, code takes the branch to statement 191 at line 340.

- (2) Else, check to see if dpm alarm exceeded detection loop in lines 235 through 282 of the unmodified code has determined that the dpm alarm was exceeded and passed a state of *exceeded* to this point. Line 328.
  - (a) If so,
    - i) Send a message to TTY saying that dpm alarm has been exceeded and that operator will be given a chance to explain why. Lines 329 through 332.
    - ii) Take branch to statement 199 at line 350. This branch goes to the unmodified code to ask for a change in state one of the states that represents a sample not okay. If the operator attempts to say that the sample is still okay, then the unmodified code will insist on retaining the *exceeded* state. Line 333.
- g. Check to see if the state read from disk (*statrd*) is *ok*. Line 337.
  - (1) If so, code takes the branch to statement 191 at line 340.
  - (2) Else, take branch to statement 199 at line 350. This branch goes to the unmodified code to ask for a state. This branch is taken if *statrd* contained no recognizable state. This branch usually happens when the file *jxktemp.dat* is empty or nonexistent. That is most likely to happen if somehow the ALPHA_MDA.FOR execution went bad or, more likely, if this job is not being run with the *y12_bioassay_output* flag set so that ALPHA_MDA.FOR never did any of the special operations that are the subject of the present report. Line 339.
- h. If *statrd* contains a recognizable state and the dpm alarm was not exceeded, a *go to 191* branch is taken. The operations at and after statement 191 are explained here. Line 340.
  - (1) Set state to value read from disk (*statrd*). Line 343.
  - (2) Send message to TTY saying that state already determined to be value passed and that no manual input of state is needed. Lines 344 through 347.
  - (3) Take branch to statement 299 at line 422. This branch goes to the end of the modified code and resumes the unmodified code after the lines that accomplish the manual specification of the sample state. Line 349.
- i. The branch to statement 199 goes to this point. The lines following this are unmodified code doing the manual setting of the sample state. Line 350.
- j. The branch to statement 299 goes to this point. The lines following this are unmodified code after the manual setting of the sample state. Line 422.

2.5 BKGD_HIST.FOR CODE

The initial operating versions of the software modifications (as of about May 1995) added a background to the history file whenever the background was used for a reagent blank sample or a normal sample. As a consequence, the results of many background measurements were never added to the history. In particular, backgrounds were not processed for nuclides that did not happen to have other samples processed during the week. The customers decided that it would be best to make further alterations to the software so that, when the background samples were initially processed, they would be added to the history file. That was not a difficult modification to make. The PROCESS.COM file already had a loop that processed all of the background samples (at least, all those whose names showed up in a NAMES.DAT file) using the regions and library for each of the nuclides passed in the variable "actinide_list." It was not difficult to construct a small DCL file that would be executed by NDAL_PROCESS.COM for each detector and each nuclide. The DCL file (NDAL_BKGD_HISTRY.COM) executes a FORTRAN file called BKGD_HIST. The BKGD_HIST.FOR file contains copies of the background history logic from ALPHA_MDA.FOR. In effect,

it is a modified subset of ALPHA_MDA.FOR. A listing of the entire BKGD_HIST.FOR file is included as Appendix 2.D.

I. OPERATIONS IN MAIN ROUTINE

- A. Get value of symbol *bkgfilnam*, which is the background file name complete with path as generated by NDAL_BKGD_HISTRY.COM. Convert to uppercase. Lines 103 through 105.
- B. Open the background channel to *alpha0*. Lines 114 through 116.
- C. Note: This code is not called unless *y12_bioassay_output* .eq. 'YES'. Therefore, it is not necessary to make an "if" statement to check to see if the rest of this code should be executed.
  1. Find background batch ID field (*bkgbat_id*) and truncate result to 24 rightmost characters. Lines 141 through 149.
  2. Initialization of background history information—call *hbkgini(debug,nbr,bkgbat_id,bkgident,time_str)*. Line 152.
- D. Note: This code is not called unless *y12_bioassay_output* .eq. 'YES'. Therefore, it is not necessary to make an "if" statement to check to see if the rest of this code should be executed.
  1. Further process background history information to create 20-sample background standard deviation—call *hbkginf(debug,xnumb,bkgcts,bkgtim,bkgbat_id,bkgident)*. Lines 173 through 182.
- E. Note: This code is not called unless *y12_bioassay_output* .eq. 'YES'. Therefore, it is not necessary to make an "if" statement to check to see if the rest of this code should be executed.
  - a. Write updated information on background history file—call *hbkgwri(debug,nbr,bkgbat_id,bkgident)*. Line 199.

II. SUBROUTINES FOR REAGENT BLANK AND BACKGROUND HISTORY INFORMATION AND OTHER AUXILIARY OPERATIONS

- A. Note that this code does not deal with blank information, so no blank routines are present or discussed.
- B. Background information—subroutine *hbkgnd*. This version of *hbkgnd* was copied from ALPHA_MDA.FOR. Some changes were made to reroute the warning messages to a temporary file rather than to TTY. Describing the operations of the *hbkgnd* subroutine of BKGD_HIST.FOR in detail would be redundant because the description would be virtually identical to that of ALPHA_MDA.FOR. Instead, only the differences between the two versions of *hbkgnd* are described below.

B.1. Initialization of background information—entry *hbkgini(debug,nbr,bkgident)*. Lines 252 through 567 of subroutine *hbkgnd*.

- a. Get symbol *jxk_temp_bkmsg*, which is name of the file to be used for writing warning messages. Open file on unit 13 with *append* access. Lines 254 through 257.
- b. Check to see if *debug(1:1)* .eq. 'Y'. Lines 381, 398.
  - (1) Only if this statement is true will the code send warning message to TTY and wait for response.
  - (2) Send duplicate set of warning messages to unit 13. Lines 399 through 420.
- c. Check to see if *debug(1:1)* .eq. 'Y'. Lines 470, 473.
  - (1) Only if this statement is true will the code send warning message to TTY and wait for response.
  - (2) Send duplicate set of warning messages to unit 13. Lines 474 through 477.
- d. Check to see if *debug(1:1)* .eq. 'Y'. Lines 515, 520.
  - (1) Only if this statement is true will the code send warning message to TTY and wait for response.
  - (2) Send duplicate set of warning messages to unit 13. Lines 521 through 525.

B.2. Further processing of background history information to create 20-sample standard

deviation—entry **hbkginf**(*debug,numb,bkgcts,bkgtim,bkgbat_id,bkgident*). Lines 570 through 688 of subroutine **hbkgnd**.

- a. Check to see if *debug(1:1) .eq. 'Y'*. Lines 614, 624.
  - (1) Only if this statement is true will the code send warning message to TTY and wait for response.
  - (2) Send duplicate set of warning messages to unit 13. Lines 625 through 635.
- b. Check to see if *debug(1:1) .eq. 'Y'*. Lines 650, 666.
  - (1) Only if this statement is true will the code send warning message to TTY and wait for response.
  - (2) Send duplicate set of warning messages to unit 13. Lines 667 through 683.

B.3. Return background standard deviation—entry **gtsbbkg**(*numb,sbblnk,debug*). Lines 691 through 749 of subroutine **hbkgnd**. Note that *bkgtim* has been added to the argument list for entry **gtsbbkg** for ALPHA_MDA.FOR. Further note that **gtsbbkg** is not called from BKGD_HIST.FOR, so the changes described here are not relevant.

- a. Check to see if *debug(1:1) .eq. 'Y'*. Lines 704, 723.
  - (1) Only if this statement is true will the code send warning message to TTY and wait for response.
  - (2) Send duplicate set of warning messages to unit 13. Lines 724 through 743.

B.4. Check to see if it is okay to write updated information on background history file—entry **hbkgchk**(*debug,bkgbat_id,bkgident*). Lines 752 through 821 of subroutine **hbkgnd**. Note that **hbkgchk** is not called from BKGD_HIST.FOR, so the changes described here are not relevant.

- a. Check to see if *debug(1:1) .eq. 'Y'*. Lines 781, 798.
  - (1) Only if this statement is true will the code send warning message to TTY and wait for response.
  - (2) Send duplicate set of warning messages to unit 13. Lines 799 through 817.

B.5. Write updated information on background history file—entry **hbkgwri**(*debug,nbr,bkgbat_id,bkgident*). Lines 824 through 896 of subroutine **hbkgnd**.

- a. Check to see if *debug(1:1) .eq. 'Y'*. Lines 834, 839.
  - (1) Only if this statement is true will the code send warning message to TTY and wait for response.
  - (2) Send duplicate set of warning messages to unit 13. Lines 840 through 844.
- b. Check to see if *debug(1:1) .eq. 'Y'*. Lines 855, 859.
  - (1) Only if this statement is true will the code send warning message to TTY and wait for response.
  - (2) Send duplicate set of warning messages to unit 13. Lines 860 through 864.

2.6 NDAL_BKGD_HISTRY.COM

As was explained in the introduction to the BKGD_HIST.FOR file, the DCL file NDAL_BKGD_HISTRY.COM executes the FORTRAN file BKGD_HIST. The file NDAL_BKGD_HISTRY.COM is called by NDAL_PROCESS.COM from within a loop that processes all of the background samples in the NAMES.DAT file for each actinide in "actinide_list." A listing of the entire NDAL_BKGD_HISTRY.COM file is included as Appendix 2.E.

NDAL_BKGD_HISTRY.COM bears a strong resemblance to NDAL_PROCESS.COM, especially the portions of the latter that execute ALPHA_MDA to process the reagent blank and regular samples. NDAL_BKGD_HISTRY.COM is not so complex as to require a detailed explanation of its operations.

2.7 FORTOPEN.FOR

FORTOPEN.FOR is a very short FORTRAN code intended to open a formatted file with FORTRAN and then close it with "keep" disposition. Its listing is Appendix 2.F. FORTOPEN.FOR was written because, when a file is opened by VMS and then written to by FORTRAN, the carriage return-line feed sequence put at the end of each FORTRAN line does not work properly. Instead, the entire file looks like one very long line. FORTOPEN.FOR is not so complex as to require a detailed explanation of its operations.

APPENDIX 2.A LISTING OF FORTRAN CODE ALPHA_MDA.FOR, FILE VERSION AS OF MARCH 12, 1996

File is located on system B disk at dub0:[000000.nd_root.ndamscust.for]

Tue Mar 12 09:04:38 EST 1996

\$ cat -n alfmdat4.for

```

1
2 C          ***** ALPHA_MDA PROGRAM *****
3
4 C          ALPHA SPECTROMETRY SOFTWARE VERSION 1.0 23JUL91
5
6 C          PROGRAM [ALPHA.FOR]ALPHA_MDA.FOR
7
8 C          This program corrects activities by the amount the tracer is
off
9
10 C         It gets the isotope type from 'sample type'
11 C         and then decides which isotope is the tracer
12 C         It calculates the correction factor from this
13 C         and corrects the results accordingly
14 C         It also corrects the errors
15
16 C         FIX BUG 12-MAR-1992, R.L.FURGUSON (MARTIN MARRIETTA - X10)
17 C         TEST XNUCL FOR '-' TO PREVENT COUNTING THE TRACER ERROR TWICE
18
19 c         rsh 5/93 changes for LLNL and RJS
20 c         average eff digit was missing
21 c         yield digit was missing
22 c         adding lambda value to header
23
24 c         jxk 12/19/94-3/??/95 additions to calculate more modern MDA
25 c         and Lc including information from background and blank history
26 c         files
27 c         jxk 12/19/94-3/??/95
28
29
-----
30 C         cld file now used in nd_ams_com:
31 C         p1 = config, /bkg=areas/[no]trailer/header=reports.hdr
32 c         /[no]tracer[=x-nnn]
33 c
34 c         define verb alpha_mda
35 c         image nd_ams_com:alpha_mda.exe
36 c         parameter p1,value(required)
37 c         qualifier header,value(required),nonnegatable
38 c         qualifier trailer,negatable
39 c         qualifier bkg,value(required),nonnegatable
40 c         qualifier tracer,value(optional),negatable
41

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

c-----
42
43      options /g_float/extend
44      implicit integer*4 (a-z)
45      INCLUDE '($FORIOSDEF)'
46      include 'lib_cam:camdef.for'
47      include 'lib_cam:campardef.for'
48
49      integer*4 hlif(2),nbr,nrec,peak,DLIV(2)
50      INTEGER*4 pgm_stat
51
52      character*80 head1           !header line #1
53      character*80 head2           !header line #2
54
55      character*16 sbhdr,hlfu,name,hunits,nucl,xnucl,xconf,lib
56      character*16 nuclib,CER_FILENAME,BKG_FILENAME,TEMP_NUCL
57      character*16 SIDENT,BKGIDENT,SUNITS,tracer_name
58      character*60 elive,time_str,alpha_mda_file
59      character*23 ECALDATE,DCALDATE,astime,stime
60      CHARACTER*64 header_file,spec,bkg,cer_name
61      character*20 stitle
62      CHARACTER*8  actunits,isac,REGION,matrix,CONTROL_LIB
63      character*1  positive,recount
64      character*8  debug
65
66      data debug/'N'/
67
68      real *4 val,VAL_CORR,Squant,yield,LTIME,BKGAREA,AVRGEFF
69      real *4 lambda_value,TRACER_FWHM
70      real *4 mpc,crit,gamma,beta,q,mac,afrac,sp1,sp2,ival
71      real *4 cent,backg,fwhm,area,ener,ctss,perr,peff,efer,
72      1      fit,flg,psp1,psp2,pdum1,pdum2
73      real *4 engy,abun,spo,factor,actmult
74
75      real *8 act,err,nlactvty      !,actmult
76      real *8 mda,decay,wtmean,wtmaer,value,corfac,trerr,saerr
77      real *8 final,toterr,sac
78
79 c      Tracer certificate parameters
80
81      integer*4  cer_date(2)
82      real*4     cer_convert, cer_quant
83      character*8 cer_units
84      integer*4  cer_half(2)
85      character*8 cer_halfunits
86      character*8 cer_NUCL
87      real*4     cer_rate
88      real*4     cer_error
89      real*4     cer_abun
90      real*4     ndl_prntdecy

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

91
92 c      tracer decay calc parameters
93
94      real*4      hl_seconds, hl_secs2, tracer_decay
95      integer*4   hl_delta(2), samp_time(2), hl_timestamp(2)
96      INTEGER*4   af_len1, AF_LEN2
97
98 c..    parameters for lld, confid changes
99
100      real*4      lld_constant, conf_level
101
102 c..    chain of custody number   llnl special
103
104      character*16 chain_cust
105      character*16 batch_id
106      character*80 alpha0_file
107      character*80 alpha0_list
108
109      common/nline/engy,abun,peak,act,err,nucl,home,lflag,
110      1      sesc,desc,bcks,comp,sum,spo,dum1,dum2
111      common/nnucl/hlif,mpc,mda,gamma,beta,q,mac,frac,
112      1      decay,wtmean,wtmaer,nflag,key,sp1,sp2,dum3,dum4
113      common/peak/iter,cent,left,width,backg,fwhm,area,
114      1      ener,ctss,perr,peff,efer,fit,flg,psp1,psp2,pdum1,pdum2
115
116
-----
c-----
--
117 c      jxk 12/19/94-3/??/95 variables for new MDA and Lc
118      real*4 sbblnk,rbblnk,sbbkgd,bkgcts,bkgtim,wtmn4,blkerr,fnlerr
119      real*4 sbtotl,lsubc
120      real*4 dpm_alarm
121      character*4 y12_bioassay
122      character*4 srs_bioassay
123      character*4 new_reagent_calc
124      character*64 bkgbatred
125      character*24 bkgbat_id
126      character*16 ssprstr3
127 c      jxk 12/19/94-3/??/95
128
-----
c-----
--
129
130      CALL LIB$GET_SYMBOL('debug',debug,IS_LEN)
131      CALL STR$UPCASE(debug,debug)
132
133      S=LIB$GET_SYMBOL('time_str',time_str,IS_LEN)
134      IF(.NOT.S) CALL EXIT(S)
135
136      S=LIB$GET_SYMBOL('BKG_FILENAME',BKG_FILENAME,IS_LEN)

```


Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

137      call str$upcase(bkg_filename,bkg_filename)
138      IF(.NOT.S) CALL EXIT(S)
139
140      S=LIB$GET_SYMBOL('REGION_TYPE',REGION,IS_LEN)
141      IF(.NOT.S) CALL EXIT(S)
142
143      S=LIB$GET_SYMBOL('matrix_TYPE',matrix,IS_LEN)
144      IF(.NOT.S) CALL EXIT(S)
145
146      S=LIB$GET_SYMBOL('CONTROL_LIB',CONTROL_LIB,IS_LEN)
147      IF(.NOT.S) CALL EXIT(S)
148
149      S=LIB$GET_SYMBOL('SAC',ISAC,IS_LEN)
150      IF(.NOT.S) CALL EXIT(S)
151      DECODE(8,999,ISAC) SAC
152 999    FORMAT(F4.0)
153
154      S=LIB$GET_SYMBOL('alpha0_file',alpha0_file,af_LEN1)
155  C      TYPE *, 'AF_LEN1=',AF_LEN1
156      IF(.NOT.S) ALPHA0_FILE = ' MCA0:ALPHA0'
157
158      S=LIB$GET_SYMBOL('alpha0_list',alpha0_list,af_LEN2)
159
160
-----C-----
--
161  c      jxk 12/19/94-3/??/95 find y12bioassay flag to see if any of
162  c      this jxk stuff should be done
163      S=LIB$GET_SYMBOL('y12_bioassay',y12_bioassay,IS_LEN)
164  c      make the flag uppercase
165      CALL STR$UPCASE(y12_bioassay,y12_bioassay)
166      if(debug(1:1).eq.'Y')TYPE *, ' Y12_BIOASSAY ',Y12_BIOASSAY
167  c      jxk 12/19/94-3/??/95
168
-----C-----
--
169
170      S=LIB$GET_SYMBOL('SRS_BIOASSAY',SRS_BIOASSAY,IS_LEN)
171      CALL STR$UPCASE(srs_bioassay,srs_bioassay)
172      if(debug(1:1).eq.'Y')TYPE *, ' srs_BIOASSAY ',srs_BIOASSAY
173
174      S=LIB$GET_SYMBOL('new_reagent_calc',new_reagent_calc,IS_LEN)
175      CALL STR$UPCASE(new_reagent_calc,new_reagent_calc)
176      if(debug(1:1).eq.'Y')TYPE *, ' new_reagent_calc
',new_reagent_calc
177
178      pgm_stat = 1
179
180      if (cli$present('header')) then
181      status = cli$get_value('header',header_file,header_size)

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

182         endif
183
184 C..... HEADER FILE: read default header
185
186         status = LIB$GET_LUN(hdr_lu)
187         IF(.NOT.status) GO TO 10000
188
189 C         type *,header_file
190         OPEN(UNIT=hdr_lu,FILE=header_file,CARRIAGECONTROL='NONE',
191             1 STATUS='OLD',READONLY,ERR=11000,IOSTAT=STATUS)
192
193         read(hdr_lu,90) head1
194         read(hdr_lu,90) head2
195 90      format(a80)
196
197         close(hdr_lu)
198
199 C. . . .OPEN CONFIG's
200
201         if ( .not. cli$present('bkg')) then
202             bkg = 'old_work'
203         else
204             status = cli$get_value('bkg',bkg)
205         endif
206
207
208         status = cli$get_value('p1',spec)
209         IF(debug(1:1).eq.'Y')type *, ' p1 = ',p1
210         IF(debug(1:1).eq.'Y')type *, ' spec = ',spec
211         IF(debug(1:1).eq.'Y')type *, ' bkg = ',bkg
212
213         if(.not. cam_open(c,spec)) call exit
214         if(.not. cam_open(d,bkg)) call exit
215
216 C         FIND TRACER 1/93
217
218         if(.not.cam_getp(c,cam_t_ssprstr5,nuc1ib)) call exit(276)
219         CER_FILENAME=NUCLIB(1:16)
220         IF(debug(1:1).eq.'Y')type *, 'Certificate
filename=',cer_filename
221
222 C         FIND TRACER LAMBDA VALUE
223
224         if(.not. cam_getp(c,cam_F_ssp1,val))call exit
225         IF(debug(1:1).eq.'Y')type *, 'TRACER Lambda VALUE FROM
SSP1=',val
226         lambda_value = val             !save for printout/header
227
228 C         FIND CORRECTION FACTOR FOR NEPTUNIUM or Radium
229

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

230      if(.not. cam_getp(c,cam_F_ssp2,factor))call exit
231      IF(debug(1:1).eq.'Y')type *, 'NP/RA TRACER VALUE FROM
SSP2=',factor
232
233  c      pull out lld constant and confidence level
234
235      if(.not.cam_getp(c,cam_f_prsp1,conf_level)) call exit(276)
236      if(.not.cam_getp(c,cam_f_prsp2,lld_constant)) call exit(276)
237
238      if(conf_level .eq. 0.0) conf_level = 4.65
239
240
c-----
--
241  c      jxk 12/19/94-3/??/95 lld_constant default changed to 3.00
242      if (y12_bioassay(1:1).EQ.'Y'.or. srs_bioassay(1:1).eq.'Y') then
243          if(lld_constant .eq. 0.0) lld_constant = 3.00 ! if y12 or srs
244      else
245          if(lld_constant .eq. 0.0) lld_constant = 2.71 ! if not y12 or
srs
246      endif
247  c      jxk 12/19/94-3/??/95
248
c-----
--
249
250  c Now look up the tracer certificate file and pull out assay date and
251  c activity per lambda!
252
253      if (lambda_value .eq. 0) goto 95
254      cer_name = 'nd_ams_tracers://'nuclib(1:16)//'.cer'
255
256      if(.not. cam_open(cer,cer_name)) then
257          type *, ' Cannot open tracer certificate file: ',cer_name
258          call exit(276)
259      endif
260
261      call cam_countrec(cer,cam_cls_certif,cer_num)
262      if (cer_num .gt. 1) type *, ' Warning more than one record in
tracer file!'
263
264      if (.not. cam_getp(cer,cam_t_ctfNUCL,cer_NUCL)) call exit
265      call str$upcase(cer_nucl,cer_nucl) !make sure
cases match
266      if (.not. cam_getp(cer,cam_x_ctfdate,cer_date)) call exit
267      if (.not. cam_getp(cer,cam_f_ctfquant,cer_quant)) call exit
268      if (.not. cam_getp(cer,cam_f_ctfecnvfac,cer_convert)) call
exit
269      if (.not. cam_getp(cer,cam_t_ctfeunits,cer_units)) call exit
270      if (.not. cam_getp(cer,cam_x_ctfhlflife,cer_half)) call exit

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

271      if (.not. cam_getp(cer,cam_t_ctfhlfunits,cer_halfunits)) call
exit
272      if (.not. cam_getp(cer,cam_f_ctfrate,cer_rate)) call exit
273      if (.not. cam_getp(cer,cam_f_ctferror,cer_error)) call exit
274      if (.not. cam_getp(cer,cam_f_ctfabun,cer_abun)) call exit
275
276      if(.not.cam_close(cer)) call exit
277
278      IF(debug(1:1).eq.'Y')then
279      type *,' '
280      type *,'***** Tracer Certificate parameters *****'
281      type *,' cer name           ',cer_name
282      type *,' cer records        ',cer_num
283      type *,' cer date           ',cer_date
284      type *,' cer quantity       ',cer_quant
285      type *,' cer conversion factor ',cer_convert
286      type *,' cer units          ',cer_units
287      type *,' cer half life      ',cer_half
288      type *,' cer NUCLIDE        ',cer_NUCL
289      type *,' cer hl units       ',cer_halfunits
290      type *,' cer emission rate   ',cer_rate
291      type *,' cer rate error      ',cer_error
292      type *,' cer abundance       ',cer_abun
293      type *,'-----'
294      type *,' '
295      endif
296
297
298 c
-----
299 c      Calculate the activity of the tracer from assay date to sample
time
300
301 c      Convert hl time stamp to r*4 seconds
302
303      call ndl_dt2fs(cer_half,hl_seconds)
304
305 c      Calculate the time difference between the assay date and the
sample
306 c      time.
307
308      if(.not. cam_getp(c,cam_x_time,samp_time)) call exit (276)
309
310      status = ndl_abstimdiff(cer_date,samp_time,hl_delta)
311
312 c      Convert delta time stamp into seconds
313
314      call ndl_dt2fs(hl_delta,hl_secs2)
315
316 c      Now plug in parts to get decay factor

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

317
318         if (status .eq. 1) hl_secs2 = - hl_secs2
319
320         tracer_decay = ndl_prntdecy(hl_seconds,hl_secs2,0)
321
322         IF(debug(1:1).eq.'Y')then
323             type *,' -----'
324             type *,' hl seconds = ',hl_seconds
325             type *,' decay seconds ',hl_secs2
326             type *,' decay fac  = ',tracer_decay
327             type *,' status = ',status
328             type *,' -----'
329         endif
330
331 c      Now convert lambda (in val) to dpm expected at count time...
332 c      cer_rate is in DPM / ml.    1000 lambda = 1 ml.
333 c      Convert val to microcuries
334
335         val_CORR = val/1000.0 * cer_rate/tracer_decay
336         val = val_CORR/2.22E6
337
338         IF(debug(1:1).eq.'Y')TYPE *,' (VAL/60*37000)/1000 * rate/decay
= ',VAL
339 95      continue
340
341 c
-----
342
343
344 C      GET SAMPLE TITLE
345
346         if(.not. cam_getp(c,CAM_T_STITLE,STITLE))call exit
347
348
349 C      GET SAMPLE ID FOR BOTH SAMPLE AND BACKGROUND CONFIGURATIONS
350
351         if(.not. cam_getp(c,CAM_T_SIDENT,SIDENT))call exit
352         call str$upcase(sident,sident)
353         if(.not. cam_getp(D,CAM_T_SIDENT,BKGIDENT))call exit
354         call str$upcase(bkgident,bkgident)
355         if(.not. cam_getp(c,CAM_T_Sloctn,batch_id))call exit
356         call str$upcase(batch_id,batch_id)
357
358 C      GET SAMPLE TIME
359
360         if(.not. cam_getp_N(C,'STIME',STIME))call exit
361
362 C      GET ACQUISITION START TIME
363
364         if(.not. cam_getp_N(C,'ASTIME',ASTIME))call exit

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

365
366
367 C      FIND CALIBRATION DATES FOR ENERGY AND EFFICIENCY  1/95
368
369      if(.not.cam_getp_N(c,'ECALTIME',ECALDATE)) call exit(276)
370      IF(debug(1:1).eq.'Y')type *, 'ECALDATE =', ECALDATE
371
372      if(.not.cam_getp_N(c,'DCALTIME',DCALDATE)) call exit(276)
373      IF(debug(1:1).eq.'Y')type *, 'DCALDATE =', DCALDATE
374
375 C      FIND SAMPLE QUANTITY
376
377      if(.not. cam_getp(c,CAM_F_SQUANT,Squant))call exit
378      IF(debug(1:1).eq.'Y')TYPE *, 'SAMPLE QUANTITY=', SQUANT
379
380
381 C      GET SAMPLE UNITS
382
383      if(.not. cam_getp_N(C,'SUNITS',SUNITS))call exit
384
385
386 C      get activty units and multiplier
387
388      if(.not. cam_getp_N(C,'activunits',actunits))call exit
389      if(.not. cam_getp(C,cam_f_activmult,actmult))call exit
390
391
392 C      FIND ELAPSEd LIVE TIME
393
394      s=cam_getp(c,cam_x_elive,dliv)
395      call ndl_dt2fs(dliv,LTIME)
396      IF(debug(1:1).eq.'Y')type *, 'ELAPSED LIVE TIME=', LTIME
397
398
399 C      GET AVERAGE EFFICIENCY FROM SAMPLE
400
401      if(.not. cam_getp(C,CAM_F_AVRGEFF,AVRGEFF))call exit
402
403
404 C      FIND NUCLIDE LIBRARY from sample type
405
406      if(.not. cam_getp(c,cam_t_stype,lib))call exit
407
408
409      IF(debug(1:1).eq.'Y')type *, 'LIBRARY=', lib
410
411 C      FIND NUMBER OF NUCLIDES
412
413      if (.not. cam_countrec(c,cam_cls_nucl,nbr)) then
414      type *, ' Nid has not been run yet.'
```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

415      call exit
416      endif
417
418      IF(debug(1:1).eq.'Y')TYPE *, 'NUMBER OF NUCLIDES FOUND=',NBR
419
420
421      if (lambda_value .eq. 0) goto 101
422
423      C      pull up the tracer activity
424
425      if(.not. cam_gnucl_n(c,CER_NUCL,hlif,subhdr,hlfu,nnumb)) then
426      type *, ' Error from tracer read: Could not find ',CER_nucl,'
in NID results'
427      pgm_stat = 276      !1/93 set status flag
428      call exit(pgm_stat)
429      endif
430
431      i=1
432      s=cam_gnucl_1(c,nnumb,i,engy)      ! get peak #
433      s=cam_gpeak(c,peak,iter)      ! get tracer fwhm
434      tracer_fwhm=fwhm
435      if(CONTROL_LIB .EQ. 'GROSS-AM') TRACER_FWHM = 0
436      if(CONTROL_LIB .EQ. 'GROSS-NP') TRACER_FWHM = 0
437
438      IF(debug(1:1).eq.'Y')type *, 'wtmean=',wtmean
439      IF(debug(1:1).eq.'Y')type *, 'wtmaer=',wtmaer
440
441      C      if (wtmean .gt. 1.0E-12) goto 101      ! CHANGED FROM 0 TO .1
RJS 25MAY89
442      C
443      C      if there is no activity, then tracer is not found
444      C      report to screen and set exit bit.  What about qualitative
analysis?
445      C
446      C      type *, '      ***** TRACER NOT FOUND *****: ',CER_nucl
447      C      yield = 0.0
448      C      IF(.NOT.CAM_PUTP(C,CAM_F_ABUNDANLIM,YIELD)) CALL EXIT
449      C      IF(debug(1:1).eq.'Y')type *, 'YIELD=',yield
450      C      pgm_stat = 276      !1/93 set status flag
451      C      goto 1000
452
453      101      if (lambda_value .eq. 0) then
454      corfac=100.0/factor
455      IF(debug(1:1).eq.'Y')type *, 'MANUAL % CORRECTION
FACTOR=',corfac
456      else
457
458      c  val is converted to micro curies on the fly (from DPM)
459
460      corfac=val/(wtmean*Squant)

```


Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

461      IF(debug(1:1).eq.'Y')type *, 'NORMAL CORRECTION FACTOR=', corfac
462      endif
463
464 C      CALCULATE YIELD AND STORE BACK INTO CONFIGURATION
465 C      ALSO STORE YIELD IN NUCLIDE LIBRARY SPARE1 (NCLSP1)
466
467 100      continue
468      yield=100.0/corfac
469      IF(debug(1:1).eq.'Y')type *, 'YIELD=', yield
470      IF(.NOT.CAM_PUTP(C, CAM_F_ABUNDANLIM, YIELD)) CALL EXIT
471
472      SP1=YIELD
473      if (lambda_value .ne. 0) then
474      if(.not. cam_Pnucl_n(c, CER_NUCL, hlif, subhdr, hlfu, nnumb)) call
exit
475      endif
476
477      if (lambda_value .eq. 0) trerr=0
478      IF(debug(1:1).eq.'Y')type *, 'TRERR==', TRERR
479
480      if (lambda_value .ne. 0) trerr = wtmaer/wtmean ! tracer err
481      if (lambda_value .ne. 0) trerr = trerr**2 ! squared
482
483      IF(debug(1:1).eq.'Y')type *, 'TRACER ERROR**2=', trerr
484
485      hdr_lu = 6
486
487 C      type *, ' alpha0_list=', alpha0_list
488      OPEN(UNIT=hdr_lu, FILE=alpha0_list,
489      1 carriagecontrol='list',
490      1 STATUS='NEW', ERR=11000, IOSTAT=STATUS)
491
492      WRITE(6,25) head1 !write out header file line #1
493      WRITE(6,25) head2 !write out header file line #2
494      WRITE(6,35) !BLANK LINE
495 25      FORMAT(a80)
496
497      WRITE(6,30) time_str(:20)
498 30      FORMAT(22X, ' ALPHA SPECTROSCOPY REPORT',/, t30, a20)
499
500      WRITE(6,35)
501 35      FORMAT(X)
502
503      if(alpha0_file .ne. ' ') then
504 C      TYPE *, 'AF_LEN1=', AF_LEN1
505 C      TYPE *, 'ALPHA0_FILE=', alpha0_file(:af_len1)
506      WRITE(6,40)
507      write(6,344) alpha0_file(:af_len1)
508 344      format(' Spectral File: ', 1a<af_len1>)
509      endif

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

510
511      WRITE(6,40)
512  40      FORMAT(X,79('*'))
513
514      WRITE(6,36)
515  36      FORMAT(X,T40,'*')
516
517      call ndl_rjust(batch_id)
518      call ndl_rjust(sident)
519      WRITE(6,23) batch_id(:16),SIDENT
520  23      FORMAT(' BATCH ID:           ',A16
521                1      ,T40,'*',T45
522                1      , 'SAMPLE ID:           ',A16)
523
524      call ndl_rjust(stime)
525      call ndl_rjust(sunits)
526      WRITE(6,10) STIME,SQUANT,SUNITS(11:16)
527  10      FORMAT(' SAMPLE DATE:           ',A17
528                1      ,T40,'*',T45
529                1      , 'ALIQUOT:           ',1pe10.3,X,A6)
530
531      call ndl_rjust(stitle)
532      WRITE(6,5) STITLE,BKGIDENT
533  5      FORMAT(' SAMPLE TITLE: ',A20
534                1      ,T40,'*',T45
535                1      , 'DETECTOR NUMBER:           ',A3)
536
537      call ndl_rjust(astime)
538      WRITE(6,20) ASTIME,AVRGEFF*100.0
539  20      FORMAT(' ACQ DATE:           ',A17
540                1      ,T40,'*',T45
541                1      , 'AVERAGE EFFICIENCY:           ',F8.1,'%')
542
543      WRITE(6,15) LTIME,YIELD
544  15      FORMAT(' ELAPSED LIVE TIME:           ',F10.0
545                1      ,T40,'*',T45
546                1      , 'RECOVERY:           ',F8.2,'%')
547
548      call ndl_rjust(cer_filename)
549      WRITE(6,21) CER_FILENAME,TRACER_FWHM
550  21      FORMAT(' TRACER ID:           ',A16
551                1      ,T40,'*',T45
552                1      , 'TRACER FWHM (kev):           ',F8.2)
553
554      call ndl_rjust(REGION)
555      WRITE(6,22) lambda_value,REGION
556  22      FORMAT(' LAMBDA VALUE:           ',f7.0
557                1      ,T40,'*',T45
558                1      , 'ROI TYPE:           ',A8)
559

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

560      WRITE(6,26) VAL_CORR, conf_level
561 26    FORMAT(' TRACER DPM AT SAMPLE DATE: ',F7.3
562      1      ,T40,'*',T45
563      1      , 'CONFIDENCE LEVEL:           ',F6.2)
564
565      call ndl_rjust(matrix)
566      WRITE(6,27) matrix,lld_constant
567 27    FORMAT(' SAMPLE MATRIX:           ',A16
568      1      ,T40,'*',T45
569      1      , 'LLD CONSTANT:               ',F6.2)
570
571      call ndl_rjust(ecaldate)
572      call ndl_rjust(dcaldate)
573      WRITE(6,29) ECALDATE,DCALDATE
574 29    FORMAT(' ENERGY CAL DATE: ',A17
575      1      ,T40,'*',T45
576      1      , 'EFF CAL DATE:           ',A17)
577
578      CALL STR$UPCASE(bkg_filename,bkg_filename)
579      call ndl_rjust(BKG_FILENAME)
580      WRITE(6,28) bkg_filename
581 28    FORMAT(' BKG FILENAME:           ',A16
582      1      ,T40,'*')
583
584      IF (LIB .EQ. 'RA') WRITE(6,24) SAC
585 24    FORMAT(T40,'*',T45
586      1      , 'SAF:                       ',F4.2)
587
588      WRITE(6,36)
589      WRITE(6,40)
590      WRITE(6,35)
591      WRITE(6,45)
592 45    FORMAT(28X,'NUCLIDE ACTIVITY SUMMARY')
593      WRITE(6,35)
594
595
-----
--
596 c      jxk 12/19/94-3/??/95 change message written depending on
whether
597 c      this is y12 bioassay, or not
598      if (y12_bioassay(1:1).EQ.'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
599      WRITE(6,57)
600 57    FORMAT('
NUCLIDE',t10,'ENERGY',t19,'NET',t27,'BKG',t32,'%ABN',t39,
601      1  'ACTIVITY',t49,'TPU/ERROR',t63,'MDA',t71,'      L_C      ')
602      WRITE(6,60) actunits,sunits(11:16),
603      1      actunits,sunits(11:16),
604      2      actunits,sunits(11:16)

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

605      goto 58
606      endif
607 c      jxk 12/19/94-3/??/95
608
-----
--
609
610      IF (SRS_BIOASSAY(1:1).eq.'Y') THEN
611      WRITE(6,55)
612 55      FORMAT('
NUCLIDE',t10,'ENERGY',t19,'NET',t27,'BKG',t32,'%ABN',t39,
613      1      'ACTIVITY',t49,'TPU/ERROR',t63,'MDC',t71,'CRIT LEVEL')
614
615      WRITE(6,60) actunits,sunits(11:16),
616      1      actunits,sunits(11:16),
617      2      actunits,sunits(11:16)
618      goto 58
619      endif
620
621      WRITE(6,56)
622 56      FORMAT('
NUCLIDE',t11,'ENERGY',t20,'NET',t29,'BKG',t34,'%ABN',t43,
623      1      'ACTIVITY',t55,'TPU/ERROR',t71,'MDC')
624
625      WRITE(6,61) actunits,sunits(11:16),
626      1      actunits,sunits(11:16)
627
628 58      continue
629
630      WRITE(6,35)
631
632
-----
--
633 c      jxk 12/19/94-3/??/95
634      if (y12_bioassay(1:1).EQ.'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
635 c      initialize blank history file information
636      call hblkini(debug,nbr,batch_id,sident,yield,time_str)
637 c      get background batch i.d.
638 c      if (.not. cam_getp(d,cam_t_sloctn,bkgbat_id))
639 c      1 type *, ' no background batch i.d. field'
640      s=lib$get_symbol('backgnd',bkgbatred,is_len)
641      call str$upcase(bkgbatred,bkgbatred)
642      call ndl_rjust(bkgbatred)
643      bkgbat_id(1:24)=bkgbatred(41:64)
644 c      also, initialize background history file information
645      call hbkgini(debug,nbr,bkgbat_id,bkgident,time_str)
646 c
647 c      also, get dpm alarm threshold from ssprstr3

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

648      S=cam_getp(c,cam_t_ssprstr3,ssprstr3)
649      DECODE(8,999,ssprstr3) dpm_alarm
650      if(debug(1:1).eq.'Y')TYPE *, ' dpm_alarm ',dpm_alarm
651      endif                                     !if y12_bioassay
652  c      jxk 12/19/94-3/??/95
653
c-----
--
654
655  C      loop----
656
657      positive = 'N'
658      recount = 'N'
659
660      do xnumb=1,nbr
661      s=cam_gnucl(c,xnumb,hlif,xnucl,sbhdr,hunits)!get next nuclide
662      i=1
663      s=cam_gnucl_1(c,xnumb,i,engy)                ! get peak #
664
665      if (peak .NE. 0) GOTO 9905                    ! peak is a 0
666
667      WRITE(6,70) XNUCL
668  70      FORMAT(X,A6,5X,'MISSING, NOT IDENTIFIED BY NID, CHECK REGIONS
& ENERGY TOLERANCE')
669      WRITE(6,35)
670      GOTO 9900
671
672  9905      IF(debug(1:1).eq.'Y')TYPE *, 'WTMEAN BEFORE CORRECTION
FACTOR=',WTMEAN
673      wtmean=wtmean*corfac
674      IF(debug(1:1).eq.'Y')TYPE *, 'WTMEAN AFTER  CORRECTION
FACTOR=',WTMEAN
675
676
c-----
677  c      jxk 12/19/94-3/??/95
678      if (y12_bioassay(1:1) .EQ. 'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
679  c      get blank averaged activity in activity units
680      call gtrbblk(xnumb,rbblnk,debug)
681  c      if this is not a blank sample (rbblnk.gt.-1.e25), subtract
682  c      averaged blank activity from sample
683      if (rbblnk.gt. -1.e25) then
684  c      note that rbblnk <= -1.e25 also flags that something is wrong
685  c      with history data or file
686
687  c      Don't subtract reagent blank from the tracer peak 29-jun-95
rjs
688
689      if( xnucl .ne. CER_nucl) then

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

690          wtmean=wtmean-rbblnk
691      endif
692
693          IF(debug(1:1).eq.'Y')then
694      TYPE *, 'WTMEAN AFTER CORRECTION for blank',
695      1 ' activity=', WTMEAN
696      type *, ' avg blank activity ', rbblnk
697      endif !debug
698  c      blank activity needs to be stored in some spare string.
699  c      convert to a coded integer and store in memory location for
700  c      spare string dum3
701      call reimpak(rbblnk, dum3)
702      if(debug(1:1).eq.'Y')type *, ' coded integer for blank activity
', dum3
703      endif                                     !if rbblnk.gt. -1.e25
704      endif                                     !if y12_bioassay
705  c      jxk 12/19/94-3/??/95
706
-----
707
708      IF(debug(1:1).eq.'Y')TYPE *, 'WTMAER BEFORE CORRECTION
FACTOR=', WTMAER
709
710      s=cam_gpeak(d, peak, iter)                !get area, eff
711
712
-----
713  c      jxk 12/19/94-3/??/95
714      if (y12_bioassay(1:1) .EQ. 'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
715  c      if this is a new background, finish running sums for sb and
716  c      calculate average sb
717  c      bkgcts=ctss*ltime
718  c      units passed to background history file are counts/time
719      bkgcts=ctss
720      bkgtim=ltime
721      if(debug(1:1).eq.'Y')type *, ' ctss, ltime passed to hbkginf:
', ctss, ltime
722      call hbkginf(debug, xnumb, xnucl, bkgcts, bkgtim, bkgbat_id, bkgident)
723      endif                                     !if y12_bioassay
724  c      jxk 12/19/94-3/??/95
725
726
-----
727      BKGAREA = CTSS * LTIME
728      IF(debug(1:1).eq.'Y')type *, 'ORIGIONAL AREA -
OLD_WORK=', BKGarea !from old work
729      s=cam_gpeak(c, peak, iter)                !get yield, eff
730
731

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

c-----
732 c      jxk 12/19/94-3/??/95
733      if (y12_bioassay(1:1) .EQ. 'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
734 c      if this is a reagent blank, finish running sums for rbar and
sb
735 c      and calculate averages
736      wtmn4=wtmean
737      if(debug(1:1).eq.'Y')type *, ' wtmean4,xnumb passed to hblkinf
', wtmn4, xnumb
738      call hblkinf(debug, xnumb, xnucl, wtmn4, actmult, dpm_alarm, cer_nucl)
739      endif                                !if y12_bioassay
740 c      jxk 12/19/94-3/??/95
741
c-----
742
743      IF(debug(1:1).eq.'Y')type *, 'CORRECTION FACTOR FROM
WORK=', corfac      !from work
744      IF(debug(1:1).eq.'Y')type *, 'PEFF FROM WORK=', peff
745
746      IF(debug(1:1).eq.'Y')TYPE *, 'BKGAREA=', BKGAREA
747      IF(debug(1:1).eq.'Y')TYPE *, 'PEFF  =', PEFF
748      IF(debug(1:1).eq.'Y')TYPE *, 'ABUN  =', ABUN/100.0
749      IF(debug(1:1).eq.'Y')TYPE *, 'SQUANT =', SQUANT
750      IF(debug(1:1).eq.'Y')TYPE *, 'YIELD  =', YIELD/100.0
751      IF(debug(1:1).eq.'Y')TYPE *, 'ELAPSED LIVE TIME=', LTIME
752
753 c      rsh, pulling lld constant and confidence level from files
754
755
756      mda = SAC * actmult * (conf_level*sqrt(BKGarea)+lld_constant)
757      1
/(peff*37000.0*(ABUN/100.0)*Squant*(YIELD/100.0)*LTIME)
758
759      CRIT = SAC * actmult *
(conf_level/2.0*sqrt(BKGarea)+lld_constant)
760      1
/(peff*37000.0*(ABUN/100.0)*Squant*(YIELD/100.0)*LTIME)
761
762
c-----
763 c      jxk 12/19/94-3/??/95 calculate more modern mda and also lc
764      if (y12_bioassay(1:1) .EQ. 'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
765 c      get blank sample averaged standard deviation in muc1
766      call gtsbblk(xnumb, sbblnk, debug)
767 c      change blank std dev to dpm
768      sbblnk=sbblnk*actmult
769 c      get background averaged standard deviation in counts/time
770      call gtsbbkg(xnumb, bkgtim, sbbkdg, debug)

```


Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

771 c      if either sbblnk or sbbkgd returned with a value <= -1.e25,
772 c      this flags that something is wrong with either history data or
773 c      file(s)
774 c      therefore, do not calculate new mda and lsubc
775          lsubc=-1.
776          if (sbblnk.gt. -1.e25 .and. sbbkgd .gt. -1.e25) then
777 c      convert background to counts
778          sbbkgd=sbbkgd*ltime
779          if(debug(1:1).eq.'Y')type *, ' nuclide ',xnumb,' background std
dev counts, live time ',sbbkgd,ltime
780 c      convert background from counts to activity (dpm)
781          sbbkgd = SAC * actmult * ((sbbkgd))
782          1 /(peff*37000.0*(ABUN/100.0)*Squant*(YIELD/100.0)*LTIME)
783          if(debug(1:1).eq.'Y')type *, ' blank and background std dev
(activity) ',sbblnk,sbbkgd
784 c      sum the squares of the standard deviations
785          sbtotl=sqrt(sbblnk**2+sbbkgd**2)
786 c      calculate mda and lsubc in activity units (dpm)
787          mda = conf_level*(sbtotl)
788          1 + SAC * actmult * lld_constant
789          1 /(peff*37000.0*(ABUN/100.0)*Squant*(YIELD/100.0)*LTIME)
790          lsubc = (2.33*(sbtotl))
791          if(debug(1:1).eq.'Y')then
792          type *, ' conf_level,lld_constant ',conf_level,lld_constant
793          type *, ' sac,actmult,peff,abun,squant,yield,ltime'
794          type *, ' sac,actmult,peff,abun,squant,yield,ltime
795          type *, ' mda, lsubc ',mda,lsubc
796          endif !debug
797          endif          ! if sbblnk.gt. -1.e25 .and. sbbkgd .gt.
-1.e25
798          endif          !if y12_bioassay
799 c      jxk 12/19/94-3/??/95
800
-----
801
802 c      store mda value in nuclide spare string sp2
803
804          SP1=YIELD
805          sp2=mda
806          MPC=CRIT
807 c      jxk 12/19/94-3/??/95 for y-12 system, put lsubc into mpc in
808 if (y12_bioassay(1:1) .EQ. 'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
809 c      place of crit provided nonnegative value has been calculated
810 if (lsubc .ge. 0.) then
811     mpc=lsubc
812     IF(DEBUG(1:1).EQ.'Y') type *, ' lsubc stored in mpc in place of',
813     1 ' crit'
814     end if
815     end if          !if

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

y12_bioassay_output

```

816 c      jxk 12/19/94-3/??/95
817
818          IF(debug(1:1).eq.'Y')type *, 'YIELD=', YIELD
819          IF(debug(1:1).eq.'Y')type *, 'MDA=', SP2
820          IF(debug(1:1).eq.'Y')TYPE *, 'MPC=', MPC
821          IF(debug(1:1).eq.'Y')type *, ' '
822
823          if (wtmean .eq. 0) goto 9910
824
825          wtmaer=wtmaer*corfac
826          IF(debug(1:1).eq.'Y')TYPE *, 'WTMAER AFTER CORRECTION
FACTOR=', WTMAER
827          saerr = wtmaer/wtmean          ! sample err
828          IF(debug(1:1).eq.'Y')type *, 'SAERR=WTMAER/WTMEAN=', SAERR
829          saerr = saerr**2              ! squared
830          IF(debug(1:1).eq.'Y')type *, 'SAERR=SAERR**2=', SAERR
831
832
833 C      CODE TO AVOID COUNTING THE TRACER ERROR TWICE 12-MAR-1992, RLF
834 c      compare the strings of xnucl and CER_nucl, if they match then
skip.
835 c      I need a str compare for 6 characters, case insensitive.
836
837          if( xnucl .eq. CER_nucl) then
838              toterr = trerr
839          else
840              IF(debug(1:1).eq.'Y')type *, 'TRACER ERROR=', TRERR
841              IF(debug(1:1).eq.'Y')type *, 'SAMPLE ERROR=', SAERR
842              toterr = trerr + saerr
843              IF(debug(1:1).eq.'Y')type *, 'TOTAL ERROR=TRACER ERR + SAMPLE
ERR', TOTERR
844
845          if(wtmean*actmult .ge. crit) positive = 'Y'
846
847          if(CONTROL_LIB .EQ. 'GROSS-AM' .AND. CRIT .ge. 0.15) RECOUNT =
'Y'
848
849          if(CONTROL_LIB .EQ. 'GROSS-NP' .AND. CRIT .ge. 0.15) RECOUNT =
'Y'
850
851          if(CONTROL_LIB .EQ. 'AM' .AND. CRIT .ge. 0.067) RECOUNT = 'Y'
852          if(CONTROL_LIB .EQ. 'PU' .AND.
1          CRIT .ge. 0.067 .and.
853          2          xnucl .ne. 'PU-236') RECOUNT = 'Y'
854          if(CONTROL_LIB .EQ. 'UU' .AND. CRIT .ge. 0.500) RECOUNT = 'Y'
855
856          endif
857
858          final = wtmean*sqrt(toterr)          ! sample err *...

```

C-----

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

      859  c      jxk 12/19/94-3/??/95 add square of sbblnk to final error for
y12
      860      if (y12_bioassay(1:1) .EQ. 'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
      861      fnlerr=final**2
      862      blkerr=0.
      863      if (sbblnk.gt.-1.e25) blkerr=sbblnk/actmult
      864      blkerr=blkerr**2
      865      fnlerr=fnlerr+blkerr
      866      final=sqrt(fnlerr)*wtmean/abs(wtmean)
      867      IF(DEBUG(1:1).EQ.'Y') then
      868      type *, 'BLANK STD DEV(muCi), BLANK
ERROR**2',sbblnk/actmult,blkerr
      869      type *, 'FINAL ERROR=sqrt[(TRACER ERR**2 + SAMPLE ERR**2)*wtmean
+ ',
      870      1 'BLANK ERR**2]',final
      871      end if !debug
      872      end if                                     ! if
(y12_bioassay_outPU
      873  c      jxk 12/19/94-3/??/95
      874
-----
      875
      876      IF(debug(1:1).eq.'Y')type *, 'FINAL ERROR=',FINAL
      877      wtmaer = ABS(final)                ! put final in wtmaer
      878      IF(debug(1:1).eq.'Y')type *, 'WTMAER=ABS(FINAL)=',FINAL
      879
      880
      881  60      FORMAT(t19,'AREA',t38,a3,'/',A6,t50,'2-SIGMA',
      882      1      t60,a3,'/',A6,t71,a3,'/',a6)
      883  61      FORMAT(t20,'AREA',t42,a3,'/',A6,t56,'2-SIGMA',
      884      1      t68,a3,'/',A6)
      885
      886
-----
      887  c      jxk 12/19/94-3/??/95 skip the next block of jxk code if
mtmean.ne.0
      888      go to 9911
      889  c      jxk 12/19/94-3/??/95
      890
-----
      891
      892  9910      CONTINUE
      893
      894
-----
      895  c      jxk 12/19/94-3/??/95 if wtmean=0, then sample error calculated
      896  c      from blank standard deviation
      897      if (y12_bioassay(1:1) .EQ. 'Y'.or. new_reagent_calc(1:1).eq.'Y')
then

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

898         if(debug(1:1).eq.'Y')then
899         type *, ' wtmean = 0.      Therefore, sample error calculated ',
900         1 'from sqrt(2)*standard deviation of reagent blank'
901         type *, ' nuclide ',xnumb,' blk std dev ',sbblnk,' (dpm)'
902         endif !debug
903 c      divide by actmult to get back to native activity units (muci)
904         final=dsqrt(2.d0)*sbblnk/actmult
905         IF(debug(1:1).eq.'Y')type *, 'FINAL ERROR=',FINAL,' (dpm)'
906         wtmaer = (final)             ! put final in wtmaer
907         IF(debug(1:1).eq.'Y')type *, 'WTMAER=(FINAL)=' ,WTMAER,' (dpm)'
908         endif
909         9911 continue
910 c      jxk 12/19/94-3/??/95
911
-----
912
913         IF (CONTROL_LIB .EQ. 'GROSS-AM') XNUCL='GROSS'
914         IF (CONTROL_LIB .EQ. 'GROSS-NP') XNUCL='GROSS'
915
916
-----
917 c      jxk 12/19/94-3/??/95 don't write mpc if this is y12bioassay
918 c      and lsubc was not usable
919         if((y12_bioassay(1:1).eq.'Y'.or. new_reagent_calc(1:1).eq.'Y')
.and.
920         1      lsubc.lt.0.) then
921         WRITE(6,51)XNUCL,ENGY,AREA,BKGAREA,ABUN,
922         1  WTMEAN*actmult,2*WTMAER*actmult,MDA
923         goto 59
924         else
925         WRITE(6,50)XNUCL,ENGY,AREA,BKGAREA,ABUN,
926         1  WTMEAN*actmult,2*WTMAER*actmult,MDA,mpc
927
928 c      Don't print reagent activity for the tracer peak 29-jun-95 rjs
929
930         if((xnucl .ne. CER_nucl).and.(rbblnk.gt. -1.e25)) then
931         WRITE(6,52)rbblnk*actmult
932         52      format(t36,'(',1pe10.3,')')
933         endif
934         goto 59
935         end if
936 c      jxk 12/19/94-3/??/95
937
-----
938         50      FORMAT(X,A6,t10,F6.1,t16,f8.2,t24,f6.2,t31,F5.1,4(X,1PE10.3))
939         51      FORMAT(X,A6,t11,F6.1,t17,f8.2,t26,f6.2,t33,F5.1,3(3X,1PE10.3))
940
941         IF (SRS_BIOASSAY(1:1).eq.'Y') THEN
942         WRITE(6,50)XNUCL,ENGY,AREA,BKGAREA,ABUN,
943         1      WTMEAN*actmult,2*WTMAER*actmult,MDA,mpc

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

944      else
945      WRITE(6,51)XNUCL,ENGY,AREA,BKGAREA,ABUN,
946      1      WTIMEAN*actmult,2*WTMAER*actmult,MDA
947      endif
948
949 59      continue
950
951      WRITE(6,35)
952
953
954      IF (CONTROL_LIB .EQ. 'GROSS-AM') XNUCL='AM-241'
955      IF (CONTROL_LIB .EQ. 'GROSS-NP') XNUCL='NP-237'
956
957
-----C-----
958  c9900      s=cam_pnucl(c,xnumb,hlif,xnucl,sbhdr,hunits)
959  c          jxk 12/19/94-3/??/95
960
961      9900      continue
962
963  c          before writing the changed information such
964  c          as corrected activity, mda, lsubc to the sample data file
965  c          check to see that the history files can successfully be written
966  c          if not, file check routines will ask if alpha_mda and
process.com
967  c          should be terminated before the cam_pnucl statement writes the
968  c          changed information to the sample data file
969
970      if (y12_bioassay(1:1).EQ.'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
971          call hblkchk(debug)
972          call hbkgchk(debug,bkgbat_id,bkgident)
973      endif
974
975      s=cam_pnucl(c,xnumb,hlif,xnucl,sbhdr,hunits)
976
977  c          jxk 12/19/94-3/??/95
978
-----C-----
979
980      end do
981
982
-----C-----
983  c          jxk 12/19/94-3/??/95 if this sample is a blank, write blank
984
985      if (y12_bioassay(1:1).EQ.'Y'.or. new_reagent_calc(1:1).eq.'Y')
then
986
987  c          history information back to blank history file, including info

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

988 c      from this sample
989
990      call hblkwri(debug,nbr)
991
992 c      if this is a new background, write background
993 c      history information back to background history file, including
994 c      info from this sample
995
996      call hbkgwri(debug,nbr,bkgbat_id,bkgident)
997
998      endif                                !if y12_bioassay
999
1000 c      jxk 12/19/94-3/??/95
1001
-----
1002
1003      WRITE(6,40)
1004      WRITE(6,35)
1005      IF (TRACER_FWHM .GE. 100.0) WRITE(6,68)
1006 68      FORMAT(' *** Tracer FWHM > 100.0 Kev   ***')
1007
1008      if (lambda_value .eq. 0) goto 102
1009
1010      IF (CONTROL_LIB .EQ. 'GROSS-AM') GOTO 102
1011      IF (CONTROL_LIB .EQ. 'GROSS-NP') GOTO 102
1012
1013      IF (TRACER_FWHM .LT. 10.0) WRITE(6,76)
1014 76      FORMAT(' *** Tracer FWHM < 10.0 Kev   ***')
1015 102      CONTINUE
1016
1017      IF (yield .lt. 25.0) WRITE(6,69)
1018 69      FORMAT(' *** Chemical Recovery < 25.0% ***')
1019 c      yield max of 125 changed to 115 because value is 115 in y12.for
and
1020 c      in QA report (we suspect 125 is a typo error) -- JXK 2/20/95
1021      IF (yield .gt. 115.0) WRITE(6,71)
1022 71      FORMAT(' *** Chemical Recovery > 115.0% ***')
1023 c      JXK 2/20/95
1024
1025      IF (SRS_BIOASSAY(1:1) .ne. 'Y') GOTO 80
1026
1027      if (positive .eq. 'Y') write(6,72)
1028 72      format(' *** POSITIVE *** ')
1029
1030      if (CONTROL_LIB .EQ. 'PU' .AND. recount .eq. 'Y') write(6,73)
1031 73      format(' *** RECOUNT SAMPLE CL > 0.067 *** ')
1032      if (CONTROL_LIB .EQ. 'UU' .AND. recount .eq. 'Y') write(6,74)
1033 74      format(' *** RECOUNT SAMPLE CL > 0.500 *** ')
1034      if (CONTROL_LIB .EQ. 'AM' .AND. recount .eq. 'Y') write(6,78)
1035 78      format(' *** RECOUNT SAMPLE CL > 0.067 *** ')

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1036      if (CONTROL_LIB .EQ. 'NP' .AND. recount .eq. 'Y') write(6,79)
1037 79      format(' *** RECOUNT SAMPLE CL > 0.150 *** ')
1038      if (CONTROL_LIB .EQ. 'GROSS-AM' .AND. recount .eq. 'Y')
write(6,75)
1039 75      format(' *** RECOUNT SAMPLE CL > 0.150 *** ')
1040      if (CONTROL_LIB .EQ. 'GROSS-NP' .AND. recount .eq. 'Y')
write(6,77)
1041 77      format(' *** RECOUNT SAMPLE CL > 0.150 *** ')
1042
1043 80      CONTINUE
1044
1045      if ( cli$present('trailer')) then
1046      WRITE(6,35)
1047      WRITE(6,35)
1048      WRITE(6,35)
1049      WRITE(6,35)
1050      WRITE(6,64)
1051      WRITE(6,65)
1052 64      format(x, '_____',t30, '_____' )
1053 65      FORMAT(X, 'Analyst',T30, 'Date',///)
1054      WRITE(6,66)
1055      WRITE(6,67)
1056 66      format(x, '_____',t30, '_____' )
1057 67      FORMAT(X, 'Reviewer',T30, 'Date')
1058      endif          !trailer
1059
1060 10000    continue
1061 11000    continue          !see header file I/O
1062 1000    close(hdr_lu,dispose='KEEP')
1063      if(.not.cam_close(c)) call exit
1064      if(.not.cam_close(d)) call exit
1065      call exit (pgm_stat)
1066      end
1067
1068
c-----
--
1069 c      jxk 12/19/94-3/??/95
1070 c
1071 c - - subroutine hblank - - - - -
1072      subroutine hblank
1073 c      subroutine for processing blank history files and information
1074 c
1075      save
1076 c
1077 c      implicit integer*4 (a-z)
1078      integer*4 hlif(2),nbr,nrec,peak,DLIV(2)
1079      character*16 dext,sbhdr,hlfu,name,hunits,nucl,xnucl,xconf,lib
1080      character*16 SIDENT,BKGIDENT,SUNITS,tracer_name
1081      character*60 elive,time_str

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

1082      CHARACTER*8 DEBUG,actunits,isac,REGION,matrix,CONTROL_LIB
1083      real *4 val,VAL_CORR,Squant,yield,LTIME,BKGAREA,AVRGEFF
1084      real *4 engy,abun,spo,factor,actmult
1085      real *8 mda,decay,wtmean,wtmaer,value,corfac,trerr,saerr
1086      character*8 cer_NUCL
1087  c
1088      CHARACTER*1 char_reply
1089      character*13 OK,EXCEEDED,UNSUPPORT,LOST1,LOST2,LOST3,LOST4,LOST5,
1090  1 STATE
1091      character*13 REPROC,RECOUNT
1092      data      ok/'OK'                '/'
1093      data exceeded/'EXCEEDED'        '/'
1094      data unsupport/'UNSUPPORT'      '/'
1095      data      lost1/'SPILLED'        '/'
1096      data      lost2/'CLOGGED RESIN'/'
1097      data      lost3/'CHARRING'       '/'
1098      data      lost4/'ACCID SALVAGE'/'
1099      data      lost5/'OTHER'          '/'
1100      data reproc/'REPROCESS'         '/'
1101      data recount/'RECOUNT'         '/'
1102      data      state/'               '/'
1103  c
1104  c      allow space for 21 blank samples--20 read off of file and
1105  c      21st newly calculated.
1106      character*16 batch_id
1107      character*107 blkhfil
1108      character*80 jxktempfil
1109      character*80 jxk_temp_path
1110      character*80 blk_hist_path
1111      character*1 chyno
1112      character*107 blkhark
1113      integer*4 blkhun,lenmtrx,lenctlb,lentpa,lenbpa
1114  c      allow for up to 10 nuclides for each library
1115      parameter (nucele=10)
1116      character*8 nuclid(nucele)
1117      character*16 blkbid(21),blkid(21)
1118      real*4 nucact(21,nucele),rbrblk(21,nucele),
1119  1 sbeblk(21,nucele)
1120      character*20 blkpdat(21)
1121      character*8 xchar
1122      real*8 smxsq20(nucele),smx20(nucele),smx6(nucele),smxrt
1123      integer*4 ismx6,ismx20
1124      real*4 sbblnk,rbblnk
1125      logical*1 lflblk,lblsok,lflchk,lbdup
1126      integer*4 nrbwarn,nsbwarn
1127      integer*4 blkstun
1128      integer*4 numb,xnumb,n1,n2,nisnum
1129      integer*4 nsmpex
1130      real*4 wtmn4,dpm_alarm,sample_act
1131      integer*4 nsmpmn

```


Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

1132      data nsmpmn /4/
1133      integer*4 blkakun
1134      c
1135      c      note that units of blank history are activity (muci)
1136      c - - -
1137      entry hblkini(debug,nbr,batch_id,sident,yield,time_str)
1138      c      initial entry for blank history
1139      c      initialize flag to say that file not yet checked
1140      if (debug(1:1).eq. 'Y') then
1141      type *, ' enter hblkini(debug,nbr,',
1142      1 'batch_id,sident,yield,time_str'
1143      type *,debug,nbr,batch_id,sident,yield,time_str
1144      end if !debug
1145      lflchk=.false.
1146      c      initialize warning counters
1147      nrbwarn=0
1148      nsbwarn=0
1149      c      initialize duplicate sample flag
1150      lbldup=.false.
1151      c      get matrix type and library for history file name
1152      S=LIB$GET_SYMBOL('matrix_TYPE',matrix,lenmtrx)
1153      call str$upcase(matrix,matrix)
1154      S=LIB$GET_SYMBOL('CONTROL_LIB',CONTROL_LIB,lenctlb)
1155      call str$upcase(control_lib,control_lib)
1156      c      get file type and therefore sample type--
1157      c      r is reagent blank, s is sample, b is background
1158      S=LIB$GET_SYMBOL('xchar',xchar,IS_LEN)
1159      call str$upcase(xchar,xchar)
1160      c      if (xchar.eq.'B') xchar='b'
1161      c      if (xchar.eq.'R') xchar='r'
1162      c      if (xchar.eq.'S') xchar='s'
1163      c
1164      c      construct blank history file name
1165      c      blank history file name
1166      c
blkhfil=dub1:[alpha.alusr.histry.blk] 'matrix'_'control_lib'_blank.his
1167      blkhfil(1:45)='
1168      blkhfil(45+1:45+12)='
1169      if (lenmtrx+1+lenctlb+10 .le. 27) then
1170      S=LIB$GET_SYMBOL('blk_hist_path',blk_hist_path,lenbpa)
1171      call str$upcase(blk_hist_path,blk_hist_path)
1172      blkhfil(1:lenbpa)=blk_hist_path(1:lenbpa)
1173      blkhfil(lenbpa+1:lenbpa+lenmtrx)=matrix
1174      blkhfil(lenbpa+lenmtrx+1:lenbpa+lenmtrx+1)='_ '
1175      blkhfil(lenbpa+lenmtrx+2:lenbpa+lenmtrx+1+lenctlb)=control_lib
1176      blkhfil(lenbpa+lenmtrx+2+lenctlb:lenbpa+lenmtrx+1+lenctlb+10)=
1177      1 '_blank.his'
1178      call str$upcase(blkhfil,blkhfil)
1179      c      also construct history archive file name
1180      blkhark=blkhfil

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

1181      blkhark(lenbpa+lenmtrx+1+lenctlb+8:lenbpa+lenmtrx+1+lenctlb+10)=
1182      1 'ark'
1183      call str$upcase(blkhark,blkhark)
1184      blkhun=99
1185      blkakun=96
1186      if (debug(1:1) .eq. 'Y') then
1187      type *, ' blank history file to open'
1188      type *,blkhfil
1189      type *,'blkhark ',blkhark
1190      type *,'blk_hist_path=',blk_hist_path
1191      end if !debug
1192      open
(unit=blkhun,file=blkhfil,status='unknown',form='formatted')
1193      open
(unit=blkakun,file=blkhark,status='unknown',form='formatted',
1194      1 access='append')
1195 c      if the sample is not a blank, read the first set of blank
1196 c      history information into memory location 1
1197      if (xchar .ne. 'R') then
1198      nisnum=1
1199      read (blkhun,'(1x,a16,1x,a16,1x,a20)',end=991) blkbid(nisnum),
1200      1 blkid(nisnum),blkpdat(nisnum)
1201      call str$upcase(blkbid(nisnum),blkbid(nisnum))
1202      call str$upcase(blkid(nisnum),blkid(nisnum))
1203      call str$upcase(blkpdat(nisnum),blkpdat(nisnum))
1204      if (debug(1:1) .eq. 'Y') then
1205      type *, ' blank history sample no. ',
1206      1 nisnum
1207      type *, ' i.d. from history ',
1208      1 blkbid(nisnum),blkid(nisnum)
1209      type *, ' process date ',blkpdat(nisnum)
1210      end if !debug
1211      do xnumb=1,nbr
1212 c read activity, rbar, and sb for each nuclide
1213      read (blkhun,'(1x,3g15.8)',end=991)
1214      1 nucact(nisnum,xnumb),rbrblk(nisnum,xnumb),
1215      1 sbeblk(nisnum,xnumb)
1216      if (debug(1:1) .eq. 'Y') then
1217      type *, ' blank activities (muci)',
1218      1 ' for nuclide ',xnumb
1219      type *, ' act, rb, sb',
1220      1 nucact(nisnum,xnumb),rbrblk(nisnum,xnumb),
1221      1 sbeblk(nisnum,xnumb)
1222      end if !debug
1223      end do
1224      go to 999
1225 c end of file before finishing first read in blank history
1226      991 continue
1227      blkid(1)= '          blkeof991'
1228      blkbid(1)= '          blkeof991'

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1229      blkpdat(1)=time_str(1:20)
1230      nisnum=0
1231      type *, ' *** notice -- problem with blank history file '
1232      type *, ' End of file on blank history file before finish'
1233      type *, ' reading first line or first set of information'
1234      type *, ' Therefore, there is no usable blank history
information'
1235      type *, ' Blank history file probably empty or nonexistent'
1236      type *, ' '
1237      type *, '
CONTACT TECHNICAL SUPPORT'
1238      type *, ' '
1239      type *, ' Hit return to acknowledge this notice and continue...'
1240      call belrng(1)
1241      read (*, '(a1)') chyno
1242      c      do not create new blank history file from scratch because
1243      c      this is not a blank
1244      999 continue
1245      lblsok=.true.
1246      else
! if
xchar.ne.'r'
1247      c
1248      c      if this is a reagent blank, read old blank history information
1249      c      count the number of samples, and put information in memory
1250      c      into mem locations 2-21 to leave location 1 for new information
1251      c      sums for rbar and sb
1252      do xnumb=1,nbr
1253      smx6(xnumb)=0.
1254      smx20(xnumb)=0.
1255      smxsq20(xnumb)=0.
1256      end do
1257      ismx6=0
1258      ismx20=0
1259      c      put i.d. from sample into blank id(1)
1260      blkid(1)=sident
1261      blkbid(1)=batch_id
1262      blkpdat(1)=time_str(1:20)
1263      nisnum=1
1264      lblsok=.true.
1265      nl=2
1266      c      check to see if blank sample is ok
1267      type *, ' alpha_mda is processing reagent blank sample'
1268      type *, ' sample i.d. is ',xchar,' _ ',batch_id,' $ ',sident,
1269      1 ' _ ',control_lib
1270      c      first, check to see if yield is out of range
1271      if (yield.lt. 25.0 .or. yield.gt. 115.0) then
1272      type *, ' yield = ',yield,' out of range 25 < yield < 115'
1273      state(1:13)=unsupport(1:13)
1274      end if
1275      type *, ' please say if this sample is ok or not'
1276      if (state(1:13).eq.unsupport(1:13)) then

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1277      type *, ' yield is out of range.  This gives you a chance to say
',
1278      1 'why'
1279      end if
1280      type *, ' possible responses are'
1281  c
1282  35  type *, '
1283      type *, '          1) SAMPLE SPILLED'
1284      type *, '          2) CLOGGED RESIN'
1285      type *, '          3) CHARRING'
1286      type *, '          4) ACCIDENTAL SALVAGING'
1287      type *, '          5) REPROCESS'
1288      type *, '          6) RECOUNT'
1289      type *, '          7) OTHER'
1290      type *, '
1291      type *, '          8) SAMPLE IS OK'
1292      type *, '
1293      write(*,60)
1294  60  format('$          Select number (1 thru 8) # ')
1295      read(*,26) char_reply
1296  26  format(a1)
1297      if(char_reply .ge. '1' .and. char_reply .le. '8') goto 30
1298      type *, '          Invalid response, try again...'
1299      go to 35
1300
1301  30  if (char_reply .eq. '1') state(1:13)=lost1(1:13)      !SPILLED
1302      if (char_reply .eq. '2') state(1:13)=lost2(1:13)      !CLOGGED
RESIN
1303      if (char_reply .eq. '3') state(1:13)=lost3(1:13)      !CHARRING
1304      if (char_reply .eq. '4') state(1:13)=lost4(1:13)      !SALVAGE
1305      if (char_reply .eq. '5') state(1:13)=reproc(1:13)      !REPROCESS
1306      if (char_reply .eq. '6') state(1:13)=recount(1:13)     !RECOUNT
1307      if (char_reply .eq. '7') state(1:13)=lost5(1:13)      !OTHER
1308  c      if (char_reply .eq. '8') STATE(1:13)=OK(1:13)      !OK
1309  c
1310  c      if operator said sample is ok, and yield is ok, set state to ok
1311  c      if ((ireply.eq.8) .and.
1312  c      1 ((state(1:13).ne.exceeded(1:13)) .or.
1313  c      jxk 2/17/95 I think it ought to be "and", not "or"
1314  c      1 ((state(1:13).ne.exceeded(1:13)) .and.
1315  c      1 (state(1:13).ne.unsuport(1:13)))) then
1316  c      2/17/95 "exceeded" logic not implemented.  if activity exceeds
1317  c      alarm limits, it is caught in y12.for or may be caught in
hblkinf
1318      if ((char_reply.eq.'8') .and.
1319      1 (state(1:13).ne.unsuport(1:13)))) then
1320      state(1:13)=ok(1:13)
1321  c      type *, ' state of the sample is ',state(1:13)
1322      lblsok=.true.
1323      else

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1324 c      sample is not ok
1325      nisnum=0
1326      nl=1
1327      lblsok=.false.
1328      end if
1329      if (debug(1:1) .eq. 'Y')
1330      1 type *, ' state of the sample is ', state(1:13)
1331 c
1332 c      pass sample state in file dubl:[alpha.alusr.histry]jxktemp.dat
1333      blkstun=97
1334      S=LIB$GET_SYMBOL('jxk_temp_path',jxk_temp_path,lentpa)
1335 c      open (unit=blkstun,file='nd_ams_histry:jxktemp.dat',
1336      jxktempfil(1:lentpa)=jxk_temp_path(1:lentpa)
1337      jxktempfil(lentpa+1:lentpa+12)='jxktemp.dat;'
1338 c      type *, ' temp file name ', jxktempfil
1339      open (unit=blkstun,file=jxktempfil,
1340      1 status='unknown',form='formatted')
1341      rewind (blkstun)
1342      endfile (blkstun)
1343      rewind (blkstun)
1344      write (blkstun,'(1x,a13)') state(1:13)
1345      if (debug(1:1) .eq. 'Y') type *, ' blank sample state passed to
1346      1 'file nd_ams_histry:jxktemp.dat ', state(1:13)
1347      endfile (blkstun)
1348      close (blkstun,disp='keep')
1349 c
1350      do num=nl,nl+19
1351 c      read history sample i.d.
1352 c      note: history samples are loaded in the order of newest to
1353 c      oldest
1354 c      this sample is a blank, therefore load history samples from 2
1355 c      to 21 to leave room
1356 c      for this sample in mem location 1
1357      read (blkhun,'(1x,a16,1x,a16,1x,a20)',end=1009)
blkbid(nisnum+1),
1358      1 blkid(nisnum+1),blkpdat(nisnum+1)
1359      call str$upcase(blkbid(nisnum+1),blkbid(nisnum+1))
1360      call str$upcase(blkid(nisnum+1),blkid(nisnum+1))
1361      call str$upcase(blkpdat(nisnum+1),blkpdat(nisnum+1))
1362      nisnum=nisnum+1
1363      if (debug(1:1) .eq. 'Y') then
1364      type *, ' blank sample no. ', nisnum
1365      type *, ' i.d. from history ', blkbid(nisnum), blkid(nisnum)
1366      type *, ' process date ', blkpdat(nisnum)
1367      end if !debug
1368      do xnumb=1,nbr
1369 c read activity, rbar, and sb for each nuclide
1370      read (blkhun,'(1x,3g15.8)',end=1001)
1371      1 nucact(nisnum,xnumb),rbrblk(nisnum,xnumb),

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1372      1 sbeblk(nisnum,xnumb)
1373      go to 1002
1374  1001 continue
1375      type *, ' abnormal end of file on blank history file'
1376      nisnum=nisnum-1
1377      go to 1009
1378  1002 continue
1379      if (debug(1:1) .eq. 'Y') then
1380      type *, ' blank activities (muci)',
1381      1 ' for nuclide ',xnumb
1382      type *, ' act, rbar, sb ',
1383      1 nucact(nisnum,xnumb),rbrblk(nisnum,xnumb),
1384      1 sbeblk(nisnum,xnumb)
1385      end if !debug
1386  c      sums for rbar and sb
1387      if (ismx6.lt.5) then
1388      smx6(xnumb)=smx6(xnumb)+nucact(nisnum,xnumb)
1389      if (xnumb.eq.nbr) ismx6=ismx6+1
1390      if (debug(1:1) .eq. 'Y') then
1391      type *, ' record, nuclide, ismx6, smx6'
1392      type *,nisnum,xnumb,ismx6,smx6(xnumb)
1393      end if !debug
1394      end if
1395      if (ismx20.lt.19) then
1396      smx20(xnumb)=smx20(xnumb)+nucact(nisnum,xnumb)
1397      smxsq20(xnumb)=smxsq20(xnumb)+nucact(nisnum,xnumb)**2
1398      if (xnumb.eq.nbr) ismx20=ismx20+1
1399      end if
1400      end do                                     ! do
xnumb=1,nbr
1401  c      compare current sample i.d. to one just read to check for
duplicate
1402  c      don't bother to check if duplicate already found or if nisnum=1
1403      if (nisnum.gt.1 .and.
1404      1      blkid(nisnum).eq.blkid(1)
1405      1      .and. blkbid(nisnum).eq.blkbid(1) .and. .not.lbldup)
then
1406      lbldup=.true.
1407      if (debug(1:1) .eq. 'Y') then
1408      type *, ' reagent blank sample 1 id:'
1409      type *,blkbid(1),blkid(1)
1410      type *, ' duplicates sample ',nisnum,' id:'
1411      type *,blkbid(nisnum),blkid(nisnum)
1412      end if !debug
1413  cjxktestC      TEST TEMPORARILY REFUSE TO RECOGNIZE DUPLICATES
1414  cjxktest      LBLDUP=.FALSE.
1415      end if
1416      end do                                     ! do
num=2,21
1417  c      end of file on blank history

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1418 1009 continue
1419     if (debug(1:1) .eq. 'Y') type *, ' blank history end of file, ',
1420     1 ' sample info sets 2 thru',nisnum,' read'
1421         if (nisnum .lt. 1) then
1422             type *, ' blank history end of file reached ',
1423             1 'before any info sets read'
1424             nisnum=0
1425         end if
1426 c     if the current i.d. duplicates any others, put information from
1427 c     mem location 2 into location 1--no new rbar or std dev will
1428 c     be calculated
1429         if (lbldup) then
1430             blkid(1)=blkid(2)
1431             blkbid(1)=blkbid(2)
1432             blkpdat(1)=blkpdat(2)
1433             do xnumb=1,nbr
1434                 nucact(1,xnumb)=nucact(2,xnumb)
1435                 rbrblk(1,xnumb)=rbrblk(2,xnumb)
1436                 sbeblk(1,xnumb)=sbeblk(2,xnumb)
1437             end do
1438         end if
1439     endif                                     ! if
xchar.ne.'r'
1440         lflblk=.true.
1441     else                                     ! if lenmtrx+1+lenctlb+10
.le. 27
1442 c     blank history file name too long--can't open file and read
1443 c     history info
1444         type *, ' *** blank history file name too long, matrix',
1445         1 ' name length ',lenmtrx
1446         type *, ' library name length ',lenctlb, ' ***'
1447         lflblk=.false.
1448 c     ask if alpha_mda should be terminated immediately
1449         type *, '      ***'
1450         type *, ' Blank history file can not be written'
1451         type *, ' because usable history file name can not be
constructed'
1452         type *, '      ***'
1453         type *, ' This may be a serious problem'
1454         type *, ' '
1455         type *, ' CONTACT TECHNICAL SUPPORT'
1456         type *, ' '
1457         type *, ' Do you want to terminate alpha_mda before writing'
1458         type *, ' any changes to the sample data files? [yes]'
1459         type *, ' '
1460 c     type *, ' any response except n or N is considered a yes'
1461 c     type *, ' (i.e., terminate)'
1462         call belrng(3)
1463         read (*,'(a1)') chyno
1464         if (chyno .ne. 'n' .and. chyno .ne. 'N') then

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

1465      call sftexi(blkhun)
1466      end if
1467      endif                                ! if lenmtrx+1+lenctlb+10
.le. 27
1468  c
1469      return
1470  c
1471  c - - -
1472      entry hblkinf(debug,numb,xnucl,wtmn4,actmult,dpm_alarm,cer_nucl)
1473      if (debug(1:1).eq.'Y') then
1474      type *, ' from hblkinf: debug,numb,wtmn4', debug,numb,wtmn4
1475      type *, ' xchar,lblsok,lbdup ',xchar,lblsok,lbdup
1476      end if !debug
1477  c      finish running sums for rbar and sb and calculate averages
1478      xnumb=numb
1479      nuclid(xnumb)=xnucl(1:8)
1480  c      if this is blank, finish running sums for rbar and sb
1481  c      provided blank sample is ok and no duplicates
1482      if (xchar.eq.'R' .and. lblsok .and. .not.lbdup) then
1483      if (debug(1:1).eq.'Y') type *, ' reagent blank sample(=record
1) .',
1484      1 ' nuclide ',xnumb,numb,' activity ',wtmn4
1485  c
1486  c      check for activity exceeding alarm limit
1487      if (xnumb.eq.1) then
1488      nsmplex=0
1489      sample_act=0.
1490      end if
1491  c do not add tracer activity. similar code in y12.for. jxk 3/6/96
1492      if (xnucl.ne.cer_nucl) sample_act=sample_act+wtmn4*actmult
1493      if (sample_act.gt. dpm_alarm .and.
1494      1      wtmn4*actmult.gt. dpm_alarm) then
1495  c      this is an exceeds condition. it means the sample is not ok
1496      lblsok=.false.
1497  c      send warning messages and ask the operator what to do
1498      type *, ' '
1499      type *, ' ***          ***          ***          ***          ***          ***'
1500      type *, ' sum of reagent blank activities for nuclides 1 through
',
1501      1 xnumb
1502      type *, '      = ',sample_act,' (dpm)',
1503      1 ' exceeds alarm limit of ',dpm_alarm,' (dpm)'
1504      type *, ' '
1505  c jxk 2/23/95 there is a mixture of type *,data and write
(*,formatno)
1506  c statements here. For reasons i never understood, the type
statements
1507  c didn't always break the lines where i thought they should.
1508      write (*,9102)
1509      9102 format (' An exceeds alarm limit condition should be rare for a

```


Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1510      1 'reagent blank sample')
1511      write (*,9103)
1512      9103 format (' and may indicate either that the sample is faulty')
1513      write (*,9104)
1514      9104 format (' or else the sample is ',
1515      1 'mislabelled')
1516      type *,' '
1517      type *,' this may be a serious problem'
1518      type *,' '
1519      write (*,9107)
1520      9107 format (' The results from this sample will NOT be added to
the'/
1521      1 ' reagent blank history file.')
1522      type *,' '
1523      type *,' You have 2 choices: 1. Continue processing this ',
1524      1 'sample.'
1525      type *,' 2. Terminate the processing of ',
1526      1 'this sample by alpha_mda.'
1527      type *,' '
1528      type *,' *** CONTACT TECHNICAL SUPPORT ***'
1529      type *,' '
1530      type *,' Hit return to acknowledge this warning'
1531      write (*,9111)
1532      9111 format (' You will be asked whether ',
1533      1 'you wish to continue processing the sample '/' or terminate')
1534      nsmplex=nsmplex+1
1535      if (nsmplex.gt.1) then
1536      write (*,9116) nsmplex
1537      9116 format (' (This is the ',i5,'-th time ',
1538      1 'you have been asked these questions)')
1539      write (*,9117)
1540      9117 format (' (The reason you are being asked again is that the ',
1541      1 'activity for nuclide ')
1542      write (*,9118) xnumb
1543      9118 format (' ',i5,' is greater than the alarm limit ',
1544      1 'all by itself)')
1545      end if
1546      call belrng(1)
1547      read (*,'(a1)') chyno
1548      c ask if alpha_mda should be terminated immediately
1549      type *,' Do you want to terminate alpha_mda right now? [yes]'
1550      type *,' '
1551      c type *,' any response except n or N is considered a yes'
1552      c type *,' (i.e., terminate)'
1553      call belrng(3)
1554      read (*,'(a1)') chyno
1555      if (chyno.ne. 'n' .and. chyno.ne. 'N') then
1556      call sftexi(blkhun)
1557      end if

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1558          end if                                ! if (wtmn4*actmult .gt.
dpm_alarm
1559  c
1560  c      if sample is no longer ok, skip the rest of this routine and
return
1561          if (.not. lblsok) then
1562              if (debug(1:1) .eq. 'Y') then
1563                  type *, ' blank sample no longer ok.  Skip further processing ',
1564                  1 ' of blank information'
1565                  type *, ' and return from hblkinf to main'
1566                  end if !debug
1567          return
1568          end if                                ! if (.not.
lblsok
1569  c      load activity into nucact and complete running sums
1570          nucact(1,xnumb)=wtmn4
1571          smx6(xnumb)=smx6(xnumb)+nucact(1,xnumb)
1572          smx20(xnumb)=smx20(xnumb)+nucact(1,xnumb)
1573          smxsq20(xnumb)=smxsq20(xnumb)+nucact(1,xnumb)**2
1574  c      increment counters for sums of 6 and 20.  do this on first
1575  c      nuclide
1576          if (xnumb .eq. 1) then
1577              ismx6=ismx6+1
1578              ismx20=ismx20+1
1579          end if
1580  c      calculate average activity and std dev
1581          if (ismx6.gt.0) then
1582              rbrblk(1,xnumb)=smx6(xnumb)/float(ismx6)
1583              if (debug(1:1).eq. 'Y') then
1584                  type *, ' blank average activity ',
1585                  1 ' calculated for nuclide ',xnumb
1586                  type *, ' blank avg activity ',rbrblk(1,xnumb)
1587              end if !debug
1588          else
1589              type *, ' average blank activity = 0 for nuclide ',xnumb
1590              rbrblk(1,xnumb)=0.
1591          end if
1592  c      if (ismx20.gt.1) then
1593  c      1/25/95 send zero standard deviation unless at least nsmpmn
(=4) samples
1594          if (ismx20.ge.nsmpmn) then
1595              smxrt=(smxsq20(xnumb)-smx20(xnumb)**2/
1596              1 dfloat(ismx20))/dfloat(ismx20-1)
1597          if (debug(1:1).eq. 'Y') then
1598              type *, ' terms for blank std dev for ', 'nuclide ',xnumb
1599              type *, ' smxsq20,smx20,ismx20,sum term'
1600              type *,smxsq20(xnumb),smx20(xnumb),ismx20,smxrt
1601          end if !debug
1602  c      check to see that std deviation will be real
1603          if (smxrt.lt. 0.) then

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

1604      smxrt=0.
1605      c      if sum of terms for root is small, then negative value is
probably due
1606      c      to truncation error
1607      if (dabs(smxrt).gt. 1.d-8*nucact(1,xnumb)**2) then
1608      type *, ' * * * * * '
1609      type *, ' blank standard deviation not real for nuclide ',xnumb
1610      type *, ' zero will be returned'
1611      type *, ' this may be a serious problem'
1612      type *, ' '
1613      type *, ' Hit return to acknowledge this notice and continue...'
1614      call belrng(1)
1615      read (*,'(a1)') chyno
1616      end if
1617      end if
1618      sbblnk(1,xnumb)=dsqrt(smxrt)
1619      if (debug(1:1).eq. 'Y') then
1620      type *, ' blank std dev calculated ', 'for nuclide ',xnumb
1621      type *, ' blank std dev ',sbblnk(1,xnumb)
1622      end if !debug
1623      else
1624      type *, ' * * * * * '
1625      type *, ' blank activity standard deviation = 0 for nuclide
',xnumb
1626      type *, ' number of samples = ',ismx20,' < ',nsmprn
1627      type *, ' * * * * * '
1628      c      it is only necessary to acknowledge the warning the first time
1629      if (xnumb.eq.1) then
1630      type *, ' '
1631      type *, ' Hit return to acknowledge this notice and continue...'
1632      call belrng(1)
1633      read (*,'(a1)') chyno
1634      end if
1635      sbblnk(1,xnumb)=0.
1636      end if
1637      c      if no blank data read, but this sample is ok, set nisnum=1
1638      if (nisnum.lt.1) nisnum=1
1639      end if
! if xchar .eq. 'r' .and.
lblsok
1640      return
1641      c
1642      c - - -
1643      entry gtsbblk(numb,sbblnk,debug)
1644      c      return blank standard deviation for this nuclide
1645      xnumb=numb
1646      sbblnk=sbblnk(1,xnumb)
1647      c      if no usable data available, write error message and set result
1648      c      to -1.1e25 as a flag
1649      c      if (nisnum.lt.1 .or. .not.lfblk .or. .not.lblsok) then
1650      c      note: even if the current blank sample is not ok (.not.lblsok

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

is

```

1651 c      true), sb from older samples on history file can be used if
there
1652 c      are any older samples in the history file
1653      if (nisnum.lt.1 .or. .not.lflblk) then
1654      type *, ' * * * * * '
1655      type *, ' from get blank standard deviation'
1656      if (nisnum.lt.1) type *, ' number of usable entries = ',
1657      1 nisnum, ' < 1'
1658      if (.not.lflblk) type *, ' no blank file available'
1659      if (.not.lblsok) type *, ' blank data not ok'
1660      type *, ' insufficient usable blank history information ',
1661      1 'available'
1662      type *, ' no standard deviation returned'
1663      type *, ' this may be a serious problem'
1664      type *, ' * * * * * '
1665 c      it is only necessary to acknowledge the warning the first time
1666      if (nsbwarn.lt.1) then
1667      type *, ' '
1668      type *, ' Hit return to acknowledge this notice and continue'
1669      call belrng(1)
1670      read (*, '(a1)') chyno
1671      end if
1672      nsbwarn=nsbwarn+1
1673      sbblnk=-1.1e25
1674      end if
1675      if (debug(1:1).eq.'Y') type *, ' from gtsbblk: blank ',
1676      1 'standard deviation for nuclide ', xnumb, ' is ', sbblnk
1677      return
1678 c
1679 c - - -
1680      entry gtrbblk(numb,rbblnk,debug)
1681 c      return blank averaged activity for this nuclide
1682      xnumb=numb
1683      rbblnk=rbrblk(1,xnumb)
1684 c      if this is a blank, return -1.1e25 as a flag not to use blank
1685 c      averaged activity
1686      if (xchar.eq.'R') then
1687      rbblnk=-1.1e25
1688      else
1689      ! if
(xchar.eq.'r'
1689 c      if no usable data available, write error message and set result
1690 c      to -1.1e25 as a flag
1691 c      type *, ' from gtrbblk: nisnum,lflblk,lblsok
',nisnum,lflblk,lblsok
1692 c      if (nisnum.lt.1 .or. .not.lflblk .or. .not.lblsok) then
1693      if (nisnum.lt.1 .or. .not.lflblk) then
1694      type *, ' from get blank average activity'
1695      if (nisnum.lt.1) type *, ' number of usable entries = ',
1696      1 nisnum, ' < 1'

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1697      if (.not.lflblk) type *, ' no blank file available'
1698      if (.not.lblsok) type *, ' blank data not ok'
1699      type *, ' * * * * * * * * * *'
1700      type *, ' insufficient usable blank history information ',
1701      1 'available'
1702      type *, ' no average returned'
1703      type *, ' this may be a serious problem'
1704      type *, ' * * * * * * * * * *'
1705      c      it is only necessary to acknowledge the warning the first time
1706              if (nrbwarn.lt.1) then
1707      type *, ' '
1708      type *, ' Hit return to acknowledge this notice and continue...'
1709      call belrng(1)
1710      read (*, '(a1)') chyno
1711              end if
1712      nrbwarn=nrbwarn+1
1713      rbblnk=-1.1e25
1714      end if
1715              end if                                     ! if
(xchar.eq.'r'
1716      if (debug(1:1).eq.'Y') type *, ' from gtrbblk: blank ',
1717      1 'average activity for nuclide ', xnumb, ' is ', rbblnk
1718      return
1719      c
1720      c - - -
1721      entry hblkchk(debug)
1722      c      see if this file has already been checked
1723      if (lflchk) then
1724      c      if so, don't check it again
1725      return
1726      else
1727      lflchk=.true.
1728      end if
1729      c      check to see whether the blank history file can be opened
1730      if (.not. lflblk) then
1731      return
1732      else                                     ! if (.not.
lflblk
1733      c      if this sample is a blank, write blank
1734      c      history information back to blank history file, including info
1735      c      from this sample
1736      c      provided blank sample is ok and no duplicates
1737      if (xchar.eq.'R' .and. lblsok .and. .not.lbldup) then
1738      c      make sure nisnum > 0
1739              if (nisnum.lt.1) then
1740      c      if not, ask if alpha_mda should be terminated immediately
1741      type *, '          ***'
1742      type *, ' no usable blank sample data available for history'
1743      type *, ' empty history file will be written'
1744      type *, '          ***'

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

1745      type *, ' this may (or may not) be a serious problem'
1746      type *, ' do you want to terminate alpha_mda before writing'
1747      type *, ' any changes to the sample data files? [yes]'
1748      type *, ' '
1749      c      type *, ' any response except n or N is considered a yes'
1750      c      type *, ' (i.e., terminate)'
1751      call belrng(3)
1752      read (*, '(a1)') chyno
1753      if (chyno .ne. 'n' .and. chyno .ne. 'N') then
1754      call sftexi(100+blkhun)
1755      end if
1756      end if
1757      end if      ! if (xchar .eq. 'r' .and. lblsok .and.
.not.lbldup
1758      end if      ! if (.not.
lflblk
1759      return
1760      c
1761      c - - -
1762      entry hblkwri(debug,nbr)
1763      c      check to see whether the blank history file can be opened
1764      if (.not. lflblk) then
1765      type *, '      ***'
1766      type *, ' blank history file can not be written'
1767      type *, '      ***'
1768      else      ! if (.not.
lflblk
1769      c      if this sample is a blank, write blank
1770      c      history information back to blank history file, including info
1771      c      from this sample
1772      c      provided blank sample is ok and no duplicates
1773      if (xchar.eq.'R' .and. lblsok .and. .not.lbldup) then
1774      c      make sure 1 <= nisnum <= 20
1775      if (nisnum.lt.1) then
1776      type *, ' no usable blank sample data available for history'
1777      type *, ' empty history file written'
1778      rewind (blkhun)
1779      endfile (blkhun)
1780      return
1781      end if
1782      nisnum=min0(nisnum,20)
1783      if (debug(1:1) .eq. 'Y') then
1784      type *, ' blank history file write ', 'starting '
1785      type *, blkhfil
1786      type *, nisnum, ' sample info sets to be written '
1787      end if !debug
1788      rewind (blkhun)
1789      do num=1,nisnum
1790      write (blkhun, '(1x,a16,1x,a16,1x,a20,1x,a27)')
1791      1 blkbid(num),blkid(num),blkpdat(num),blkhfil(31:57)

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1792         if (num .eq. 1)
1793         1 write (blkakun, '(1x,a16,1x,a16,1x,a20,1x,a27)')
1794         1 blkbid(num),blkid(num),blkpdat(num),blkhfil(31:57)
1795         if (debug(1:1).eq.'Y') type *, ' info set no. ',num,
1796         1 ' sample i.d. ',blkbid(num),blkid(num), ' process date ',
1797         1 blkpdat(num)
1798         do xnumb=1,nbr
1799         write (blkhun,9002) nucact(num,xnumb),rbrblk(num,xnumb),
1800         1 sbeblk(num,xnumb),nuclid(xnumb)
1801         if (num .eq. 1)
1802         1 write (blkakun,9002) nucact(num,xnumb),rbrblk(num,xnumb),
1803         1 sbeblk(num,xnumb),nuclid(xnumb)
1804         9002 format (1x,3g15.8, ' act,average,std dev(uCi) ',a8)
1805         if (debug(1:1).eq.'Y') then
1806         type *, ' nuclide, activity (muci), rbar, ', 'sb ', ' name'
1807         type *,xnumb,nucact(num,xnumb),rbrblk(num,xnumb),
1808         1 sbeblk(num,xnumb),nuclid(xnumb)
1809         end if !debug
1810         end do
1811         end do
1812         end if ! if (xchar .eq. 'r' .and. lblsok .and.
.not.lbldup
1813         end if ! if (.not.
lflblk
1814         return
1815 c
1816         end
1817 c
1818 c - - subroutine hbkgnd - - - - -
1819         subroutine hbkgnd
1820 c         subroutine for processing background history files and
information
1821 c
1822         save
1823 c
1824 c         implicit integer*4 (a-z)
1825         integer*4 hlif(2),nbr,nrec,peak,DLIV(2)
1826         character*16 dext,sbhdr,hlfu,name,hunits,nucl,xnucl,xconf,lib
1827         character*16 SIDENT,BKGIDENT,SUNITS,tracer_name
1828         character*60 elive,time_str
1829         CHARACTER*8 DEBUG,actunits,isac,REGION,matrix,CONTROL_LIB
1830         real *4 val,VAL_CORR,Squant,yield,LTIME,BKGAREA,AVRGEFF
1831         real *4 cent,backg,fwhm,area,ener,ctss,perr,peff,efer,
1832         1 fit,flg,psp1,psp2,pdum1,pdum2
1833 c
1834 c         allow space for 21 background samples--20 read off of file and
1835 c         21st newly calculated.
1836         character*24 bkgbat_id
1837         character*102 bkgghfil
1838         character*80 bkg_hist_path

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

1839      character*1 chyno
1840      integer*4 bkghun, lenchmb, lenctlb, lenbpa
1841  c      allow for up to 10 nuclides for each library
1842      parameter (nucele=10)
1843      character*8 nuclid(nucele)
1844      character*16 bkgid(21)
1845      character*24 bkgbid(21)
1846      real*4 ltimbk(21)
1847      real*4 nucact(21, nucele), sbebk(21, nucele)
1848      character*20 bkgpdat(21)
1849      real*8 smxsq20(nucele), smx20(nucele), smxrt
1850      integer*4 ismx20
1851      real*4 sbbk(21, nucele), bkgcts, bkgtim
1852      character*3 chamber, chamtmp
1853      character*16 bkgid1
1854      character*24 bkgbid1
1855      logical*1 lflbkg, lflchk, lbkdup
1856      integer*4 nsbwarn
1857      integer*4 numb, xnumb, n1, n2, nisnum
1858      integer*4 nsmpmn
1859      data nsmpmn /4/
1860  c
1861  c      note that units of background history are counts/time
1862  c - - -
1863      entry hbkgini(debug, nbr, bkgbat_id, bkgident, time_str)
1864  c      initial entry for background history
1865  c      initialize flag to say that file not yet checked
1866      if (debug(1:1) .eq. 'Y') then
1867      type *, ' from hbkgini: bkgbat_id, bkgident, bkgbid(1), bkgid(1), ',
1868 1 'bkgbid1, bkgid1'
1869      type *, bkgbat_id, bkgident
1870      type *, bkgbid(1), bkgid(1)
1871      type *, bkgbid1, bkgid1
1872      end if !debug
1873      lflchk=.false.
1874  c      initialize warning counter
1875      nsbwarn=0
1876  c      initialize duplicate sample flag
1877      lbkdup=.false.
1878  c      get chamber and library for history file name
1879      S=LIB$GET_SYMBOL('chamber', chamber, lenchmb)
1880      call str$upcase(chamber, chamber)
1881  c      call ndl_rjust(chamber)
1882  c      construct a full 3 character chamber i.d. padded w/ zeroes
1883      chamtmp(1:3)='000'
1884      if (lenchmb.le.3 .and. lenchmb.gt.0) then
1885      chamtmp(3-lenchmb+1:3)=chamber(1:lenchmb)
1886      else
1887      chamtmp(1:3)=chamber(1:3)
1888      end if

```


Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1889      chamber(1:3)=chamtmp(1:3)
1890      lenchmb=3
1891      S=LIB$GET_SYMBOL('CONTROL_LIB',CONTROL_LIB,lenctlb)
1892      call str$upcase(control_lib,control_lib)
1893 c
1894 c      construct background history file name
1895 c      background history file name
1896 c
bkghfil=dub1:[alpha.alusr.histry.bkgd]'control_lib'_chamber'_bkgnd.his
1897      S=LIB$GET_SYMBOL('bkg_hist_path',bkg_hist_path,lenbpa)
1898      call str$upcase(bkg_hist_path,bkg_hist_path)
1899      bkghfil(1:40)='
1900      bkghfil(40+1:40+12)='
1901      if (lenchmb+1+lenctlb+10 .le. 22) then
1902      bkghfil(1:lenbpa)=bkg_hist_path(1:lenbpa)
1903      bkghfil(lenbpa+1:lenbpa+lenctlb)=control_lib
1904      bkghfil(lenbpa+lenctlb+1:lenbpa+lenctlb+1)='_ '
1905      bkghfil(lenbpa+lenctlb+2:lenbpa+lenctlb+1+lenchmb)=chamber
1906      bkghfil(lenbpa+lenctlb+2+lenchmb:lenbpa+lenctlb+1+lenchmb+10)=
1907      1 '_bkgnd.his'
1908      call str$upcase(bkghfil,bkghfil)
1909      bkghun=98
1910      if (debug(1:1) .eq. 'Y') then
1911      type *, ' i.d. of current background',
1912      1 ' sample ',bkgbat_id,bkgident
1913      type *, ' background history file opened'
1914      type *,bkghfil
1915      type *,bkg_hist_path
1916      end if !debug
1917      open
(unit=bkghun,file=bkghfil,status='unknown',form='formatted')
1918 c      read i.d. of first background history sample and live time
1919      read (bkghun,'(1x,a24,1x,a16,g15.8,a20)',end=981)
bkgbid1,bkgid1,
1920      1 ltimbk(1),bkgpdat(1)
1921      call str$upcase(bkgbid1,bkgbid1)
1922      call str$upcase(bkgid1,bkgid1)
1923      call str$upcase(bkgpdat(1),bkgpdat(1))
1924      if (debug(1:1) .eq. 'Y') then
1925      type *, ' i.d. of first background',
1926      1 ' history sample ',bkgbid1,bkgid1
1927      type *, ' live time ',ltimbk(1), ' process date ',bkgpdat(1)
1928      end if !debug
1929      go to 989
1930 c end of file before finishing first line read in background history
1931      981 continue
1932      bkgid1=' eof981bkg
1933      bkgid(1)=' eof981bkg
1934      bkgbid1=' eof981bkg
1935      bkgbid(1)=' eof981bkg

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

1936      ltimbk(1)=0.
1937      bkgpdat(1)=time_str
1938      nisnum=0
1939 c      3/20/95 decided that this is not a serious error, but rather a
1940 c      startup problem. Messages only in debug mode
1941          if (debug(1:1) .eq. 'Y') then
1942      type *, ' *** notice -- problem with background history file '
1943      type *, ' End of file on background history file before finish'
1944      type *, ' reading first line of information'
1945      type *, ' Therefore, there is no background history information'
1946      type *, ' Background history file probably empty or nonexistent'
1947      type *, ' '
1948      type *, ' CONTACT TECHNICAL SUPPORT'
1949      type *, ' '
1950      type *, ' Hit return to acknowledge this notice and continue...'
1951      call belrng(1)
1952      read (*, '(a1)') chyno
1953      end if !debug
1954 c      end of file on first read means create new history file
1955 c      create new background history file from scratch
1956      rewind (bkghun)
1957          if (debug(1:1) .eq. 'Y') then
1958      type *, ' new background history information will be put in file'
1959      type *, bkghfil
1960      end if ! debug
1961      989 continue
1962 c      if i.d. of first background history sample
1963 c      is same as current background, load history info into mem
1964 c      location 1
1965      if (bkgidl .eq. bkgident .and. bkgbid1.eq.bkgbat_id) then
1966      nisnum=1
1967      bkgid(1)=bkgidl
1968      bkgbid(1)=bkgbid1
1969      do xnumb=1,nbr
1970 c read activity (counts/time) and sb for each nuclide
1971      read (bkghun, '(1x,2g15.8)',end=991)
1972      1 nucact(nisnum,xnumb),sbebk(nisnum,xnumb)
1973          if (debug(1:1) .eq. 'Y') then
1974      type *, ' background activities (counts'
1975      1 , '/time) for nuclide ',xnumb
1976      type *, ' act, sb ',nucact(nisnum,xnumb),sbebk(nisnum,xnumb)
1977      end if !debug
1978      end do
1979      go to 999
1980 c end of file before finishing first set read in background history
1981      991 continue
1982      bkgidl='          bkg eof991'
1983      bkgid(1)='          bkg eof991'
1984      bkgbid1='          bkg eof991'
1985      bkgbid(1)='          bkg eof991'

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

1986      ltimbk(1)=0.
1987      bkgpdat(1)=time_str
1988      nisnum=0
1989      type *, ' *** notice -- problem with background history file '
1990      type *, ' End of file on background history file before finish'
1991      type *, ' reading first set of information'
1992      type *, ' Therefore, there is no background history information'
1993      type *, ' Background history file probably faulty (incomplete)'
1994      type *, ' '
1995      type *, ' CONTACT TECHNICAL SUPPORT'
1996      type *, ' '
1997      type *, ' Hit return to acknowledge this notice and continue...'
1998      call belrng(1)
1999      read (*, '(a1)') chyno
2000  c      create new background history file from scratch
2001      rewind (bkghun)
2002      type *, ' new background history information in file'
2003      type *, bkghfil
2004  999 continue
2005      else ! if bkgidl .eq.
bkgident
2006  c
2007  c      if first background history i.d. does not match current
2008  c      background i.d., read old background history information,
2009  c      count the number of samples, and put information in memory
2010  c      into mem locations 2-21 to leave location 1 for new information
2011  c      sums for sb
2012      do xnumb=1,nbr
2013      smx20(xnumb)=0.
2014      smxsq20(xnumb)=0.
2015      end do
2016      ismx20=0
2017  c      put i.d. from sample into background id(1)
2018      bkgid(1)=bkgident
2019      bkgbid(1)=bkghbat_id
2020      ltimbk(1)=0.
2021      bkgpdat(1)=time_str
2022      nisnum=1
2023  c      rewind history file so code can reread first line of i.d. and
2024  c      load it into mem location 2
2025      rewind (bkghun)
2026      do num=2,21
2027  c      read history sample i.d.
2028  c      note: history samples are loaded in the order of newest to
2029  c      oldest
2030  c      this sample is a new background, therefore load history samples
2031  c      from 2 to 21 to leave room for this sample in mem location 1
2032      read (bkghun, '(1x,a24,1x,a16,g15.8,a20)', end=1009)
2033      1 bkgbid(nisnum+1), bkgid(nisnum+1), ltimbk(nisnum+1),
2034      1 bkgpdat(nisnum+1)

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

2035      call str$upcase(bkgbid(nisnum+1),bkgbid(nisnum+1))
2036      call str$upcase(bkgid(nisnum+1),bkgid(nisnum+1))
2037      call str$upcase(bkgpdat(nisnum+1),bkgpdat(nisnum+1))
2038  c      type *, ' after read background id s,time ',nisnum
2039  c      type *,bkgbid(nisnum+1),
2040  c      1 bkgid(nisnum+1),ltimbk(nisnum+1)
2041      nisnum=nisnum+1
2042      if (debug(1:1) .eq. 'Y') then
2043      type *, ' background sample no. ',nisnum
2044      type *, ' i.d. from history ',bkgbid(nisnum),bkgid(nisnum)
2045      1 , ' live time ',ltimbk(nisnum), ' process date ',bkgpdat
2046      end if !debug
2047      do xnumb=1,nbr
2048  c read activity (counts/time) and sb for each nuclide
2049      read (bkghun, '(1x,2g15.8)',end=1001)
2050      1 nucact(nisnum,xnumb),sbebk(nisnum,xnumb)
2051      go to 1002
2052  1001 continue
2053      type *, ' abnormal end of file on background history file'
2054      nisnum=nisnum-1
2055      go to 1009
2056  1002 continue
2057      if (debug(1:1) .eq. 'Y') then
2058      type *, ' background activities (counts'
2059      1 , '/time) for nuclide ',xnumb
2060      type *, ' act, sb ',nucact(nisnum,xnumb),sbebk(nisnum,xnumb)
2061      end if !debug
2062  c      sums for sb
2063      if (ismx20.lt.19) then
2064      smx20(xnumb)=smx20(xnumb)+nucact(nisnum,xnumb)
2065      smxsq20(xnumb)=smxsq20(xnumb)+nucact(nisnum,xnumb)**2
2066      if (xnumb.eq.nbr) ismx20=ismx20+1
2067      end if
2068      end do                      ! do
xnumb=1,nbr
2069  c      compare current sample i.d. to one just read to check for
duplicate
2070  c      don't bother to check if duplicate already found or if nisnum=1
2071      if (nisnum.gt.1 .and.
2072      1      bkgid(nisnum).eq.bkgid(1)
2073      1      .and. bkgbid(nisnum).eq.bkgbid(1) .and. .not.lbkdup)
then
2074      lbkdup=.true.
2075      if (debug(1:1) .eq. 'Y') then
2076      type *, ' background sample 1 id:'
2077      type *,bkgbid(1),bkgid(1)
2078      type *, ' duplicates sample ',nisnum
2079      type *,bkgbid(nisnum),bkgid(nisnum)
2080      end if !debug
2081  cjktestC      TEST REFUSE TO NOTICE DUPLICATES

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

2082  cjkxtest      LBKDUP=.FALSE.
2083              end if
2084              end do                                ! do
num=2,21
2085  c              end of file on background history
2086  1009 continue
2087              if (debug(1:1) .eq. 'Y') type *, ' background history end of ',
2088              1 'file, ',
2089              1 ' sample info sets 2 thru',nisnum,' read'
2090              if (nisnum .lt. 1) then
2091              type *, ' background history end of file ',
2092              1 'reached ',
2093              1 'before any info sets read'
2094              nisnum=0
2095              end if
2096  c              if the current i.d. duplicates any others, put information from
2097  c              mem location 2 into location 1--no std dev will be calculated
2098              if (lbkdup) then
2099              bkgid(1)=bkgid(2)
2100              bkgbid(1)=bkgbid(2)
2101              ltimbk(1)=ltimbk(2)
2102              bkgpdat(1)=bkgpdat(2)
2103              do xnumb=1,nbr
2104              nucact(1,xnumb)=nucact(2,xnumb)
2105              sbekbg(1,xnumb)=sbekbg(2,xnumb)
2106              end do
2107              end if
2108              endif                                ! if bkgid1 .eq.
bkgident
2109              lflbkg=.true.
2110              else                                ! if lenchmb+1+lenctlb+10
.le. 27
2111  c              background history file name too long--can't open file and read
2112  c              history info
2113              type *, ' *** background history file name too long, matrix',
2114              1 ' name length ',lenchmb
2115              type *, ' library name length ',lenctlb, ' ***'
2116              lflbkg=.false.
2117  c              ask if alpha_mda should be terminated immediately
2118              type *, ' ***'
2119              type *, ' background history file can not be written'
2120              type *, ' because usable history file name can not be
constructed'
2121              type *, ' ***'
2122              type *, ' this may be a serious problem'
2123              type *, ' do you want to terminate alpha_mda before writing'
2124              type *, ' any changes to the sample data files? [yes]'
2125              type *, ' '
2126  c              type *, ' any response except n or N is considered a yes'
2127  c              type *, ' (i.e. terminate)'

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

2128      call belrng(3)
2129      read (*,'(a1)') chyno
2130      if (chyno .ne. 'n' .and. chyno .ne. 'N') then
2131      call sftexi(bkghun)
2132      end if
2133      endif                                ! if lenchmb+1+lenctlb+10
.le. 27
2134 c
2135      return
2136 c
2137 c - - -
2138      entry hbkginf(debug,numb,xnucl,bkgcts,bkgtim,bkgbat_id,bkgident)
2139 c      finish running sums for sb and calculate standard deviation
2140      xnumb=numb
2141      nuclid(xnumb)=xnucl(1:8)
2142      if (debug(1:1) .eq. 'Y') then
2143      type *, ' from hbkginf: bkgbat_id,bkgident,bkgbid(1),bkgid(1),',
2144 1 'bkgbid1,bkgid1,lbkdup'
2145      type *,bkgbat_id,bkgident
2146      type *,bkgbid(1),bkgid(1)
2147      type *,bkgbid1,bkgid1,lbkdup
2148      end if !debug
2149 c      if background i.d. does not match first line read from history
2150 c      file and no other duplicates, finish running sums for sb
2151      if ((bkgid1.ne.bkgident .or. bkgbid1.ne.bkgbat_id)
2152 1 .and. .not.lbkdup) then
2153      if (debug(1:1) .eq. 'Y') type *, ' background sample(=record 1).
',
2154 1 ' nuclide ',xnumb,' counts/sec ',bkgcts,' time ',bkgtim
2155      nucact(1,xnumb)=bkgcts
2156      ltimbk(1)=bkgtim
2157      smx20(xnumb)=smx20(xnumb)+nucact(1,xnumb)
2158      smxsq20(xnumb)=smxsq20(xnumb)+nucact(1,xnumb)**2
2159 c      increment counter for sum of 20. do this on first
2160 c      nuclide
2161      if (xnumb .eq. 1) then
2162      ismx20=ismx20+1
2163      end if
2164 c      calculate std dev
2165 c      if (ismx20.gt.1) then
2166 c      1/12/95 decision made that standard deviation for fewer than
nsmppmn
2167 c      (=4) samples not worthwhile, so make special provisions
2168      if (ismx20.ge.nsmppmn) then
2169      smxrt=(smxsq20(xnumb)-smx20(xnumb)**2/
2170 1 dfloat(ismx20))/dfloat(ismx20-1)
2171      if (debug(1:1).eq. 'Y') then
2172      type *, ' terms for backgr std dev for ', 'nuclide ',xnumb
2173      type *, ' smxsq20,smx20,ismx20,sum term'
2174      type *,smxsq20(xnumb),smx20(xnumb),ismx20,smxrt

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

2175             end if !debug
2176 c           check to see that std deviation will be real
2177             if (smxrt.lt. 0.) then
2178                 smxrt=0.
2179 c           if sum of terms for root is small, then negative value is
probably due
2180 c           to truncation error
2181             if (dabs(smxrt).gt. 1.d-8*nucact(1,xnumb)**2) then
2182                 type *, ' * * * * * '
2183                 type *, ' backg standard deviation not real for nuclide ',xnumb
2184                 type *, ' zero will be returned'
2185                 type *, ' this may be a serious problem'
2186                 type *, ' '
2187                 type *, ' Hit return to acknowledge this notice and continue...'
2188                 call belrng(1)
2189                 read (*,'(a1)') chyno
2190             end if
2191         end if
2192         sbekbg(1,xnumb)=dsqrt(smxrt)
2193         if (debug(1:1).eq. 'Y') then
2194             type *, ' background std dev calculated ', 'for nuclide ',xnumb
2195             type *, ' background std dev ',sbekbg(1,xnumb)
2196         end if !debug
2197         else
2198 c           not enough samples for usable standard deviation
2199 c           type *, ' background standard deviation = 0 for nuclide ',xnumb
2200 c           sbekbg(1,xnumb)=0.
2201 c           1/12/95 pass root of total number of counts for std dev
2202 c           pass negative value to flag that this was done
2203             sbekbg(1,xnumb)=-sqrt(bkgcts*bkgtim)
2204             type *, ' * * * * * '
2205             type *, ' square root(background counts) passed for nuclide ',
2206 1 xnumb
2207             type *, ' square root of counts = ',-sbekbg(1,xnumb),
2208 1 ' replaces std dev'
2209             type *, ' number of samples = ',ismx20,' < ',nsmpmn
2210             type *, ' * * * * * '
2211 c           it is only necessary to acknowledge the warning the first time
2212             if (xnumb.eq.1) then
2213                 type *, ' '
2214                 type *, ' Hit return to acknowledge this notice and continue...'
2215                 call belrng(1)
2216                 read (*,'(a1)') chyno
2217             end if
2218         end if
2219 c           if no background data read, but this sample is ok, set nisnum=1
2220             if (nisnum.lt.1) nisnum=1
2221         end if
! if
bkgidl.eq.bkgident
2222             return

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

2223 c
2224 c - - -
2225     entry gtsbbkg (numb,bkgtim,sbbkgd,debug)
2226 c     return background standard deviation for this nuclide
2227     xnumb=numb
2228     sbbkgd=sbebkg(1,xnumb)
2229 c     if std dev is negative, this flags that the value is the root
2230 c     of a number in counts. Therefore, divide by live time to get
2231 c     counts/time
2232     if (sbebkg(1,xnumb).lt.0.) then
2233 c     sbbkgd=-sbebkg(1,xnumb)/ltimbk(1)
2234 cc     5/12 changes in process.com causing backgrounds to be
processed
2235 cc     in another part of com file with their own true live times
2236 cc     require that background counts be corrected by multiplying by
2237 cc     ratio of sample live time to background live time
2238 c     sbbkgd=sbbkgd*sqrt(bkgtim/ltimbk(1))
2239 c     5/30 to calculate background standard deviation from counts,
2240 c     first correct counts to sample time by multiplying by sample
time
2241 c     / background sample time
2242 c     sbbkgd=(sbebkg(1,xnumb)**2)*bkgtim/ltimbk(1)
2243 c     next, take square root of counts and divide by sample time
2244 c     sbbkgd=sqrt(sbbkgd)/bkgtim
2245 c     the next line does this with fewer operations
2246 c     sbbkgd=-sbebkg(1,xnumb)/sqrt(bkgtim*ltimbk(1))
2247 c     end if
2248 c     if no usable data available, write error message and set result
2249 c     to -1.1e25 as a flag
2250     if (nisnum.lt.1 .or. .not.lflbkg) then
2251 c     type *, ' * * * * * '
2252 c     type *, ' from get background standard deviation'
2253 c     if (nisnum.lt.1) type *, ' number of usable entries = ',
2254 c     1 nisnum, ' < 1'
2255 c     if (.not.lflbkg) type *, ' no background file available'
2256 c     type *, ' insufficient usable background history information ',
2257 c     1 'available'
2258 c     type *, ' no standard deviation returned'
2259 c     type *, ' this may be a serious problem'
2260 c     type *, ' * * * * * '
2261 c     it is only necessary to acknowledge the warning the first time
2262 c     if (nsbwarn.lt.1) then
2263 c     type *, ' '
2264 c     type *, ' Hit return to acknowledge this notice and continue...'
2265 c     call belrng(1)
2266 c     read (*,'(a1)') chyno
2267 c     end if
2268 c     nsbwarn=nsbwarn+1
2269 c     sbbkgd=-1.1e25
2270 c     end if

```


Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

2271      if (debug(1:1).eq.'Y') type *, ' from gtsbbkg: background ',
2272      1 'standard deviation for nuclide ',xnumb,' is ',sbbkgd
2273      return
2274 c
2275 c - - -
2276      entry hbkgchk(debug,bkgbat_id,bkgident)
2277 c      see if this file has already been checked
2278      if (debug(1:1) .eq. 'Y') then
2279      type *, ' from hbkgchk: bkgbat_id,bkgident,bkgbid(1),bkgid(1)',
2280      1 'bkgbid1,bkgid1,lflchk,lflbkg,lbkdup'
2281      type *,bkgbat_id,bkgident
2282      type *,bkgbid(1),bkgid(1)
2283      type *,bkgbid1,bkgid1,lflchk,lflbkg,lbkdup
2284      end if !debug
2285      if (lflchk) then
2286 c      if so, don't check it again
2287      return
2288      else
2289      lflchk=.true.
2290      end if
2291 c      check to see whether the background history file can be opened
2292      if (.not. lflbkg) then
2293      return
2294      else
2295      ! if (.not.
lflbkg
2295 c      if background i.d. does not match first line read from history
2296 c      and there are no duplicates
2297 c      write background
2298 c      history information back to background history file, including
2299 c      info from this sample
2300      if ((bkgid1.ne.bkgident .or. bkgbid1.ne.bkgbat_id)
2301      1 .and. .not.lbkdup) then
2302 c      make sure nisnum > 0
2303      if (nisnum.lt.1) then
2304 c      if not, ask if alpha_mda should be terminated immediately
2305      type *, '      ***'
2306      type *, ' no usable background sample data available for history'
2307      type *, ' empty history file will be written'
2308      type *, '      ***'
2309      type *, ' this may (or may not) be a serious problem'
2310      type *, ' do you want to terminate alpha_mda before writing'
2311      type *, ' any changes to the sample data files? [yes]'
2312      type *, ' '
2313 c      type *, ' any response except n or N is considered a yes'
2314 c      type *, ' (i.e. terminate)'
2315      call belrng(3)
2316      read (*,'(a1)') chyno
2317      if (chyno .ne. 'n' .and. chyno .ne. 'N') then
2318      call sftexi(100+bkgghun)
2319      end if

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR. file version as of January 10, 1996

```

2320          end if
2321          end if                      ! if bkgidl.ne.bkgident .and.
.not.lbkdup
2322          end if                      ! if (.not.
lflbkg
2323          return
2324      c
2325      c - - -
2326          entry hbkgwri(debug,nbr,bkgbat_id,bkgident)
2327      c      check to see whether the background history file can be opened
2328          if (debug(1:1) .eq. 'Y') then
2329              type *, ' from hbkgwri: bkgbat_id,bkgident,bkgbid(1),bkgid(1),',
2330              1 'bkgbid1,bkgidl,lflbkg,lbkdup'
2331              type *,bkgbat_id,bkgident
2332              type *,bkgbid(1),bkgid(1)
2333              type *,bkgbid1,bkgidl,lflbkg,lbkdup
2334              end if !debug
2335          if (.not. lflbkg) then
2336              type *, '          ***'
2337              type *, ' background history file can not be written'
2338              type *, '          ***'
2339          else                      ! if (.not.
lflbkg
2340      c      if background i.d. does not match first line read from history
2341      c      and there are no duplicates
2342      c      write background
2343      c      history information back to background history file, including
2344      c      info from this sample
2345          if ((bkgidl.ne.bkgident .or. bkgbid1.ne.bkgbat_id)
2346      1 .and. .not.lbkdup) then
2347      c      make sure 1 <= nisnum <= 20
2348          if (nisnum.lt.1) then
2349              type *, ' no usable background sample data available for history'
2350              type *, ' empty history file written'
2351              rewind (bkghun)
2352              endfile (bkghun)
2353              return
2354          end if
2355          nisnum=min0(nisnum,20)
2356          if (debug(1:1) .eq. 'Y') then
2357              type *, ' background history file ','write starting'
2358              type *,bkghfil
2359              type *,nisnum, ' sample info sets to be written '
2360              end if !debug
2361              rewind (bkghun)
2362              do num=1,nisnum
2363                  write (bkghun,'(1x,a24,1x,a16,g15.8,a20,1x,a22)') bkgbid(num),
2364                  1 bkgid(num),ltimbk(num),bkgsdat(num),bkghfil(31:52)
2365                  if (debug(1:1).eq.'Y') then
2366                      type *, ' info set no. ',num,

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

2367      1 ' sample i.d. ',bkgbid(num),bkgid(num),' live time
',ltimbk(num)
2368      type *,' process date ',bkgpdat(num)
2369      end if !debug
2370      do xnumb=1,nbr
2371      write (bkg hun,9002)nucact (num,xnumb) ,sbebk g (num,xnumb) ,
2372      1 nuclid(xnumb)
2373      9002 format (1x,2g15.8,' act,std dev(counts/sec) ',a8)
2374      if (debug(1:1).eq.'Y') then
2375      type *,' nuclide, activity (counts/time),' , ' sb ',' name'
2376      type *,xnumb,nucact (num,xnumb) ,sbebk g (num,xnumb) ,nuclid(xnumb)
2377      end if !debug
2378      end do
2379      end do
2380      end if          ! if bkgidl.ne.bkgident .and.
.not.lbkdup
2381      end if          ! if (.not.
lflbk g
2382      return
2383      c
2384      end
2385      c
2386      c - - subroutine reimpak - - - - -
2387      subroutine reimpak(relnum,intnum)
2388      real*4 relnum,rnum,rexpon
2389      integer*4 intnum,inum,iexpon
2390      c pack a real number into an integer
2391      c in effect, i am taking a lpe13.6 format, moving the exponent to the
2392      c 8th digit from the right and higher and leaving the number itself
2393      c in the right 7 digits with the decimal suppressed
2394      c in other words, i.jklmnoe+ab becomes abijklmno, and
2395      c i.jklmnoe-ab becomes -abijklmno
2396      c it should be easy to look at one of these numbers and tell what it
is
2397      c
2398      c      pack the real into an integer
2399      c      do not pack a negative number, set result=0
2400      if (relnum.le. 0.) then
2401      intnum=0
2402      go to 999
2403      end if
2404      rexpon=alog10(relnum)
2405      if (relnum .lt. 1.) then
2406      c numbers < 1 ==> negative integers returned
2407      c "small" numbers mean returning a large negative integer
2408      c underflow and too small numbers control
2409      if (relnum.lt. 1.e-25) then
2410      intnum=-25*(10**7)-0900000
2411      go to 999
2412      end if

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

2413      iexpon=rexpon-1
2414      rnum=relnum*10.**float(-iexpon)*1.e6
2415      inum=int(rnum+0.4999)
2416      intnum=inum-(10**7)*iexpon
2417      if (iexpon.lt.0) intnum=-inum+(10**7)*iexpon
2418      else
2419      c numbers >= 1 ==> positive integers returned
2420      c "large" numbers mean returning a large positive integer
2421      c overflow and too large numbers control
2422          if (relnum.gt. 1.e25) then
2423              intnum=25*(10**7)+1100000
2424              go to 999
2425          end if
2426      iexpon=rexpon
2427      rnum=relnum*(10.**float(-iexpon))*1.e6
2428      inum=int(rnum+0.4999)
2429      intnum=inum+(10**7)*iexpon
2430      end if
2431      999 continue
2432      c      write (*,*) ' real, integer ',relnum,intnum
2433      return
2434      end
2435      c
2436      c - - subroutine inreupk - - - - -
2437      subroutine inreupk(relnum,intnum)
2438      real*4 relnum,rnum,rexpon
2439      integer*4 intnum,inum,iexpon
2440      c pack a real number into an integer
2441      c in effect, i am taking a 1p13.6 format, moving the exponent to the
2442      c 8th digit from the right and higher and leaving the number itself
2443      c in the right 7 digits with the decimal suppressed
2444      c in other words, i.jklmnoe+ab becomes abijklmno, and
2445      c i.jklmnoe-ab becomes -abijklmno
2446      c it should be easy to look at one of these numbers and tell what it
is
2447      c
2448      c      unpack the integer and reconstruct the real
2449      c      inputting a zero means returning a zero
2450      if (intnum.eq.0) then
2451          relnum=0.
2452          go to 999
2453      end if
2454      iexpon=intnum/(10**7)
2455      if (intnum.lt.0) then
2456      c numbers < 1 ==> negative integers returned
2457          inum=-intnum+(10**7)*iexpon
2458          rnum=float(inum)/1.e6
2459          rexpon=float(iexpon)
2460          relnum=rnum*10.**rexpon
2461      else

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```

2462 c numbers >= 1 ==> positive integers returned
2463     inum=intnum-(10**7)*iexpon
2464     rnum=float(inum)/1.e6
2465     rexpon=float(iexpon)
2466     relnum=rnum*10.**rexpon
2467     end if
2468     999 continue
2469 c     write (*,*) ' real, integer ',relnum,intnum
2470     return
2471     end
2472 c
2473 c - - subroutine sftexi - - - - -
2474     subroutine sftexi(iflexi)
2475     integer*4 iflexi
2476     character*1 chyno
2477 c     soft exit subroutine
2478 c     ask if the process.com should exit
2479     type *, '      ***'
2480     type *, ' alpha_mda is exiting at your request'
2481     type *, ' do you want process.com to terminate also?'
2482     type *, ' if not,'
2483     type *, ' process.com will continue processing samples'
2484     type *, ' '
2485     type *, ' any response except n or N is considered a yes'
2486     type *, ' (i.e. terminate)'
2487     call belrng(3)
2488     read (*, '(a1)') chyno
2489     if (chyno .eq. 'N') chyno='n'
2490 c write messages to tty and get flag symbol (alphaerr) ready to send
2491 c back to process.com
2492     if (chyno.ne. 'n') then
2493     type *, ' you told process.com to quit'
2494     else
2495     type *, ' you told process.com to continue'
2496 c if process.com is not to terminate, send alphaerr='g' to tell
2497 c process.com to go to next spectrum
2498     chyno='g'
2499     end if
2500 c return the flag symbol (alphaerr) to process.com
2501     call lib$set_symbol('alphaerr',chyno)
2502     call exit(iflexi)
2503     end
2504 c
2505 c - - subroutine belrng - - - - -
2506     subroutine belrng(nring)
2507     character*1 bell
2508     data bell/7/
2509 c     ring the bell nring times w/ 1 sec(?) pause between rings
2510     do n=1,nring
2511     type *,bell

```

Appendix 2.A Listing of FORTRAN code ALPHA_MDA.FOR, file version as of January 10, 1996

```
2512      call lib$wait(1.0)
2513      end do
2514      return
2515      end
2516 c      jxk 12/19/94-3/??/95
```

**APPENDIX 2.B LISTING OF DCL FILE NDAL_PROCESS.COM,
FILE VERSION AS OF JANUARY 10, 1996**

File is located on system B disk at dub0:[000000.nd_root.ndamscust]

Tue Jan 9 08:56:10 EST 1996

\$ cat -n proceskc.com

```
1 $
2 $ goto start      !(ndal_PROCESS.COM)
3 -----
4 Jan 92 This is the processing for all of the configurations
5     listed in names.dat.
6
7 May 92 Updated with BS's primary/secondary calibration sources
8     for weekly cals.
9
10 5/18/92 Added code for new flags to control hard copy printing.
11     This is only ok if there is an output device. There is a special
12     flag for each report type. E.g., nid_hc, list_hc etc. They all
13     end in _hc.
14
15     The report_queue is "" if there is not printer queue!
16
17     added code to control printing for:
18         - wtmean
19         - channel list
20         - enback
21         - sample peak/region
22         - backgrounds peak/region
23         - nid
24         - post nid
25     not done for:      (Flag names:)
26         - control      control_hc
27         - mda           mda_hc
28         - calibration summary calsum_hc
29
30 7/2/92 Adjustments for 9/2/92 added code for plotting spectrum plot_hc
31 1/5/93 Code to do move/fpl on prime/second processing
32 4/7/92 Added code for post nid peak search postnid_hc
33
34 5/93  dvm  it corporation
35         added code for batch processing
36
37 5/93  dvm  it corporation
38         changed to use it's plot program
39
40 5/93  dvm  it corporation
```


Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

41      changed to use /compressed form and headers for channel by
42      channel listing.
43
44 5/93  dvm   it corporation
45      changed post-nid peak search to run only when report asked for.
46
47 5/93  dvm   it corporation
48      cleaned up printouts to print in order, and to use headers,
49      and to delete temporary files after printing.
50
51 5/93  dvm   it corporation
52      re-installed overall background processing, peak search and
53      channel by channel listings to background printouts.
54
55 10/94 jps   Implemented changes made by Bob S with respect to '0 count'
56      background spectra.
57 -----
58 $ start:
59 $   on control_y then goto abort_exit
60 $   on error   then goto abort_exit
61 $
62 $   if debug   then set verify
63 $   if .not. debug then set noverify
64 $
65 $   flat_file_output = f$edit(flat_file_output,"upcase")
66 $!-----
67 $! setup names and qualifiers for temporary results files
68 $
69 $   plot_file = "nd_ams_list:plot.lis;"
70 $   plot_line = "/list="plot_file"
71 $   if dvm
72 $   then
73 $     chan1_file = "nd_ams_list:chan1.lis;"
74 $     chan1_line = "/list="chan1_file"
75 $     chan2_file = "nd_ams_list:chan2.lis;"
76 $     chan2_line = "/list="chan2_file"
77 $   else
78 $     list_file = "nd_ams_list:list.lis;"
79 $     list_line = "/list="list_file"
80 $   endif   !dvm
81 $   gross_file = "nd_ams_list:gross.lis;"
82 $   gross_line = "/list="gross_file"
83 $   bkgnd_file = "nd_ams_list:bkgnd.lis;"
84 $   bkgnd_line = "/list="bkgnd_file"
85 $! background_lis = "nd_ams_list:background.lis;"
86 $   enback_file = "nd_ams_list:enback.lis;"

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

87 $   enback_line = "/list=enback_file"
88 $   peak_file   = "nd_ams_list:peak.lis;"
89 $   peak_line   = "/list=peak_file"
90 $   nid_file    = "nd_ams_list:nid.lis;"
91 $   nid_line    = "/list=nid_file"
92 $   nidvar_file = "nd_ams_list:nidvar.lis;"
93 $   nidvar_line = "/list=nidvar_file"
94 $   wtmean_file = "nd_ams_list:wtmean.lis;"
95 $   wtmean_line = "/list=wtmean_file"
96 $   nidpeak_file = "nd_ams_list:nidpeak.lis;"
97 $   nidpeak_line = "/list=nidpeak_file"
98 $   qaanal_file  = "nd_ams_list:qaa.lis;"
99 $   qaanal_line  = "/list=qaanal_file"
100 $   qaplot_file  = "nd_ams_list:qaplot.lis;"
101 $   qaplot_line  = "/list=qaplot_file"
102 $
103 $!   set up a list device line and blank it out if there is no
104 $!   printer. To use: if nid_hc then nid 'report_queue'
105 $
106 $   REPORT_QUEUE=F$EDIT(REPORT_QUEUE,"UPCASE")
107 $   if report_queue .eqs. "NONE" then report_queue = ""
108 $   if report_queue .eqs. "NL:" then report_queue = ""
109 $
110 $   PLOT_QUEUE=F$EDIT(PLOT_QUEUE,"UPCASE")
111 $   if plot_queue .eqs. "NONE" then plot_queue = ""
112 $   if plot_queue .eqs. "NL:" then plot_queue = ""
113 $
114 $!-----
115 $! Local symbols
116 $
117 $   purge_flag="N" ! first time flag for daily check file purge
118 $   batch_reply="N" ! first time flag for qc master copy to batch
119 $   IORU=""       ! FIRST TIME FLAG FOR INIT/UPDATE CALIBRATION
120 $   check=""      ! define initial or update calibration
121 $
122 $!   asked_for_batch = "" !7/8/92
123 $
124 $!-----
125 $! Take a look at names.dat!
126 $
127 $! names file defined so that new versions of names.dat created by others
128 $! that are starting counts during processing does not mess up QC reports
129 $
130 $   names_file = f$search("nd_ams_user:names.dat;")
131 $   if f$trnlnm("in_file") .nes. "" then close in_file
132 $   open/read/error=read_err/end_of_file=end_read in_file 'names_file'

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

133 $
134 $   mca/command "erase ALPHA0"-
135       "delete/region ALPHA0" "set label ""      ""
136 $
137 $   IF ON_ESP_DISPLAY THEN
@ND_AMS_COM:NDAL_CLEAR_REGION_ENERGY.COM
138 $
139 $   if dis_ok then display alpha0
140 $
141 $!-----
142 $! 7/8/92
143 $! The configuration name has the following format:
144 $!   type_BATCH-ID$$SAMPLE-ID_library, e.g., S_BATCH-ID$$SAMPLE-ID_uu
145 $! Types are now possibly more than one character.
146 $
147 $!   jxk 8/22/95 modify messages from background processing so
148 $!   that a single file is generated and printed at the end
149 $!   create file for notice messages from background history processing
150 $   if f$edit(f$extract(0,1,y12_bioassay),"upcase") .eqs. "Y" -
151     .or. f$edit(f$extract(0,1,new_reagent_calc),"upcase") .eqs. "Y"
152 $   then
153 $   jxk_temp_path = f$logical("nd_ams_histy")
154 $!   construct file name
155 $   temp_notemsg = "jxktempnotemsg.dat"
156 $   jxk_temp_notemsg = ""jxk_temp_path""+""temp_notemsg""
157 $!   show sym jxk_temp_notemsg
158 $!   first, delete all old copies
159 $   jxkcolast = ".*"
160 $   jxkfdel = ""jxk_temp_notemsg""+""jxkcolast""
161 $!   show sym jxkfdel
162 $!   if (f$search(jxkfdel) .nes. "") then show sym jxkfdel
163 $   if (f$search(jxkfdel) .nes. "") then delete 'jxkfdel'
164 $
165 $!   then, open new file
166 $!   first, have to open it with fortran. Otherwise, file
167 $!   attributes are wrong
168 $   file_fortopen = ""jxk_temp_notemsg""
169 $!   show sym file_fortopen
170 $   RUN ND_AMS_EXE:fortopen
171 $!   r fortopen.exe
172 $
173 $!   open/write jxknotefile 'jxk_temp_notemsg'
174 $!   then open it with append to preserve attributes
175 $   open/append jxknotefile 'jxk_temp_notemsg'
176 $
177 $!   write header lines to file

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

178 $   datim=f$time()
179 $   write jxknotefile datim
180 $   write jxknotefile " notice messages from PROCESS.COM"
181 $   jxknotehdlncnt=2
182 $   close jxknotefile
183 $   endif           ! if y12_bioassay .or. new_reagent_calc
184 $!   jxk 8/22/95
185 $
186 $ read_again:
187 $
188 $   read/error=read_err/end_of_file=end_read in_file aconfig
189 $   on error then goto abort_exit
190 $
191 $   aconfig = f$edit(aconfig,"upcase,trim,collapse")
192 $   if f$length(aconfig) .eq. 0 then goto read_again ! skip blank lines
193 $
194 $   xchar =f$edit(f$element(0,"_",aconfig),"UPCASE")
195 $   IF xchar .EQS. "E" THEN GOTO READ_AGAIN ! SKIP EMPTIES
196 $
197 $   chamber=f$edit(f$element(1,"_",aconfig),"UPCASE")
198 $
199 $   control_lib=f$edit(f$element(2,"_",aconfig),"UPCASE")
200 $
201 $   IF xchar .eqs. "B"   .AND. CONTROL_LIB .EQS. "NONE" then -
202 $       goto process_backgrounds
203 $
204 $   IF xchar .eqs. "PRIME" .and. control_lib .eqs. "NONE" then -
205 $       goto process_calibrations
206 $
207 $   IF xchar .eqs. "SECOND" .and. control_lib .eqs. "NONE" then -
208 $       goto process_calibrations
209 $
210 $!-----
211 $
212 $! Put modified library back into configuration
213 $
214 $   pars/comm nd_ams_archive 'xchar':aconfig' -
215 $   stype='CONTROL_lib' ABUND=75 astime expback SSPRSTR4
216 $
217 $   EXPBACK=F$EDIT(EXPBACK,"UPCASE")
218 $   IF EXPBACK .EQS. "" THEN EXPBACK="BKG"
219 $
220 $   MATRIX_TYPE=F$EDIT(SSPRSTR4,"UPCASE")
221 $
222 $   if control_lib .eqs. "RA" then-
223 $   pars/comm nd_ams_archive 'xchar':aconfig' "toler=400"

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

224 $
225 $   MCA/COMMAND   "MOVE nd_ams_archive_"xchar':"aconfig' ALPHA0"-
226 $       "DELETE/REGION ALPHA0" -
227 $       "set label ""Spectrum "aconfig""
228 $
229 $   if fermco .and. control_lib .eqs. "RA"
230 $   then
231 $   set_user
232 $   pars/scr/fpl=nd_ams_fpl:ndal_alpha_sample.fpl alpha0
233 $   endif
234 $
235 $   IF ON_ESP_DISPLAY THEN
@ND_AMS_COM:NDAL_CLEAR_REGION_ENERGY.COM
236 $
237 $   say ""
238 $   say "       You are looking at alpha spectrum "+bold_on+"aconfig'+bold_off+ "
239 $
240 $!-----
241 $
242 $   IF xchar .eqs. "D" then goto process_dailys
243 $   IF xchar .eqs. "B" then goto process_backgrounds
244 $   IF xchar .eqs. "PRIME" then goto process_calibrations
245 $   IF xchar .eqs. "SECOND" then goto process_calibrations
246 $   goto process_samples
247 $
248 $!-----
249 $
250 $ read_err:
251 $
252 $   say "       Error reading (nd_ams_user:NAMES.DAT)"
253 $
254 $   if f$trnlnm("in_file") .nes. "" then close in_file
255 $   if f$trnlnm("qa_file") .nes. "" then close qa_file
256 $
257 $!   jxk 9/7/95 exits changed to goto master_exit
258 $!   exit
259 $   goto master_exit
260 $!   jxk 9/7/95
261 $
262 $ end_read:
263 $
264 $   say "       The file (nd_ams_user:NAMES.DAT) is empty"
265 $
266 $   if f$trnlnm("in_file") .nes. "" then close in_file
267 $   if f$trnlnm("qa_file") .nes. "" then close qa_file
268 $

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

269 $ ask_do_qa:
270 $
271 $   qc_plots = "Y"
272 $   if xchar .eqs. "B"   then goto do_background_qa
273 $   if xchar .eqs. "D"   then goto do_daily_qa
274 $
275 $ ask_qc_plots:
276 $
277 $   ask qc_plots -
278 "   Generate QC Plots & Reports [(Y)/N] # "
279 $   qc_plots = F$EDIT(F$EXTRACT(0,1,qc_plots),"UPCASE")
280 $   IF qc_plots .eqs. "" then qc_plots="Y"
281 $   IF qc_plots .EQS. "Y" THEN GOTO DO_QA
282 $   IF qc_plots .EQS. "N" THEN GOTO DO_QA
283 $   SAY ""
284 $   SAY "   Invalid response, try again..."
285 $   goto ask_qc_plots
286 $
287 $ DO_QA:
288 $
289 $   if xchar .eqs. "PRIME" then goto do_weekly_qa
290 $   if xchar .eqs. "SECOND" then goto do_weekly_qa
291 $   goto do_sample_qa
292 $
293 $!-----
294 $
295 $PROCESS_DAILYS:
296 $
297 $   PARS/COMMAND ALPHA0 "DISPECOUNT=16384" "DISPMODE=LIN"
298 $
299 $ if (.not. purge_flag .and. .NOT. DEMO)
300 $ then
301 $   SAY -
302 "       one moment ....."+bold_on+"purging files"+bold_off+"....."
303 $   PURGE/keep=2/EXCLUDE=(MCA*.LOG,NET*.LOG) -
304       nd_ams_user:*.cnf,nd_ams_user:names.dat
305 $   PURGE/before=yesterday nd_ams_list:*.lis
306 $   delete/before=yesterday nd_ams_archive_alpha:alpha*_d_*.cnf;*/log
307 $   purge_flag="Y"
308 $ endif ! purge_flag
309 $
310 $   @nd_ams_regions:PULSER.REGION
311 $
312 $   PEAK/REGION/TYPE=GROSS ALPHA0
313 $
314 $   qaxfer ALPHA0 nd_ams_qa_d:D'chamber'

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

315 $
316 $!   Save current acq start time and ajust for qaxfer
317 $
318 $   pars/comm alpha0 astime/symbol=astime_save
319 $
320 $   det=f$integer(chamber)
321 $   adc = (det-1) / number_of_groups + 1
322 $   offset = det - (adc-1) * number_of_groups
323 $   qaxfer_astime="1-JAN-94 00:"adc':"offset'"
324 $   pars/comm alpha0 astime=""qaxfer_astime'"
325 $
326 $   QAXFER ALPHA0 nd_ams_qa 'xchar':batch 'xchar' !7/2/92
327 $
328 $!   Put back original acq start time
329 $
330 $   pars/comm alpha0 astime=""astime_save'"
331 $
332 $   goto read_again
333 $
334 $!-----
335 $
336 $PROCESS_BACKGROUNDS:
337 $
338 $! fetch the most recent file for selected detector number if date=NONE
339 $
340 $ if control_lib .eqs. "NONE"
341 $ then
342 $   @nd_ams_com:ndal_getlast ""'xchar','chamber'" "cnf" "nd_ams_archive_'xchar'"
343 $   @nd_ams_com:ndal_extract _.'ndlastfile'
344 $   @nd_ams_com:ndal_extract _.'extraction'
345 $   aconfig=""'xchar_'chamber_'extraction'"-.cnf"
346 $   say ""
347 $   say "           You are looking at alpha spectrum "+bold_on+"aconfig'+bold_off+"
348 $ endif
349 $
350 $   MCA/COMMAND   "MOVE nd_ams_archive_'xchar':"aconfig' ALPHA0"-
351 $               "DELETE/REGION ALPHA0" -
352 $               "set label ""Spectrum "aconfig'"
353 $
354 $   PARS/COMMAND ALPHA0 "DISPECOUNT=32" "DISPMODE=LIN" -
355 $               "DETECTOR="CHAMBER" "DETNAME="CHAMBER"
356 $
357 $!-----
358 $
359 $!   generate background spectral plot dvm 5/93
360 $

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

361 $ if plot_hc .and. plot_queue .nes. ""
362 $ then
363 $ if dvm
364 $ then
365 $ say ""
366 $ say " System is now developing a plot on "+bold_on+"Alpha0"+bold_off+"
367 $ plot/alpha/left=3500/right=6500/nonid/noregion ALPHA0 'plot_file'
368 $ else
369 $
370 $ goto skip_BKG_plot
371 $
372 $ display nd_ams_archive 'xchar': 'aconfig' -
373 $ /linear/proto='plot_proto'plot_line'/land/start=3
374 $ endif !dvm
375 $ endif !hc flag
376 $
377 $skip_BKG_plot:
378 $
379 $!-----
380 $
381 $! generate channel by channel listings dvm 5/93
382 $
383 $ if list_hc .and. report_queue .nes. ""
384 $ then
385 $ if dvm
386 $ then
387 $ list nd_ams_archive 'xchar': 'aconfig' -
388 $ /head=nd_ams_headers:chan1.hdr/col=10/end=600'chan1_line'
389 $ list nd_ams_archive 'xchar': 'aconfig' -
390 $ /head=nd_ams_headers:chan2.hdr/col=10/start=601'chan2_line'
391 $ else
392 $ list nd_ams_archive 'xchar': 'aconfig' 'list_line'
393 $ endif !dvm
394 $ endif !hc
395 $!-----
396 $
397 $! Let's do background checks on actinide regions of interest,
398 $
399 $! Build a background file
400 $
401 $! copy nd_ams_headers:reports.hdr nd_ams_list:background.lis
402 $! copy nd_ams_headers:reports.hdr 'background_lis'
403 $
404 $ pars/com alpha0 stype="Backgrounds"
405 $ @nd_ams_regions:BACKGROUND.REGION
406 $

```


Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

407 $! peak/region/midpoint/type=gross/header=nd_ams_headers:bkgnds.hdr alpha0 'bkgnd_line'
408 $ peak/region/midpoint/type=gross alpha0
409 $
410 $! append 'bkgnd_file' nd_ams_list:background.lis
411 $! append 'bkgnd_file' 'background_lis'
412 $
413 $! delete 'bkgnd_file'
414 $
415 $ QAXFER ALPHA0 nd_ams_qa_b:B'CHAMBER'
416 $
417 $! Save current acq start time and ajust for qaxfer
418 $
419 $ pars/comm alpha0 astime/symbol=astime_save
420 $
421 $ det=f$integer(chamber)
422 $ adc = (det-1) / number_of_groups + 1
423 $ offset = det - (adc-1) * number_of_groups
424 $ qaxfer_astime="1-JAN-94 00:"adc':"offset"
425 $ pars/comm alpha0 astime=""qaxfer_astime"
426 $
427 $ QAXFER ALPHA0 nd_ams_qa_'xchar':batch_'xchar' !7/2/92
428 $
429 $! Put back original acq start time
430 $
431 $ pars/comm alpha0 astime=""astime_save"
432 $
433 $! jxk 8/9/95 create temporary file for background messages
434 $! from this sample
435 $ if f$edit(f$extract(0,1,y12_bioassay),"upcase") .eqs. "Y" -
436 .or. f$edit(f$extract(0,1,new_reagent_calc),"upcase") .eqs. "Y"
437 $ then
438 $ jxk_temp_path = f$logical("nd_ams_histy")
439 $! construct file name
440 $ temp_bkmsg = "jxktempbkmsg.dat"
441 $ jxk_temp_bkmsg = ""jxk_temp_path""+""temp_bkmsg""
442 $! show sym jxk_temp_bkmsg
443 $! first, delete all old copies
444 $ jxkcolast = ".*"
445 $ jxkfdel = ""jxk_temp_bkmsg""+""jxkcolast""
446 $! show sym jxkfdel
447 $ delete 'jxkfdel'
448 $
449 $! then, open new file
450 $! first, have to open it with fortran. Otherwise, file
451 $! attributes are wrong
452 $ file_fortopen = ""jxk_temp_bkmsg""

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

453 $   show sym file_fortopen
454 $ RUN ND_AMS_EXE:fortopen
455 $!   r fortopen.exe
456 $
457 $!   open/write jxkbkfile 'jxk_temp_bkmsg'
458 $!   then open it with append to preserve attributes
459 $   open/append jxkbkfile 'jxk_temp_bkmsg'
460 $
461 $!   write header message
462 $   write jxkbkfile " "
463 $   write jxkbkfile " sample ",aconfig
464 $   jxkbkhdlnct=2
465 $   close jxkbkfile
466 $   endif           ! if y12_bioassay .or. new_reagent_calc
467 $!   jxk 8/9/95
468 $
469 $   cnt=-1
470 $ bkg_loop:
471 $   cnt=cnt+1
472 $   actinide=f$edit(f$element(cnt,",",actinide_list),"upcase")
473 $   if actinide .eqs. "END" then goto bkg_loop_exit
474
475 $   if actinide .eqs. "TH" then pars/comm alpha0 TOLER=200
476 $   pars/com alpha0 stype=""'actinide' Backgrounds"
477 $   @nd_ams_regions:'actinide'.REGION
478 $   peak/region/midpoint/type=gross/header=nd_ams_headers:bkgnd_'actinide'.hdr -
479     alpha0 'bkgnd_line'
480 $
481 $!   append 'bkgnd_file' nd_ams_list:background.lis
482 $!   append 'bkgnd_file' 'background_lis'
483 $
484 $!   delete 'bkgnd_file'
485 $   QAXFER ALPHA0 nd_ams_qa_b:B'CHAMBER'_'actinide'
486 $
487 $!   Save current acq start time and ajust for qaxfer
488 $
489 $   pars/comm alpha0 astime/symbol=astime_save
490 $
491 $   det=f$integer(chamber)
492 $   adc = (det-1) / number_of_groups + 1
493 $   offset = det - (adc-1) * number_of_groups
494 $   qaxfer_astime="1-JAN-94 00:"adc':"offset"
495 $   pars/comm alpha0 astime=""'qaxfer_astime'"
496 $
497 $   QAXFER ALPHA0 nd_ams_qa_'xchar':batch_'xchar'_'ACTINIDE' !7/2/92
498 $

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

499 $!   Put back original acq start time
500 $
501 $   pars/comm alpha0 astime=""astime_save"
502 $
503 $!   execute jxk's process backgrounds for history .com file 6/95
504 $
505 $ @nd_ams_com:ndal_bkgd_histroy.com
506 $
507 $!   execute jxk's process backgrounds for history .com file 6/95
508 $
509 $   goto bkg_loop
510 $
511 $ bkg_loop_exit:
512 $
513 $!   jxk 8/9,22/95 append temporary background message file for this
514 $!   sample to message file for all samples and delete
515 $   if f$edit(f$extract(0,1,y12_bioassay),"upcase") .eqs. "Y" -
516     .or. f$edit(f$extract(0,1,new_reagent_calc),"upcase") .eqs. "Y"
517 $       then
518 $!   print/delete 'jxk_temp_bkmsg'
519 $!   close jxkbkfile
520 $! temporary type of messages file to see contents
521 $ type 'jxk_temp_bkmsg'
522 $!   count lines in the message file to see if it has any messages
523 $   jxklinecnt=0
524 $   open/read jxkinfile 'jxk_temp_bkmsg'
525 $!   3 reads to make sure I count past header lines
526 $   read/end_of_file=jxkbkeof jxkinfile jxkline
527 $   jxklinecnt = jxklinecnt + 1
528 $   read/end_of_file=jxkbkeof jxkinfile jxkline
529 $   jxklinecnt = jxklinecnt + 1
530 $   read/end_of_file=jxkbkeof jxkinfile jxkline
531 $   jxklinecnt = jxklinecnt + 1
532 $
533 $   jxkbkeof:
534 $   close jxkinfile
535 $!   if there is more than the header line(s), append the background
536 $!   messages file for this sample to the total messages file
537 $   if jxklinecnt .gt. jxkbkhdlnent
538 $       then
539 $   append 'jxk_temp_bkmsg' 'jxk_temp_notemsg'
540 $   endif
541 $!   don't delete jxk_temp_bkmsg here because it will be deleted
542 $!   before it is re-created. redundant construct file name and
543 $!   delete wastes time
544 $   endif           ! if y12_bioassay .or. new_reagent_calc

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

545 $!   jxk
546 $
547 $   IF REPORT_QUEUE.EQS. "" THEN GOTO SKIP_BKG_REPORT
548 $   if report_queue.EQS. "TT:"
549 $   THEN
550 $
551 $!     TYPE nd_ams_list:background.lis
552 $!     TYPE 'background_lis'
553 $
554 $!     DELETE ND_AMS_LIST:BACKGROUND.LIS;
555 $!     DELETE 'BACKGROUND_LIS'
556 $
557 $   ELSE
558 $     IF REMOTE_PRINTER
559 $     THEN
560 $
561 $!       @nd_ams_com:ndal_send nd_ams_list:background.lis
562 $!       @nd_ams_com:ndal_send 'background_lis'
563 $
564 $     else
565 $
566 $!       print/delete/queue='report_queue' nd_ams_list:background.lis
567 $!       print/delete/queue='report_queue' 'background_lis'
568 $
569 $     endif !remote_printer
570 $   ENDIF !report_queue
571 $
572 $SKIP_BKG_REPORT:
573 $
574 $   MCA/COMMAND "DELETE/REGION ALPHA0"
575 $
576 $!   SEND UPDATED BACKGROUND TO OTHER NODE ??
577 $
578 $   IF net_node.NES. "NONE" THEN -
579 $   COPY/LOG/prot=w:rwed nd_ams_archive_b:'ACONFIG'.CNF -
580 $   'NET_node'"net_user' "net_pass"::'net_disk':[net_dir'alusr.archive.b]*
581 $
582 $   goto read_again
583 $
584 $!-----
585 $
586 $PROCESS_CALIBRATIONS:
587 $
588 $   check=""xchar"           !7/8/92 prime/second
589 $   pors = xchar             !7/8/92
590 $

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

591 $   if xchar .eqs. "SECOND"      !7/8/92
592 $   then
593 $     DOING_EFFICIENCY = "N"
594 $     PARS/COMMAND ALPHA0 "DISPECOUNT=32" "DISPMODE=LIN"
595 $   else
596 $     DOING_EFFICIENCY = "Y"
597 $     PARS/COMMAND ALPHA0 "DISPECOUNT=32" "DISPMODE=LIN"
598 $   endif      !XCHAR
599 $
600 $!-----
601 $
602 $! fetch the most recent file for selected detector number if date=NONE
603 $
604 $ if control_lib .eqs. "NONE"
605 $ then
606 $ @nd_ams_com:ndal_getlast ""'xchar';"chamber'" "cnf" "nd_ams_archive_"'xchar'"
607 $ @nd_ams_com:ndal_extract _.'ndlastfile'
608 $ @nd_ams_com:ndal_extract _.'extraction'
609 $ aconfig=""'xchar_' "chamber_' "extraction""-".cnf"
610 $ endif
611 $
612 $   MCA/COMMAND   "MOVE nd_ams_archive_"'xchar':"aconfig' ALPHA0"-
613 $               "DELETE/REGION ALPHA0" -
614 $               "set label ""Spectrum "aconfig""
615 $!   say ""
616 $!   say "       You are looking at alpha spectrum "+bold_on+"aconfig'+bold_off+ "
617 $
618 $! BRING IN CURRENT CALIBRATION REGIONS
619 $
620 $   @nd_ams_regions:'xchar'.REGION
621 $
622 $   PEAK/REGION/TYPE=GROSS ALPHA0
623 $
624 $   if xchar .eqs. "SECOND"      !7/8/92
625 $   then
626 $     set_user
627 $     CALIBRATE/ALPHA/UPDATE/CONFIRM-
628 $       /CERTIFICATE=nd_ams_'xchar':master_second ALPHA0
629 $     pars/comm alpha0 ASTIME      ! get acq date/time
630 $     pars/comm alpha0 ecaltime=""ASTIME" ! set energy date/time
631 $     GOTO SKIP_EFF
632 $   else
633 $     IF ONE_LINE_EFF THEN GOTO DO_EFF   ! ONE POINT EFF STANDARD
634 $     set_user
635 $     CALIBRATE/ALPHA/UPDATE/CONFIRM-
636 $       /CERTIFICATE=nd_ams_'xchar':'xchar_' 'CHAMBER' ALPHA0

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

637 $    pars/comm alpha0 ASTIME          ! get acq date/time
638 $    pars/comm alpha0 ecaltime=""ASTIME" ! set energy date/time
639 $    endif          !XCHAR
640 $
641 $
642 $!-----
643 $
644 $DO_EFF:
645 $
646 $    IF DOING_EFFICIENCY
647 $    THEN
648 $
649 $! BRING IN CURRENT CALIBRATION REGIONS
650 $
651 $    @nd_ams_regions:'xchar'.REGION
652 $
653 $    PEAK/REGION/TYPE=GROSS ALPHA0
654 $
655 $!  FETCH THE CURRENT CERTIFICATE DATE AND PASS TO ALPHA0
656 $
657 $    PARS/COMM nd_ams 'xchar':'xchar' 'CHAMBER'.CER CTFDATE
658 $    PARS/COMM ALPHA0 ASTIME "STIME="CTFDATE"
659 $
660 $!    1/93 changed /nofwhm to /fwhm (rsh)
661 $
662 $    set_user
663 $    CALIBRATE/ALPHA/UPDATE/EFF/NOENERGY/FWHM/CONFIRM/peak_report-
664 $    /CERTIFICATE=nd_ams 'xchar':'xchar' 'CHAMBER' ALPHA0
665 $
666 $    pars/comm alpha0 dcaltime=""ASTIME" ! set eff date/time
667 $
668 $    if plotting_eff .AND. dis_ok then eff/plot alpha0
669 $
670 $    endif !doing_eff
671 $
672 $!-----
673 $
674 $ SKIP_EFF:
675 $
676 $! BRING IN CURRENT CALIBRATION REGIONS
677 $
678 $    @nd_ams_regions:'xchar'.REGION
679 $
680 $    PEAK/REGION/TYPE=GROSS ALPHA0'peak_line'
681 $
682 $    if report_queue .eqs. "" then goto skip_cal_report

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

683 $   if report_queue .eqs. "TT:"
684 $   then
685 $       type 'peak_file'
686 $       DELETE 'PEAK_FILE'
687 $   else
688 $!     print/delete/queue='report_queue' 'peak_file'
689 $   endif
690 $
691 $skip_cal_report:
692 $
693 $! 1/93 improved the move/partial call with new technology! (rsh)
694 $
695 $   move/partial alpha0/eff nd_ams_archive 'xchar': 'ACONFIG'
696 $   move/partial alpha0/eff nd_ams_user:1 'CHAMBER'
697 $
698 $   if current_software
699 $   then
700 $   MOVE/partial/fpl=nd_ams_fpl:ndal_cal_params 'xchar'.fpl-
701 $       ALPHA0 nd_ams_archive 'xchar': 'ACONFIG'
702 $   MOVE/partial/fpl=nd_ams_fpl:ndal_cal_params 'xchar'.fpl-
703 $       alpha0 nd_ams_user:1 'CHAMBER'
704 $   else
705 $   move ALPHA0 nd_ams_archive 'xchar': 'ACONFIG'
706 $   move ALPHA0 nd_ams_user:1 'CHAMBER'
707 $   endif
708 $
709 $   det=f$integer(chamber)
710 $
711 $   adc = (det-1) / number_of_groups + 1
712 $   offset = det - (adc-1) * number_of_groups
713 $   START = 'group_size' * (offset - 1) + 1
714 $   if start .eq. 1
715 $   then
716 $       if current_software
717 $       then
718 $       MOVE/partial/fpl=nd_ams_fpl:ndal_cal_params 'xchar'.fpl-
719 $           alpha0 nd_ams_setup:setup_alpha'adc'
720 $       MOVE/partial/fpl=nd_ams_fpl:ndal_cal_params 'xchar'.fpl-
721 $           alpha0 alpha'adc'
722 $       else
723 $       move/part alpha0/calib nd_ams_setup:setup_alpha'adc'
724 $       move/part alpha0/calib alpha'adc'
725 $       endif
726 $   endif
727 $
728 $!   SEND UPDATED HEADER TO OTHER NODE ??

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

729 $
730 $ IF NET_node .NES. "NONE"
731 $ THEN
732 $ COPY/LOG/prot=w:rwed nd_ams_user:l'CHAMBER'.CNF -
733 'NET_node'""net_user' "net_pass""::'net_disk':['net_dir'.alusr]*
734 $ COPY/LOG/prot=w:rwed nd_ams_archive 'xchar': 'ACONFIG'.cnf -
735 'NET_node'""net_user' "net_pass""::'net_disk':['net_dir'.alusr.archive.'xchar']*
736 $ endif
737 $
738 $   NID/LIB=nd_ams_lib:'xchar'.NLB/nolist ALPHA0
739 $
740 $!-----
741 $
742 $!generate calibration spectral plot dvm 5/93
743 $
744 $   if plot_hc .and. plot_queue .nes. ""
745 $   then
746 $     if dvm
747 $     then
748 $       say ""
749 $       say "      System is now developing a plot on "+bold_on+"Alpha0"+bold_off+"
750 $       plot/alpha/left=3500/right=6500/nonid/noregion ALPHA0 'plot_file'
751 $     else
752 $ GOTO SKIP_CALIBRATE_PLOT
753 $       display nd_ams_archive 'xchar': 'aconfig' -
754 $       /linear/proto='plot_proto'plot_line'/land/start=3
755 $     endif !dvm
756 $   endif !hc flag
757 $
758 $SKIP_CALIBRATE_PLOT:
759 $
760 $!-----
761 $
762 $   QAXFER ALPHA0 nd_ams_qa 'xchar': 'xchar'CHAMBER'
763 $
764 $!   Save current acq start time and ajust for qaxfer
765 $
766 $   pars/comm alpha0 astime/symbol=astime_save
767 $
768 $   det=f$integer(chamber)
769 $   adc = (det-1) / number_of_groups + 1
770 $   offset = det - (adc-1) * number_of_groups
771 $   qaxfer_astime="1-JAN-94 00:"adc':"offset"
772 $   pars/comm alpha0 astime=""qaxfer_astime""
773 $
774 $   QAXFER ALPHA0 nd_ams_qa 'xchar':batch 'xchar' !7/2/92

```


Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

775 $
776 $!   Put back original acq start time
777 $
778 $   pars/comm alpha0 astime=""astime_save""
779 $
780 $   goto read_again
781 $
782 $!-----
783 $
784 $!   All sample processing starts here...
785 $
786 $PROCESS_SAMPLES:
787 $
788 $   PARS/COMMAND ALPHA0 "DISPECOUNT=32" "DISPMODE=LIN" TITLE
789 $
790 $   len=f$length(title)
791 $   if len .eq. 6 then det=f$extract(3,3,title)
792 $   if len .eq. 3 then det=f$extract(0,3,title)
793 $   CHAMBER=f$integer(det)
794
795 $   pars/comm nd_ams_archive 'xchar': 'aconfig' -
796       sloctn/symbol=batch_id_num ssprstr5/sym=tr_cert ssp1/sym=t_lambda
797 $
798 $!-----
799 $!   4/94 check for sane sample matrix
800 $!   CREATE QC HISTORY YIELD FILE AND BATCH YIELD FILE ??
801 $!-----
802 $
803 $   cnt=-1
804 $
805 $ matrix_loop:
806 $
807 $   cnt=cnt+1
808 $   valid_matrix=f$edit(f$element(cnt,",",matrix_list),"upcase")
809 $   if valid_matrix .eqs. "END" then goto invalid_matrix_type
810 $   if valid_matrix .eqs. matrix_type then goto matrix_type_ok
811 $   goto matrix_loop
812 $
813 $invalid_matrix_type:
814 $
815 $   IF MATRIX_TYPE .EQS. "" THEN MATRIX_TYPE="NONE"
816 $   say ""
817 $   say "  Unsupported matrix type (" + bold_on + ""matrix_type"" + bold_off + ")"
818 $   say "  Valid matrices are as follows:"
819 $   say bold_on + "  "matrix_list"" + bold_off
820 $   ask reply "    Hit return to make correction # "

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

821 $    set_user
822 $    pars/scr/fpl=nd_ams_fpl:ndal_alpha_sample.fpl alpha0
823 $    pars/comm alpha0 SSPRSTR4/sym=matrix_type
824 $    matrix_type=f$edit(matrix_type,"upcase")
825 $    cnt=-1
826 $    goto matrix_loop
827 $
828 $matrix_type_ok:
829 $
830 $!-----
831 $
832 $!    CREATE SUPPORTING (YIELD) QC FILES
833 $
834 $ IF f$search -
835     ("nd_ams_qa_y:BATCH_y_"CONTROL_LIB'"matrix_type'.qaf") .eqs. ""
836 $ THEN
837 $     copy/LOG -
838         nd_ams_qa_y:master_y_'control_lib'"matrix_type'.qaf -
839         nd_ams_qa_y:batch_y_'control_lib'"matrix_type'.qaf
840 $ endif
841 $
842 $ IF f$search -
843     ("nd_ams_qa_y:"batch_id_num'_y_"CONTROL_LIB'"matrix_type'.qaf;*") .eqs. ""
844 $ THEN
845 $     copy/LOG -
846         nd_ams_qa_y:master_y_'control_lib'"matrix_type'.qaf -
847         nd_ams_qa_y:batch_id_num'_y_'control_lib'"matrix_type'.qaf
848 $ endif
849 $
850 $!-----
851 $
852 $!    CREATE SUPPORTING (CONTROL) QC FILES
853 $
854 $ IF f$search ("nd_ams_qa_C:BATCH_C_"CONTROL_LIB'"matrix_type'.qaf") .eqs. ""
855 $ THEN
856 $     copy/LOG -
857         nd_ams_qa_C:master_C_'control_lib'"matrix_type'.qaf -
858         nd_ams_qa_C:batch_C_'control_lib'"matrix_type'.qaf
859 $ endif
860 $
861 $!-----
862 $
863 $!    CREATE SUPPORTING (REAGENT) QC FILES
864 $
865 $ IF f$search ("nd_ams_qa_R:BATCH_R_"CONTROL_LIB'"matrix_type'.qaf") .eqs. ""
866 $ THEN

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

867 $    copy/LOG -
868     nd_ams_qa_R:master_R_'control_lib'_matrix_type'.qaf -
869     nd_ams_qa_R:batch_R_'control_lib'_matrix_type'.qaf
870 $ endif
871 $
872 $!-----
873 $
874 $!
875 $! Added the following code to change filename from mmddyyb.RES to
876 $! DDDMMYYYYY.RES for today's date. We wanted one file to contain
877 $! all samples processed in one day.
878 $! JLH -- 1/11/95
879 $!
880 $    if flat_file_output .eqs. "Y12"
881 $    then
882 $        today = F$TIME()
883 $        if (F$EXTRACT(0,1,today) .eqs. " ")
884 $        then
885 $            today = F$EXTRACT(1,1,today) + F$EXTRACT(3,3,today) + -
886 $                F$EXTRACT(7,4,today)
887 $        else
888 $            today = F$EXTRACT(0,2,today) + F$EXTRACT(3,3,today) + -
889 $                F$EXTRACT(7,4,today)
890 $        endif
891 $        res_filename = "nd_ams_biotrack_bif:"today'.RES"
892 $    endif
893 $!
894 $! End of added code. JLH -- 1/11/95
895 $!
896 $!
897 $! Modified the following if statement (removed y12_bioassay_output). If
898 $! y12_bioassay_output, create a different filename (see code above).
899 $! JLH -- 1/11/95
900 $!
901 $!-----
902 $
903 $    if flat_file_output .nes. "NO"
904 $    then
905 $        IF f$search ("nd_ams_biotrack_bif:"batch_id_num'.res;*") .eqs. ""
906 $        THEN
907 $            batch_reply="Y"
908 $        else
909 $            if .not. batch_reply
910 $            then
911 $                copy -
912 $                nd_ams_biotrack_bif:'batch_id_num'.res -

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

913      nd_ams_biotrack_bif:'batch_id_num'.res
914 $      batch_reply="Y"
915 $      endif ! batch_reply
916 $      endif ! flat_file_output
917 $      endif ! flat_file_output
918 $
919 $!-----
920 $
921 $!      SRS treats AM/NP as GROSS spiked/unspiked
922 $
923 $ if flat_file_output .eqs. "SRS" .AND. -
924 (control_lib .eqs. "GROSS-AM" .OR. CONTROL_LIB .EQS. "GROSS-NP")
925 $ then
926 $ IF f$search ("nd_ams_qa_y:"batch_id_num'_y_'CONTROL_LIB'_control.qaf;*") .eqs. ""
927 $ THEN
928 $ copy/LOG -
929 nd_ams_qa_y:master_y_'control_lib'_matrix_type'.qaf -
930 nd_ams_qa_y:'batch_id_num'_y_'control_lib'_control.qaf
931 $ endif ! srs_bioassay_output
932 $ endif ! srs_bioassay_output
933 $
934 $!-----
935 $
936 $!      setup regions for plots moved here to allow more time to examine
937 $!      regions without breaking up program flow dvm 5/93 it corporation
938 $
939 $      @nd_ams_regions:'CONTROL_LIB'.REGION
940 $
941 $!-----
942 $!      dump list of whole spectrum ?? Set list_hc via maintenance menu.
943 $!      generate channel by channel listings
944 $!      printout moved to below for setting printout order
945 $
946 $      if dvm
947 $      then
948 $          if list_hc then list nd_ams_archive 'xchar': 'aconfig' -
949 /head=nd_ams_headers:chan1.hdr/col=10/end=600'chan1_line'
950 $          if list_hc then list nd_ams_archive 'xchar': 'aconfig' -
951 /head=nd_ams_headers:chan2.hdr/col=10/start=601'chan2_line'
952 $      else
953 $          if list_hc then list nd_ams_archive 'xchar': 'aconfig' 'list_line'
954 $      endif ! dvm
955 $
956 $!-----
957 $
958 $!      start building a peaks search report if necessary dvm 5/93

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

959 $
960 $   if samp_hc .or. back_hc .or. enback_hc then -
961     copy nd_ams_headers:reports.hdr 'peak_file'
962 $
963 $!-----
964 $
965 $   redo_peak_cnt = 0
966 $   REGION_TYPE="STANDARD"
967 $   pars alpha0 tolerance=100
968 $
969 $ redo_peak_search:
970 $
971 $   say ""
972 $   say "      System is now doing a peak on   "+bold_on+"aconfig'+bold_off+"
973 $
974 $   peak/region/type=gross/header=nd_ams_headers:gross.hdr ALPHA0'gross_line'
975 $
976 $   IF .NOT. DEBUG .AND. ON_ESP_DISPLAY THEN -
977     @ND_AMS_COM:NDAL_SET_REGION_ENERGY.COM
978 $
979 $   type 'gross_file'
980 $
981 $   IF CONTROL_LIB.EQS. "GROSS-AM" .OR. CONTROL_LIB.EQS. "GROSS-NP"
982 $   THEN
983 $     pars alpha0 tolerance=2000
984 $     goto region_exit
985 $   endif ! gross
986 $
987 $   if adjust_regions
988 $   then
989 $
990 $ ask_regions_ok:
991 $
992 $   ask reply "      Do the regions look ok? (Y/N) [Yes]: "
993 $   REPLY=F$EDIT(REPLY,"UPCASE")
994 $   if reply .eqs. "NEXT" then GOTO READ_AGAIN
995 $   if reply .eqs. "" then reply = "YES"
996 $   if .not. reply
997 $   then
998 $
999 $ modify_regions:
1000 $
1001 $   if f$search("nd_ams_regions:adjust_offset.com") .eqs. "" then-
1002     goto manual_adjust
1003 $   @nd_ams_regions:adjust_offset.com
1004 $   REGION_TYPE="MANUAL"

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1005 $    goto redo_peak_search
1006 $
1007 $ manual_adjust:
1008 $
1009 $    redo_peak_cnt = redo_peak_cnt + 1
1010 $    if redo_peak_cnt .eq. 1
1011 $    then
1012 $    REGION_TYPE="EXPANDED"
1013 $    pars alpha0 tolerance=125
1014 $    @ND_AMS_REGIONS:'control_lib'_WIDE.REGION
1015 $    goto redo_peak_search
1016 $    else
1017 $    REGION_TYPE="MANUAL"
1018 $    pars alpha0 tolerance=150
1019 $    say ""
1020 $    say " To manually change the regions for this sample. Use the mouse to"
1021 $    say " adjusted the preset regions to their new position. When finished"
1022 $    ask x " hit return to continue..."
1023 $    goto redo_peak_search
1024 $    endif ! redo_peak_cnt
1025 $
1026 $    endif !reply = No
1027 $    endif !adjust_regions
1028 $
1029 $!-----
1030 $! Now... Append/get rid of peak report dvm 5/93
1031 $    if samp_hc then append 'gross_file' 'peak_file'
1032 $    delete 'gross_file'
1033 $!-----
1034 $
1035 $ region_exit:
1036 $
1037 $ IF .NOT. colorado_doh THEN GOTO SKIP_colorado_doh
1038 $ ask reply " Would you like to delete a peak region (Y/[N]) # "
1039 $ reply=f$edit(f$extract(0,1,reply),"upcase")
1040 $ if .not. reply then goto skip_colorado_doh
1041 $ask_next_region:
1042 $ ask record " Enter region number to be deleted or return when finished # "
1043 $ if record .eqs. "" then goto skip_colorado_doh
1044 $ pars/comm alpha0 psarea/record='record'
1045 $ say " Region 'record' contains 'psarea' counts"
1046 $ ask reply " Is this the correct region (Y/N) # "
1047 $ if .not. reply then goto ask_next_region
1048 $ pars/comm alpha0 psarea="0"/record='record' psctss="0"/record='record'
1049 $ goto ask_next_region
1050 $skip_colorado_doh:

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1051 $
1052 $ sac="1.0"
1053 $ assign/nolog 'sac' sac
1054 $
1055 $ IF .NOT. TMA_EBERLINE .OR. CONTROL_LIB .NES. "RA" THEN GOTO SKIP_RADIUM
1056 $
1057 $ ask sac "      Enter SAC factor (default=1.0) # "
1058 $ if sac .eqs. "" then sac="1.0"
1059 $ assign/nolog 'sac' sac
1060 $ SAC = f$trnlnm("SAC")
1061 $
1062 $ say ""
1063 $ say "      System is now doing a RA_MANIP on "+bold_on+"aconfig'+bold_off+"
1064 $ say "      RA_MANIP ALPHA0=ALPHA0*"sac' for (AREA & CPS)."
1065 $
1066 $ RUN ND_AMS_EXE:RA_MANIP
1067 $
1068 $ say ""
1069 $ say "      System is now reporting adjusted peaks on "+bold_on+"aconfig'+bold_off+"
1070 $
1071 $      ndreport/peak ALPHA0'nid_line' !rsh, added : for ln
1072 $
1073 $!      type 'nid_file'
1074 $
1075 $!-----
1076 $
1077 $!      Fetch chamber number - and batch id number dvm 5/93
1078 $
1079 $SKIP_RADIUM:
1080 $
1081 $      DET=F$INTEGER(CHAMBER)
1082 $      @ND_AMS_COM:NDAL_PREFIX.COM 'DET'
1083 $      NUMBER=""PRFX"DET"
1084 $
1085 $!      Fetch most recent background if necessary
1086 $
1087 $ if f$edit(expback,"upcase") .eqs. "BKG"
1088 $ then
1089 $      @nd_ams_com:ndal_getlast "b;"number"" "cnf" "nd_ams_archive_b"
1090 $      backgnd = ""ndlastfile"
1091 $      pars/comm alpha0 expback=""backgnd"
1092 $ else
1093 $      backgnd = ""expback"
1094 $ endif
1095 $
1096 $      @nd_ams_com:ndal_extract ] . 'backgnd'

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1097 $ backgnd = "nd_ams_archive_b:"+extraction+".cnf"
1098 $
1099 $   define/nolog bkg 'backgnd'
1100 $   define/nolog areas 'backgnd'
1101 $
1102 $!-----
1103 $! PLACE CURRENT SELECTED REGIONS INTO BACKGROUND SPECTRUM
1104 $! modified to use bkgnd_file dvm 5/93
1105 $
1106 $   MOVE/PARTIAL ALPHA0/REGIONS BKG:      !rsh, added : for ln
1107 $
1108 $   peak/region/midpoint/type=gross/header=nd_ams_headers:bkgnd.hdr -
1109 $   bkg:'bkgnd_line' !rsh, added : for ln
1110 $   type 'bkgnd_file'
1111 $
1112 $!-----
1113 $! Now... Append/get rid of background report dvm 5/93
1114 $   if back_hc then append 'bkgnd_file' 'peak_file'
1115 $   delete 'bkgnd_file'
1116 $!-----
1117 $
1118 $!   MOVE BKG: AREAS !rsh, added : for ln
1119 $
1120 $   say ""
1121 $   say "      System is now doing an enback using background"
1122 $   say "      "+bold_on+"backgnd'+bold_off+"
1123 $
1124 $   enback_qual="/negative/header=nd_ams_headers:enback.hdr"
1125 $   if .not. neg_areas then -
1126 $   enback_qual="/nonegative/header=nd_ams_headers:enback.hdr"
1127 $   enback'enback_qual'enback_line'/bkg=bkg: ALPHA0 !rsh, added : for ln
1128 $   type 'enback_file'
1129 $
1130 $!-----
1131 $! Now... Append/get rid of enbackground dvm 5/93
1132 $   if enback_hc then append 'enback_file' 'peak_file'
1133 $   delete 'enback_file'
1134 $!-----
1135 $
1136 $   say ""
1137 $   say "      System is now doing an nid using      "+bold_on+"control_lib'+bold_off+"
1138 $
1139 $   nid'nid_line'/lib=nd_ams_lib:'control_lib' ALPHA0
1140 $!   type 'nid_file'
1141 $
1142 $!-----

```


Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1143 $!   dvm 5/93 changed to not generate report unless asked, also printout
1144 $!   moved to later on to put in proper order
1145 $
1146 $   if postnid_hc
1147 $   then
1148 $       say ""
1149 $       say -
1150 $           System is now doing a post-nid peak on  "+bold_on+""aconfig"+bold_off+"
1151 $
1152 $       ndreport/nid=apeak'nidpeak_line' ALPHA0
1153 $!   type 'nidpeak_file'
1154 $   endif
1155 $
1156 $!-----
1157 $
1158 $!generate spectral data plot dvm 5/93
1159 $
1160 $       area/nolist/symbol=backcounts/start=3 alpha0
1161 $   if plot_queue .eqs. "TT:" then goto skip_spec_plot
1162 $   if plot_hc .and. plot_queue .nes. ""
1163 $   then
1164 $       if dvm
1165 $       then
1166 $           say ""
1167 $           say "       System is now developing a plot on  "+bold_on+"Alpha0"+bold_off+"
1168 $           plot/alpha/left=3500/right=6500/nonid/noregion ALPHA0 'plot_file'
1169 $       else
1170 $!       area/nolist/symbol=backcounts/start=3 alpha0
1171 $       if (backcounts .eqs. "0 0")
1172 $       then
1173 $           say ""
1174 $           say "       Spectrum contains 0 counts and will not be plotted"
1175 $           ask reply "       Hit RETURN to continue..."
1176 $           goto SKIP_SPEC_PLOT
1177 $       endif
1178 $
1179 $       display nd_ams_archive 'xchar': 'aconfig' -
1180 $           /linear/proto='plot_proto'plot_line'/land/start=3
1181 $   endif !dvm
1182 $   endif !hc flag
1183 $
1184 $skip_spec_plot:
1185 $
1186 $!-----
1187 $
1188 $   say ""

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1189 $    say "        System is now doing a wtmean on  "+bold_on+"aconfig'+bold_off+"
1190 $
1191 $    wtmean ALPHA0'wtmean_line'
1192 $!    type 'wtmean_file'
1193 $
1194 $!-----
1195 $
1196 $! 4/93 check for sane certificate file for tracer
1197 $
1198 $check_tracer_id:
1199 $
1200 $    if f$search("nd_ams_tracers:"tr_cert'.cer").eqs. ""
1201 $    then
1202 $        SAY " "
1203 $        SAY "    INVALID TRACER ID ("tr_cert')"
1204 $        SAY " "
1205 $        ASK REPLY "    HIT RETURN, THEN MAKE CORRECTION # "
1206 $        dir/col=1 nd_ams_tracers:*.cer;
1207 $        set_user
1208 $        PARS/screen alpha0/fpl=nd_ams_fpl:ndal_alpha_sample_tracer.fpl
1209 $
1210 $        pars/comm alpha0 ssprstr5/sym=tr_cert ssp1/sym=t_lambda
1211 $        GOTO check_tracer_id
1212 $    endif
1213 $
1214 $!-----
1215 $
1216 $!    Var report pre yield correction    ! 1/27/93 rjs
1217 $
1218 $    if srs_environmental
1219 $    then
1220 $        ndreport/nid=var ALPHA0'nidvar_line' !rsh, added : for ln
1221 $        type 'nidvar_file'
1222 $    endif ! srs_environmental
1223 $
1224 $!-----
1225 $!    SRS treats AM/NP as GROSS spiked/unspiked
1226 $!    determine mean for AM recovery
1227 $
1228 $ if flat_file_output .eqs. "SRS" .AND. -
1229     t_lambda .eqs. "0.00000E+00" .AND. -
1230     (control_lib .eqs. "GROSS-AM" .OR. CONTROL_LIB .EQS. "GROSS-NP")
1231 $ then
1232 $
1233 $ QA_FILE =
F$SEARCH("nd_ams_qa_Y:"BATCH_ID_NUM'_Y_'CONTROL_LIB'_CONTROL.QAF")

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1234 $ IF QA_FILE .EQS. "" THEN GOTO gross_MEAN_EXIT
1235 $
1236 $ IF CONTROL_LIB .EQS. "GROSS-AM" THEN PARAM="NCLSP1-AM241"
1237 $ IF CONTROL_LIB .EQS. "GROSS-NP" THEN PARAM="NCLSP1-NP237"
1238 $
1239 $ qaanal/LIST=nd_ams_list:qaanal.LIS/PARAM=PARAM 'QA_FILE'
1240 $ open/read GROSS_MEAN_file nd_ams_list:qaanal.lis
1241 $
1242 $ read_loop1:
1243 $
1244 $   read/err=GROSS_MEAN_exit/end=GROSS_MEAN_exit GROSS_MEAN_file buf1
1245 $   param=f$edit(f$extract(0,14,buf1),"upcase")
1246 $   if param .NES. "PARAMETER NAME" then goto read_loop1
1247 $
1248 $   POS = F$LOCATE(":",BUF1)
1249 $   name = F$EXTRACT(POS+1,20,BUF1)
1250 $   name = F$EDIT(name,"TRIM,COLLAPSE")
1251 $
1252 $ read_loop2:
1253 $
1254 $   read/err=end_exit/end=end_exit GROSS_MEAN_file buf2
1255 $   mean=f$edit(f$extract(0,4,buf2),"upcase")
1256 $   if mean .NES. "MEAN" then goto read_loop2
1257 $
1258 $   POS = F$LOCATE(":",BUF2)
1259 $   MEAN = F$EXTRACT(POS+1,20,BUF2)
1260 $   MEAN = F$EDIT(MEAN,"TRIM")
1261 $
1262 $GROSS_MEAN_EXIT:
1263 $
1264 $   PARS ALPHA0 SSP2='MEAN'
1265 $
1266 $   if f$trnlnm("GROSS_MEAN_file") .nes. "" then close GROSS_MEAN_file
1267 $ endif ! srs_bioassay_output
1268 $
1269 $!-----
1270 $
1271 $   time_str = f$time()
1272 $   alpha0_file := nd_ams_archive 'xchar': 'aconfig'.cnf
1273 $   alpha0_list := nd_ams_list: 'aconfig'.lis
1274 $
1275 $   BKG_FILENAME = F$ELEMENT(1,":",F$ELEMENT(0,":",BACKGND))
1276 $   IF DEBUG THEN SHOW SYMBOL BKG_FILENAME
1277 $
1278 $   if trailer_qual
1279 $   then

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1280 $   mda_trailer = "/trailer"
1281 $   else
1282 $   mda_trailer = ""
1283 $   endif
1284 $
1285 $!   jxk 12/94-2/95 new alpha_mda with exit flag
1286 $!   also, define sys$input to tty (sys$command) to pass from code
1287 $!   to tty and back
1288 $
1289 $   jxk_temp_path = f$logical("nd_ams_histry")
1290 $   blk_hist_path = f$logical("nd_ams_histblnk")
1291 $   bkg_hist_path = f$logical("nd_ams_histbkgd")
1292 $
1293 $!   show sym jxk_temp_path
1294 $!   show sym blk_hist_path
1295 $!   show sym bkg_hist_path
1296 $
1297 $   DEFINE/USER SYSS$INPUT SYSS$COMMAND
1298 $   alphaerr="n"
1299 $   alpha_mda/header=nd_ams_headers:alpha_mda.hdr'mda_trailer'/bkg=bkg alpha0
1300 $!   if alpha_mda does a deliberate termination using soft exit,
1301 $!   it asks if process.com should be terminated.  if not, alphaerr = "n"
1302 $   if alphaerr .nes. "n"
1303 $   then
1304 $!   if alpha_mda is told to terminate, but not terminate process.com
1305 $!   alphaerr = "g", which is a signal to go to the next spectrum
1306 $   if alphaerr .eqs. "g"
1307 $   then
1308 $   say " nd_ams_com:ndal_process.com to next spectrum "
1309 $   goto ask_next_spec
1310 $   endif
1311 $   say " nd_ams_com:ndal_process.com aborting "
1312 $   say " after alpha_mda as ordered"
1313 $   goto abort_exit
1314 $   endif
1315 $!   jxk 12/94-2/95
1316 $
1317 $   type 'alpha0_list'
1318 $
1319 $   if keep_mda_list_file
1320 $   then -
1321 $   copy 'alpha0_list' nd_ams_archive_'xchar':'aconfig'.lis
1322 $   endif
1323 $
1324 $!-----
1325 $

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1326 $!   dvm 5/93 report printouts moved to here and set in order
1327 $
1328 $skip_alpha_mda:
1329 $
1330 $ QAXFER ALPHA0 nd_ams_qa_y:'batch_id_num'_y_'CONTROL_LIB'_matrix_type'
1331 $
1332 $ QAXFER ALPHA0 nd_ams_qa_y:batch_y_'control_lib'_matrix_type'
1333 $
1334 $!-----
1335 $
1336 $!   SRS treats AM/NP as GROSS spiked/unspiked
1337 $
1338 $ if flat_file_output .eqs. "SRS" .AND. -
1339     t_lambda .nes. "0.00000E+00" .AND. -
1340     (control_lib .eqs. "GROSS-AM" .OR. CONTROL_LIB .EQS. "GROSS-NP")
1341 $ then
1342 $ IF f$search ("nd_ams_qa_y:'batch_id_num'_y_'CONTROL_LIB'_control.qaf;*" ) .nes. ""
1343 $ THEN
1344 $ qaxfer alpha0 nd_ams_qa_y:'batch_id_num'_y_'CONTROL_LIB'_control.qaf
1345 $ endif      ! srs_bioassay_output
1346 $ endif ! srs_bioassay_output
1347 $
1348 $!-----
1349 $
1350 $ if flat_file_output .NES. "NO"
1351 $ then
1352 $
1353 $ set def nd_ams_biotrack_bif:
1354 $ DEFINE/USER SYS$INPUT SYS$COMMAND
1355 $!   show sym jxk_temp_path
1356 $
1357 $!   jxk 8/9/95 the code flat_file_output used to be called y12.for
1358 $ RUN ND_AMS_EXE:'FLAT_FILE_OUTPUT'
1359 $
1360 $ SET DEF ND_AMS_USER:
1361 $
1362 $ endif ! flat_file_output
1363 $
1364 $   if xchar .eqs. "C" then goto CONTROL  ! CONTROLS
1365 $   if xchar .eqs. "R" then goto REAGENT  ! REAGENTS
1366 $   goto clean_up ! SAMPLES
1367 $
1368 $!-----
1369 $
1370 $ control:           ! controls
1371 $

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1372 $!-----
1373 $
1374 $ ask_control_ok:
1375 $
1376 $ IF FLAT_FILE_OUTPUT .NES. "SRS"
1377 $ THEN
1378 $ ask_spec_ok "          Does control look OK ?? (Y/N) # "
1379 $ spec_ok = f$edit(spec_ok,"trim,collapse,upcase")
1380 $ spec_ok = f$extract(0,1,spec_ok)
1381 $ if spec_ok .eqs. "Y" .or. spec_ok .eqs. "N" then goto do_control_hp
1382 $ say "          Invalid entry, try again..."
1383 $ goto ask_control_ok
1384 $ ENDIF ! flat_file_output
1385 $
1386 $ do_control_hp:
1387 $
1388 $ @nd_ams_com:ndal_get_control_values
1389 $
1390 $ DEFINE/NOLOG WORK ALPHA0
1391 $ DEFINE/NOLOG CLIB nd_ams_lib:CONTROL 'CONTROL_LIB'
1392 $
1393 $ set def nd_ams_user:
1394 $ Run ND_AMS_EXE:CONTROL
1395 $
1396 $! save original units
1397 $
1398 $ pars/comm ALPHA0 activmult/symbol=save_activmult -
1399 $          activunits/symbol=save_activunits
1400 $
1401 $! All control values are qaxfered as microcuries (no unit conversion)
1402 $
1403 $ pars ALPHA0 activmult=1.0 activunits=uCi
1404 $
1405 $ QAXFER ALPHA0 nd_ams_qa_c: BATCH_c 'control_lib' 'MATRIX_TYPE'
1406 $
1407 $! put original units back
1408 $
1409 $ pars/comm ALPHA0 activmult=""save_activmult" -
1410 $          activunits=""save_activunits"
1411 $
1412 $ if current_software
1413 $ then
1414 $ QAANAL/BOUNDS/REPORT=LAST'qaanal_line'/measure=""astime" -
1415 $ nd_ams_qa_c: BATCH_c 'control_lib' 'MATRIX_TYPE'
1416 $ else
1417 $ QAANAL/BOUNDS/REPORT=LAST'qaanal_line' -

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1418      nd_ams_qa c:batch_c 'control_lib' 'MATRIX_TYPE'
1419 $    endif ! CURRENT_SOFTWARE
1420 $
1421 $    IF REPORT_QUEUE.EQS. "" THEN GOTO clean_up
1422 $    if report_queue.EQS. "TT:"
1423 $    THEN
1424 $      type 'qaanal_file'
1425 $      DELETE 'QAANAL_FILE'
1426 $    ELSE
1427 $      if control_hc
1428 $      then
1429 $        IF REMOTE_PRINTER
1430 $        THEN
1431 $          @nd_ams_com:ndal_send 'qaanal_file'
1432 $        else
1433 $          print/delete/queue='report_queue' 'qaanal_file'
1434 $        endif !remote_printer
1435 $      endif !control_hc
1436 $    ENDIF ! REPORT_QUEUE
1437 $
1438 $    goto CLEAN_UP
1439 $
1440 $!-----
1441 $
1442 $ reagent:          ! reagents
1443 $
1444 $!   save original units
1445 $
1446 $   pars/comm ALPHA0 activmult/symbol=save_activmult -
1447 $       activunits/symbol=save_activunits
1448 $
1449 $!   All reagent values are qaxfered as picocuries
1450 $
1451 $   IF X10_BIOASSAY ! X10 STORES REGENT VALUES IN DPM
1452 $   THEN
1453 $     pars ALPHA0 activmult=2.22E6 activunits=DPM
1454 $   ELSE
1455 $     pars ALPHA0 activmult=1e6 activunits=pCi
1456 $   ENDIF
1457 $
1458 $   QAXFER ALPHA0 nd_ams_qa_r:batch_r 'control_lib' 'MATRIX_TYPE'
1459 $
1460 $!   put original units back
1461 $
1462 $   pars ALPHA0 "activmult="save_activmult" -
1463 $       "activunits="save_activunits"

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1464 $
1465 $   if current_software
1466 $   then
1467 $       QAANAL/BOUNDS/REPORT=LAST'qaanal_line'/measure=""'astime" -
1468 $       nd_ams_qa_r:BATCH_r_'control_lib_'MATRIX_TYPE'
1469 $   else
1470 $       QAANAL/BOUNDS/REPORT=LAST'qaanal_line' -
1471 $       nd_ams_qa_r:BATCH_r_'control_lib_'MATRIX_TYPE'
1472 $   endif
1473 $
1474 $   IF REPORT_QUEUE.EQS. "" THEN GOTO clean_up
1475 $   if report_queue.EQS. "TT:"
1476 $   THEN
1477 $       type 'qaanal_file'
1478 $       DELETE 'QAANAL_FILE'
1479 $   ELSE
1480 $       if control_hc then print/delete/queue='report_queue' 'qaanal_file'
1481 $   ENDIF ! REPORT_QUEUE
1482 $
1483 $   goto CLEAN_UP
1484 $
1485 $!-----
1486 $
1487 $ ask_spec_ok:
1488 $
1489 $ IF flat_file_output.nes. "SRS"
1490 $ THEN
1491 $   ask_spec_ok "           Does spectrum look OK ?? (Y/N) # "
1492 $   spec_ok = f$edit(spec_ok,"trim,collapse,upcase")
1493 $   spec_ok = f$extract(0,1,spec_ok)
1494 $   if spec_ok.eqs. "Y" .or. spec_ok.eqs. "N" then goto clean_up
1495 $   say "           Invalid entry, try again..."
1496 $   goto ask_spec_ok
1497 $ ENDIF ! flat_file_output
1498 $
1499 $!-----
1500 $
1501 $ clean_up:
1502 $
1503 $ if dvm
1504 $ then
1505 $   if report_queue.nes. ""
1506 $   then
1507 $       if mda_hc then print/delete/queue='report_queue'/form=shift_normal 'alpha0_list'
1508 $       if plot_queue.nes. "TT:"
1509 $       then

```


Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1510 $      if plot_hc then print/delete/queue='plot_queue' 'plot_file'
1511 $      endif
1512 $      if list_hc then print/delete/queue='report_queue'/form=chan_x_chan 'chan1_file'
1513 $      if list_hc then print/delete/queue='report_queue'/form=chan_x_chan 'chan2_file'
1514 $      if samp_hc .or. back_hc .or. enback_hc then print/delete/queue='report_queue' 'peak_file'
1515 $      if nid_hc then print/delete/queue='report_queue' 'nid_file'
1516 $      if nidvar_hc then print/delete/queue='report_queue' 'nidvar_file'
1517 $      if wtmean_hc then print/delete/queue='report_queue' 'wtmean_file'
1518 $      if postnid_hc then print/delete/queue='report_queue' 'nidpeak_file'
1519 $      else
1520 $      if mda_hc then delete 'alpha0_list'
1521 $      if plot_queue .nes. "TT:"
1522 $      then
1523 $      if plot_hc then delete 'plot_file'
1524 $      endif
1525 $      if list_hc then delete 'chan1_file'
1526 $      if list_hc then delete 'chan2_file'
1527 $      if samp_hc .or. back_hc .or. enback_hc then delete 'peak_file'
1528 $      if nid_hc then delete 'nid_file'
1529 $      if nidvar_hc then delete 'nidvar_file'
1530 $      if wtmean_hc then delete 'wtmean_file'
1531 $      if postnid_hc then delete 'nidpeak_file'
1532 $      endif
1533 $      else
1534 $      if report_queue .nes. ""
1535 $      then
1536 $      if mda_hc
1537 $      then
1538 $      IF REMOTE_PRINTER
1539 $      THEN
1540 $      @nd_ams_com:ndal_send 'alpha0_list'
1541 $      ELSE
1542 $      print/delete/queue='report_queue' 'alpha0_list'
1543 $      ENDIF !remote_printer
1544 $      ENDIF !mda_hc
1545 $
1546 $      if flat_file_output .eqs. "SRS"
1547 $      then
1548 $      say ""
1549 $      ask reply " Plot spectrum to printer ?? [N] # "
1550 $      reply=f$edit(f$extract(0,1,reply),"upcase")
1551 $      if reply .eqs. "Y" then print/delete/queue='plot_queue' 'plot_file'
1552 $      else
1553 $      if ((flat_file_output .nes. "SRS") .and. plot_hc .and. -
1554 $      (backcounts .nes. "0 0")) then -
1555 $      print/delete/queue='plot_queue' 'plot_file'

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1556 $      endif
1557 $
1558 $      if list_hc then print/delete/queue='report_queue' 'list_file'
1559 $      if samp_hc .or. back_hc .or. enback_hc then print/delete/queue='report_queue' 'peak_file'
1560 $      if nid_hc then print/delete/queue='report_queue' 'nid_file'
1561 $      if nidvar_hc then print/delete/queue='report_queue' 'nidvar_file'
1562 $      if wtmean_hc then print/delete/queue='report_queue' 'wtmean_file'
1563 $      if postnid_hc then print/delete/queue='report_queue' 'nidpeak_file'
1564 $      else
1565 $          if mda_hc then delete 'alpha0_list'
1566 $          if plot_hc then delete 'plot_file'
1567 $          if list_hc then delete 'list_file'
1568 $          if samp_hc .or. back_hc .or. enback_hc then delete 'peak_file'
1569 $          if nid_hc then delete 'nid_file'
1570 $          if nidvar_hc then delete 'nidvar_file'
1571 $          if wtmean_hc then delete 'wtmean_file'
1572 $          if postnid_hc then delete 'nidpeak_file'
1573 $      endif
1574 $ endif !dvm
1575 $
1576 $!-----
1577 $
1578 $ move ALPHA0 nd_ams_archive 'xchar': 'aconfig' ! ARCHIVE SPECTRUM
1579 $
1580 $! send updated sample, control or reagent to other node ??
1581 $
1582 $ IF net_node .NES. "NONE" THEN -
1583 COPY/LOG/prot=w:rwed nd_ams_archive 'xchar': 'ACONFIG'.CNF -
1584 'NET_node' "net_user" "net_pass" :: "net_disk": ['net_dir'. alusr.archive. 'xchar'] *
1585 $
1586 $ ask_next_spec:
1587 $
1588 $! purge nd_ams_archive 'xchar': 'aconfig'.cnf/log
1589 $ IF flat_file_output .NES. "NO" THEN goto read_again ! do next spectrum
1590 $
1591 $ ask ans " Are you ready go to the next spectrum ?? (Y/N) # "
1592 $ if ans .eqs. "N" then goto abort_exit ! close names.dat
1593 $! if ans .eqs. "Y" then purge nd_ams_archive 'xchar': 'aconfig'.cnf/log
1594 $ if ans .eqs. "Y" then goto read_again ! do next spectrum
1595 $ say " Invalid entry, try again..."
1596 $ goto ask_next_spec
1597 $
1598 $!-----
1599 $
1600 $ abort_exit:
1601 $

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1602 $
1603 $   say "      nd_ams_com:ndal_process.com aborted"
1604 $
1605 $   if f$trnlnm("in_file") .nes. "" then close in_file
1606 $   if f$trnlnm("qa_file") .nes. "" then close qa_file
1607 $
1608 $!   jxk 9/7/95 exits changed to goto master_exit
1609 $!   exit
1610 $   goto master_exit
1611 $!   jxk 9/7/95
1612 $
1613 $!-----
1614 $
1615 $ do_background_qa:
1616 $
1617 $! Produce requested background plots
1618 $
1619 $   if .not. qc_plots then goto do_bkg_action_report
1620 $
1621 $!   CALL QA_PLOT_PARAM B ""
1622 $   cnt=-1
1623 $ qaplot_bkg_loop:
1624 $   cnt=cnt+1
1625 $   actinide=f$edit(f$element(cnt, ", ", actinide_list), "upcase")
1626 $   if actinide .eqs. "END" then goto qaplot_bkg_loop_exit
1627 $!   CALL QA_PLOT_PARAM B " " "actinide"
1628 $   goto qaplot_bkg_loop
1629 $ qaplot_bkg_loop_exit:
1630 $
1631 $! search for background action entries
1632 $
1633 $ do_bkg_action_report:
1634 $
1635 $   @nd_ams_com:ndal_qa_report.com "B"
1636 $   cnt=-1
1637 $ action_report_bkg_loop:
1638 $   cnt=cnt+1
1639 $   actinide=f$edit(f$element(cnt, ", ", actinide_list), "upcase")
1640 $   if actinide .eqs. "END" then goto action_report_bkg_loop_exit
1641 $   @nd_ams_com:ndal_qa_report.com "B" " " "actinide"
1642 $   goto action_report_bkg_loop
1643 $ action_report_bkg_loop_exit:
1644 $
1645 $!   jxk 9/7/95 exits changed to goto master_exit
1646 $!   exit
1647 $   goto master_exit

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1648 $!   jxk 9/7/95
1649 $
1650 $!-----
1651 $
1652 $ do_daily_qa:
1653 $
1654 $! Produce requested daily plots
1655 $
1656 $   if .not. qc_plots then goto do_daily_action_report
1657 $
1658 $!   CALL qa_plot_param "D"
1659 $
1660 $! search for daily action entries
1661 $
1662 $do_daily_action_report:
1663 $
1664 $   @nd_ams_com:ndal_qa_REPORT "D"
1665 $
1666 $!   jxk 9/7/95 exits changed to goto master_exit
1667 $!   exit
1668 $   goto master_exit
1669 $!   jxk 9/7/95
1670 $
1671 $!-----
1672 $
1673 $ do_weekly_qa:
1674 $
1675 $ if calsum_hc
1676 $ then
1677 $   time_str = f$time()
1678 $   RUN ND_AMS_EXE:CALIBRATION_REPORT
1679 $   TYPE ND_AMS_LIST:calibration_report.lis
1680 $
1681 $   IF REPORT_QUEUE.EQS. "" THEN GOTO SKIP_CALIB_REPORT
1682 $   if report_queue.EQS. "TT:"
1683 $   THEN
1684 $     DELETE ND_AMS_LIST:calibration_report.lis;*
1685 $   ELSE
1686 $     IF REMOTE_PRINTER
1687 $     THEN
1688 $       @ND_AMS_COM:NDAL_SEND nd_ams_list:calibration_report.lis
1689 $     else
1690 $       print/delete/queue='report_queue' nd_ams_list:calibration_report.lis
1691 $     endif !remote_printer
1692 $   ENDIF !REPORT_QUEUE
1693 $ ENDIF !CALSUM_HC

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```
1694 $
1695 $SKIP_CALIB_REPORT:
1696 $
1697 $! Produce requested weekly plots
1698 $
1699 $   if .not. qc_plots then goto do_pors_action_report
1700 $
1701 $!   CALL qa_plot_param 'xchar'
1702 $
1703 $! search for weekly action entries
1704 $
1705 $do_pors_action_report:
1706 $
1707 $   @nd_ams_com:ndal_qa_REPORT 'xchar'
1708 $
1709 $!   jxk 9/7/95 exits changed to goto master_exit
1710 $!   exit
1711 $   goto master_exit
1712 $!   jxk 9/7/95
1713 $
1714 $!-----
1715 $
1716 $! Produce requested yield & FWHM tracer plots
1717 $
1718 $ do_sample_qa:
1719 $
1720 $   if .not. qc_plots then goto do_yield_action_report
1721 $
1722 $   CALL qa_plot_param "Y" "control_lib"
1723 $
1724 $! search for yield action entries
1725 $
1726 $do_yield_action_report:
1727 $
1728 $   @nd_ams_com:ndal_qa_REPORT "Y"
1729 $!   jxk 9/7/95 exits changed to goto master_exit
1730 $!   exit
1731 $   goto master_exit
1732 $!   jxk 9/9/95
1733 $
1734 $!   jxk 9/7/95 final master exit
1735 $   master_exit:
1736 $!   jxk 9/7/95
1737 $!   jxk 8/22/95 modify messages from background processing so
1738 $!   that a single file is generated and printed at the end of
1739 $!   execution of process.com
```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1740 $! close the messages file, print, and delete
1741 $ if f$edit(f$extract(0,1,y12_bioassay),"upcase") .eqs. "Y" -
1742 .or. f$edit(f$extract(0,1,new_reagent_calc),"upcase") .eqs. "Y"
1743 $ then
1744 $! close jxknotefile
1745 $! temporary type of messages file to see contents
1746 $ type 'jxk_temp_notemsg'
1747 $! count lines in the message file to see if it has any messages
1748 $ jxklinecnt=0
1749 $ open/read jxkinfile 'jxk_temp_notemsg'
1750 $! 3 reads to make sure I count past header lines
1751 $ read/end_of_file=jxknoteeof jxkinfile jxkline
1752 $ jxklinecnt = jxklinecnt + 1
1753 $ read/end_of_file=jxknoteeof jxkinfile jxkline
1754 $ jxklinecnt = jxklinecnt + 1
1755 $ read/end_of_file=jxknoteeof jxkinfile jxkline
1756 $ jxklinecnt = jxklinecnt + 1
1757 $
1758 $ jxknoteeof:
1759 $ close jxkinfile
1760 $! if there is more than the header line(s), print messages file
1761 $! and delete
1762 $ if jxklinecnt .gt. jxknotehdlnct
1763 $ then
1764 $ print 'jxk_temp_notemsg'
1765 $ endif
1766 $! delete the messages file so no excess files will hand around
1767 $! to possibly cause confusion as well as clutter up disk
1768 $ jxkcolast = ".*"
1769 $ jxkfdel = ""jxk_temp_notemsg""+""jxkcolast""
1770 $! show sym jxkfdel
1771 $ delete 'jxkfdel'
1772 $ endif ! if y12_bioassay .or. new_reagent_calc
1773 $! jxk 8/22/95
1774 $! jxk 9/7/95 final master exit
1775 $ exit
1776 $! jxk 9/7/95
1777 $
1778 $!-----
1779 $! p1 is the type of analysis, supports prime & second
1780 $! 7/2/92 cleaned up for prime/second support
1781 $! 5/93 looking for nl: on plot device, if so quick exit
1782 $
1783 $ QA_PLOT_PARAM: SUBROUTINE
1784 $
1785 $ if plot_queue .eqs. "" then exit

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```

1786 $   if plot_queue .eqs. "TT:" then plot_qual=""
1787 $   if plot_queue .nes. "TT:" then-
1788     plot_qual="/proto="plot_proto'/LAND"
1789 $
1790 $   OPEN/READ/ERROR=QA_END/END_OF_FILE=QA_END-
1791 $       QA_FILE nd_ams_mdf:QA_params_'p1"p2'.mdf
1792 $
1793 $! skip/next across mdh header
1794 $
1795 $   READ/END_OF_FILE=QA_END/ERROR=QA_END QA_FILE tmp
1796 $   READ/END_OF_FILE=QA_END/ERROR=QA_END QA_FILE tmp
1797 $   READ/END_OF_FILE=QA_END/ERROR=QA_END QA_FILE tmp
1798 $   READ/END_OF_FILE=QA_END/ERROR=QA_END QA_FILE tmp
1799 $
1800 $ NEXT_QA:
1801 $
1802 $   READ/END_OF_FILE=QA_END/ERROR=QA_END QA_FILE tmp
1803 $   param = f$edit(f$element(1,":",tmp),"trim,collapse,upcase")
1804 $   param = f$element(0,":",param)
1805 $   if param .eqs. "XX" then param = ""
1806 $   if param .eqs. "" then goto next_qa    !blank line?
1807 $
1808 $   ON ERROR THEN CONTINUE
1809 $
1810 $ if p1 .nes. "Y"
1811 $ then
1812 $   QAPLOT'qaplot_line"plot_qual'/PARAM='PARAM'/BOUNDS -
1813 $       nd_ams_qa_'p1':BATCH_'p1"p2'
1814 $
1815 $   if plot_queue .nes. "TT:" .AND. .NOT. REMOTE_PRINTER
1816 $   then
1817 $     if plot_proto .eqs. "EPSON"
1818 $     then
1819 $       print/delete/queue='plot_queue'/passall 'qaplot_file'
1820 $     else
1821 $       print/delete/queue='plot_queue' 'qaplot_file'
1822 $     endif !epson
1823 $   endif
1824 $
1825 $   if plot_queue .nes. "TT:" .AND. REMOTE_PRINTER then -
1826 $       @nd_ams_com:ndal_send 'qaplot_file'
1827 $   else
1828 $   if plot_queue .eqs. "TT:"
1829 $   then
1830 $   QAPLOT'plot_qual'/PARAM='PARAM'/BOUNDS -
1831 $       nd_ams_qa_'p1':batch_id_num_'p1'_'CONTROL_LIB'_'matrix_type'

```

Appendix 2.B Listing of DCL file NDAL_PROCESS.COM, file as of January 10, 1996

```
1832 $ ELSE
1833 $ QAPLOT'qaplot_line"PLOT_QUAL'/PARAM='PARAM'/BOUNDS -
1834     nd_ams_qa_'p1':"batch_id_num'_p1'_CONTROL_LIB'_matrix_type'
1835 $
1836 $ IF REMOTE_PRINTER
1837 $ THEN
1838 $     @nd_ams_com:ndal_send 'qaplot_file'
1839 $ else
1840 $     if plot_proto .eqs. "EPSON"
1841 $     then
1842 $         print/delete/queue='plot_queue'/passall 'qaplot_file'
1843 $     else
1844 $         print/delete/queue='plot_queue' 'qaplot_file'
1845 $     endif !epson
1846 $     endif !remote_printer
1847 $ endif !plot_queue
1848 $
1849 $ QAanalyze/PARAM='PARAM'/BOUNDS'qaanal_line' -
1850     nd_ams_qa_'p1':"batch_id_num'_p1'_CONTROL_LIB'_matrix_type'
1851 $
1852 $     if report_queue .eqs. "TT:"
1853 $     then
1854 $         type 'qaanal_file'
1855 $         DELETE 'qaanal_file'
1856 $     ELSE
1857 $         IF .NOT. REMOTE_PRINTER THEN -
1858 $             print/delete/queue='report_queue' 'qaanal_file'
1859 $         IF REMOTE_PRINTER THEN -
1860 $             print/delete/queue='report_queue' 'qaanal_file'
1861 $         ENDIF
1862 $     endif
1863 $
1864 $     GOTO NEXT_QA
1865 $
1866 $ QA_END:
1867 $
1868 $     if f$trnlnm("qa_file") .nes. "" then CLOSE QA_FILE
1869 $     EXIT
1870 $
1871 $     ENDSUBROUTINE
```


APPENDIX 2.C LISTING OF FORTRAN CODE Y12.FOR, FILE VERSION AS OF NOVEMBER 20, 1995

File is located on system B disk at dub0:[000000.nd_root.ndamscust.for]

Tue Jan 2 15:19:50 EST 1996

\$ cat -n y12.for

```

1  c      [NDAMS.FOR]Y12.FOR
2  c      This program takes NID releases and puts them in a flat file
3  c      Work is the sample logical name...channel d
4
5      options /g_float
6      include '($foriosdef)'
7      implicit integer*4 (a-z)
8      include 'lib_cam:camdef.for'
9  c      include 'lib_cam:msgdef.for'
10     include 'lib_cam:campardef.for'
11
12     INTEGER*4 PEAK,HOME,LFLAG,SESC,DESC,BCKS,COMP,SUM,DUM1,DUM2
13     real *4 engy,abun,spo,dpm_alarm
14     real *8 act,err
15
16     common/nline/engy,abun,peak,act,err,nucl,home,lflag,
17     1      sesc,desc,bcks,comp,sum,spo,dum1,dum2
18
19     integer*4 hlif(2),nflag,key,dum3,dum4
20     real*4 mpc,gamma,beta,q,mac,afrac,sp1,sp2
21     real*8 mda,decay,wtmean,wtmaer
22
23     common/nnucl/hlif,mpc,mda,gamma,beta,q,mac,afrac,
24     1      decay,wtmean,wtmaer,nflag,key,sp1,sp2,dum3,dum4
25
26     integer*4 iter,left,width
27     real*4 cent,backg,fwhm,area,ener,ctss,perr,efer
28     1      fit,flg,psp1,psp2,pdum1,pdum2
29
30     common/peak/iter,cent,left,width,backg,fwhm,area,
31     1      ener,ctss,perr,peff,efer,fit,flg,psp1,psp2,pdum1,pdum2
32
33     REAL*4 LTIME,tracer_fwhm,bkg_area,sample_area
34
35     REAL*4 squant,recovery,activmult,ssp1,ssp2,prsp1,prsp2,avrgeff
36
37     real*8 sample_act,sample_err
38
39     integer*4 DLIV(2)
40     INTEGER*4 NBR
41
42     CHARACTER*1 char_reply
43     character*8 activunits
44     CHARACTER*8 NUCLIDE,NUCL

```

Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

45      character*13
OK, EXCEEDED, UNSUPORT, LOST1, LOST2, LOST3, LOST4, LOST5, STATE
46      character*13 REPROC, RECOUNT
47      character*16
DEXT, SBHDR, HUNITS, stype, DUMMY, SIDENT, slocn, sunits, DETNAME
48
49      CHARACTER*16 ssprstr3      ! DPM ALARM THRESHOLD
50      CHARACTER*16 ssprstr4      ! SAMPLE MATRIX
51      CHARACTER*16 ssprstr5      ! TRACER CERTIFICATE
52      CHARACTER*16 ssprstr6      ! SAMPLE WEIGHT
53
54      CHARACTER*13 BKG_FILENAME
55      character*20 stitle, stime, spltname, astime
56      character*60 time_str, cer_name, tracer_name, res_filename
57      character*1 bell
58
59      data bell/7/
60      data      ok/'OK'           '/'
61      data exceeded/'EXCEEDED'    '/'
62      data unsuport/'UNSUPPORT'   '/'
63      data      lost1/'SPILLED'    '/'
64      data      lost2/'CLOGGED RESIN'/'
65      data      lost3/'CHARRING'   '/'
66      data      lost4/'ACCID SALVAGE'/'
67      data      lost5/'OTHER'      '/'
68      data      reproc/'REPROCESS' '/'
69      data      recount/'RECOUNT' '/'
70      data      state/'           '/'
71
72      data dext/' .nlb'/'
73  c
74  c      jxk 12/94-2/95
75      character*8 xchar
76      integer*4 blkstun, lentpa
77      character*13 statrd
78      character*80 jxktempfil
79      character*80 jxk_temp_path
80  c      jxk 12/94-2/95
81
82      S=LIB$GET_SYMBOL('time_str', time_str, IS_LEN)
83      IF(.NOT.S) CALL EXIT(S)
84
85      S=LIB$GET_SYMBOL('BKG_FILENAME', BKG_FILENAME, IS_LEN)
86      CALL STR$UPCASE(BKG_FILENAME, BKG_FILENAME)
87      IF(.NOT.S) CALL EXIT(S)
88
89  C Added the following two lines of code to retrieve the filename of
the
90  C      result file.  JLH -- 9/12/94
91  C

```

Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

 92      S=LIB$GET_SYMBOL('res_filename',res_filename,IS_LEN)
 93      IF(.NOT.S) CALL EXIT(S)
 94
 95      call cam_set(cam_v_cam_sigmiss)
 96      if(.not. cam_open(d,'work'))call exit
 97      s= cam_getp(d,cam_F_activmult,activmult)
 98
 99      s = cam_getp(d,cam_T_SLOCTN,sloctn)
100 C      TYPE *, ' release=',sloctn
101
102 c      OPEN FILE
103 C
104 C Opened file with 'list' carriagecontrol and no defaultfile. Also,
105 C   changed filename to look at res_filename instead of sloctn. JLH
-- 9/12/94
106 C
107
open(1,file=res_filename,status='UNKNOWN',err=10,IOSTAT=STATUS,
108      1
access='APPEND',form='formatted',recordtype='variable',
109      2      carriagecontrol='list',dispose='keep',
110      3      RECORDSIZE=300)
111      GOTO 15
112
113 10      type *, ' Unable to create batch result file, STATUS = ',STATUS
114      call exit
115
116 15      continue
117
118 C      FIND NUCLIDE LIBRARY from sample type
119
120      if(.not. cam_getp(d,cam_t_stype,stype))call exit
121
122 C      type *, ' LIBRARY=',stype
123
124 c      GET DATE AND TIME
125
126 c      call lib$date_time(time_str)
127 C
128 C      Modified to move section of code that asks for sample status.
That
129 C      code used to be here. JLH -- 2/10/95
130 C
131
132 c      output all values
133
134 45      continue
135
136 c done  posting date/time
137

```

Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

138 c      release number          sloctn          char*16
139      s = cam_getp(d,cam_T_SLOCTN,sloctn)
140
141 c      sample identification      sident          char*16
142      s = cam_getp(d,cam_T_sident,sident)
143
144 c      sample date                stime          char*20
145      s = cam_getp_N(d,'STIME',STIME)
146
147 c      sample squantity (aliquot)  squant          real*4
148      s = cam_getp(d,CAM_F_SQUANT,Squant)
149
150 c      sample title                stitle          char*20
151      s = cam_getp(d,CAM_T_STITLE,STITLE)
152
153 c      sample type (s,c,r)          spltname          char*20
154      s = cam_getp(d,CAM_T_Spltname,Spltname)
155
156 c      sample type (am,np...)        stype          char*16
157      s = cam_getp(d,cam_t_stype,stype)
158
159 c      activity units                actunits          char*8
160      s = cam_getp_n(d,'activunits',activunits)
161
162 c      sample units                sunits          char*16
163      s = cam_getp_N(d,'SUNITS',SUNITS)
164
165 c      lambda value                ssp1          real*4
166      s = cam_getp(d,cam_F_ssp1,ssp1)
167
168 c      tracer id & peak search fwhm  ssprstr5          char*16
169
170      s = cam_getp(d,cam_t_ssprstr5,ssprstr5)
171      cer_name = 'nd_ams_tracers://'ssprstr5(1:16)//'.cer'
172 c      type *, ' certificate name = ',cer_name
173      s = cam_open(cer,cer_name)
174      s = cam_getp(cer,cam_t_ctfnucl,tracer_name)
175      s = cam_close(cer,cer_name)
176      call str$upcase(tracer_name,tracer_name)
177 c      type *, ' tracer name = ',tracer_name
178
179      IF (TRACER_NAME .NE. 'NONE') THEN
180      s = cam_gnucl_n(d,tracer_name,hlf,subhdr,hlfu,nnumb)
181      s = cam_gnucl_l(d,nnumb,1,engy)
182      s = cam_gpeak(d,peak,iter)
183 c      type *, ' peak number = ',peak
184      tracer_fwhm = fwhm
185 c      type *, ' tracer fwhm = ',tracer_fwhm
186      ELSE
187      tracer_fwhm = 0

```

Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

188      ENDIF
189
190  c      tracesless recovery (ra,np)      ssp2      real*4
191      s = cam_getp(d,cam_F_ssp2,ssp2)
192
193  c      sample matrix      ssprstr4      char*16
194      s = cam_getp(d,cam_t_ssprstr4,ssprstr4)
195
196  c      sample weight      ssprstr6      char*16
197      s = cam_getp(d,cam_t_ssprstr6,ssprstr6)
198
199  c      DPM ALARM THRESHOLD      ssprstr3      char*16
200      s = cam_getp(d,cam_t_ssprstr3,ssprstr3)
201      DECODE(8,999,ssprstr3) dpm_alarm
202  999    FORMAT(F4.0)
203
204  c      mda confidence level      (4.65) prsp1      real*4
205      s = cam_getp(d,cam_f_prsp1,prsp1)
206
207  c      mda constant      (2.71) prsp2      real*4
208      s = cam_getp(d,cam_f_prsp2,prsp2)
209
210  c      recovery      abundance limit
211      s= cam_getp(d,cam_f_abundanlim,recovery)
212
213  c      sample status
214
215  c      detector name      detname      char*16
216      s = cam_getp_n(D,'detname',detname)
217
218  c      detector efficiency      avrgeff      real*4
219      s = cam_getp(D,CAM_F_AVRGEFF,AVRGEFF)
220
221  c      acquisition start time      astime      char*20
222      s = cam_getp_N(d,'ASTIME',ASTIME)
223
224  c      elapsed live time      ltime      REAL*4
225      s = cam_getp(D,cam_x_elive,dliv)
226      call ndl_dt2fs(dliv,LTIME)
227
228
-----
229
230  C      CREATE THE SUM OF ALL ACTIVITIES EXCEPT THE TRACER
231  C      AND CHECK TO SEE IF IT IS GREATER THEN THE ALARM LIMIT
232
233  C      FETCH THE NUMBER OF NUCLIDES
234
235      if (.not. cam_countrec(d,cam_cls_nucl,nbr)) then
236      type *, ' Nid has not been run yet.'
```

Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

237      call exit
238      endif
239
240      SAMPLE_ACT = 0
241
242      do xnumb=1,nbr
243
244      s=cam_gnucl(D,xnumb,hlif,nucl,sbhdr,hunits)      !get next
nuclide
245
246      IF (nucl .NE. TRACER_NAME) THEN                  ! NOT THE
TRACER
247          i=1
248          s=cam_gnucl_1(D,xnumb,i,engy) ! get peak number
249          s = cam_gpeak(d,peak,iter)      ! fetch sample peak
information
250          sample_act = SAMPLE_ACT + (wtmean * activmult)      ! sum
activity
251      ENDIF
252
253      end do
254      IF (SAMPLE_ACT .lt. dpm_alarm) goto 20 ! activity < alarm
255
256      STATE(1:13)=EXCEEDED(1:13)
257
258      do i=1,5
259          type *,bell
260          call lib$wait(1.0)
261      end do
262
263      WRITE(*,61) SIDENT,SAMPLE_ACT,DPM_ALARM
264      61      FORMAT(' SAMPLE=',A10,' TOTAL DPM=',1PE10.3,'
EXCEEDS=',1PE10.3)
265      C
266      C Also, write out the yield.  JLH -- 11/20/95
267      C
268      WRITE(*,62) recovery
269      62      FORMAT(' YIELD=',1PE10.3)
270      C      type *, ' Sample=',sident,' total dpm=',sample_act,'
EXCEEDS=',dpm_alarm
271
272      C
273      C Modified the number of bells from 5 to 2.  JLH -- 11/20/95
274      C
275      do i=1,2
276          type *,bell
277          call lib$wait(1.0)
278      end do
279
280      type *, ' Hit return to continue...'

```

Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

281          read(*,25) ireply
282 25       format(i1)
283
284 20       continue
285
c-----
286
287 c       jxk 12/94-2/95 modified to read state for a reagent blank
288 c       from file passed from alpha_mda
289         S=LIB$GET_SYMBOL('xchar',xchar,IS_LEN)
290         if (xchar.eq.'R') xchar='r'
291 c       if this is a reagent, read dubl:[alpha.alusr.histry]jxktemp.dat
to
292 c       see if a state already exists
293         statrd(1:13)=' '
294         if (xchar.eq.'r') then
295           blkstun=97
296           S=LIB$GET_SYMBOL('jxk_temp_path',jxk_temp_path,lentpa)
297           jxktempfil(1:lentpa)=jxk_temp_path(1:lentpa)
298           jxktempfil(lentpa+1:lentpa+12)='jxktemp.dat;'
299 c       type *, ' temp file name ',jxktempfil
300         open (unit=blkstun,file=jxktempfil,
301 1 status='unknown',form='formatted')
302         read (blkstun,'(1x,a13)',end=181) statrd(1:13)
303         go to 182
304 181      continue
305 c       end of file. state read will probably not be one of the
accepted
306 c       states
307         type *, ' end of file on jxktemp.dat state = ',state(1:13)
308 182      continue
309 c       type *, ' state = ',statrd(1:13)
310         close (unit=blkstun,
311 1 status='delete')
312 c       if the state is one of the accepted manually input values or
313 c       unsupport, the state has already been determined,
314 c       so don't ask for state again
315 c       first, check to see if the state passed from alpha_mda is one
316 c       of the not ok states
317         if (statrd(1:13) .eq. unsuport(1:13)) go to 191
318         if (statrd(1:13) .eq. lost1(1:13)) go to 191
319         if (statrd(1:13) .eq. lost2(1:13)) go to 191
320         if (statrd(1:13) .eq. lost3(1:13)) go to 191
321         if (statrd(1:13) .eq. lost4(1:13)) go to 191
322         if (statrd(1:13) .eq. lost5(1:13)) go to 191
323         if (statrd(1:13) .eq. reproc(1:13)) go to 191
324         if (statrd(1:13) .eq. recount(1:13)) go to 191
325 c       if sample activity exceeded alarm, send message and ask for
326 c       explanation
327 c       note that this is considered an unlikely situation

```


Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

328      if (state(1:13) .eq. exceeded(1:13)) then
329      type *, ' in y12.for reagent blank activity exceeded alarm level'
330      type *, ' you now have a chance to explain why'
331      type *, ' note: if you say sample is ok, it will still be'
332      type *, '      flagged alarm level exceeded'
333      go to 199
334      end if
335      c      if no not ok states have been found, inquire if state passed
336      c      is ok
337      if (statrd(1:13) .eq. ok(1:13)) go to 191
338      c if no recognizable state is read, do manual check of status
339      go to 199
340      191 continue
341      c      use the state passed from alpha_mda as the state of the
342      c      reagent blank sample
343      state(1:13)=statrd(1:13)
344      type *, ' in Y12.for, reagent blank sample status is ',
345      1 state(1:13)
346      type *, ' no need to ask for manual input of status'
347      c skip beyond manual check of status
348      go to 299
349      end if                                     ! if (xchar .eq.
'r'
350      199 continue
351      c      jxk 12/94-2/95
352
353      if (recovery .lt. 25 .or. recovery .gt. 115)
STATE(1:13)=unsuport(1:13)
354      C
355      C Give the user a message that shows the sample id, the total dpm, and
356      C the yield if this sample is unsupported. Make him/her press
return.
357      C      JLH -- 11/20/95
358      C
359      if (STATE(1:13) .eq. unsuport(1:13)) then
360      WRITE(*,63) SIDENT,SAMPLE_ACT,RECOVERY
361      63      FORMAT(' SAMPLE=',A10,' TOTAL DPM=',1PE10.3,'
YIELD=',1PE10.3)
362
363      do i=1,2
364      type *,bell
365      call lib$wait(1.0)
366      end do
367
368      type *, ' Hit return to continue...'
369      read(*,25) ireply
370      endif
371      C
372      C Modified to move the section of code that asks for the sample status
to here.

```

Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

373 C      We wanted to ask for the status after we have tested for EXCEEDED
and
374 C      UNSUPPORTED. Also changed the ireply to be char_reply so that if
the user
375 C      entered a character value, the program would not exit. JLH --
2/10/95
376 C
377 c      ASK FOR SAMPLE STATUS
378 C
379 C Modified to include reprocess and recount options. JLH -- 9/12/94
380 C
381 35      type *, ' '
382      type *, '      1) SAMPLE SPILLED'
383      type *, '      2) CLOGGED RESIN'
384      type *, '      3) CHARRING'
385      type *, '      4) ACCIDENTAL SALVAGING'
386      type *, '      5) REPROCESS'
387      type *, '      6) RECOUNT'
388      type *, '      7) OTHER'
389      type *, ' '
390      type *, '      8) SAMPLE IS OK'
391      type *, ' '
392      write(*,60)
393 60      format('$      Select number (1 thru 8) # ')
394      read(*,26) char_reply
395 26      format(a1)
396      if(char_reply .ge. '1' .and. char_reply .le. '8') goto 30

397      type *, '      Invalid response, try again...'
398      goto 35
399
400 30      if (char_reply .eq. '1') state(1:13)=lost1(1:13)      !
SPILLED
401      if (char_reply .eq. '2') state(1:13)=lost2(1:13)      !
CLOGGED RESIN
402      if (char_reply .eq. '3') state(1:13)=lost3(1:13)      !
CHARRING
403      if (char_reply .eq. '4') state(1:13)=lost4(1:13)      !
SALVAGE
404      if (char_reply .eq. '5') state(1:13)=reproc(1:13)      !
REPROCESS
405      if (char_reply .eq. '6') state(1:13)=recount(1:13)      !
RECOUNT
406      if (char_reply .eq. '7') state(1:13)=lost5(1:13)      !
OTHER
407 C
408 C If the state of the sample has already been set to EXCEEDED or
UNSUPPORT,
409 C      don't overwrite it with OK. JLH -- 2/10/95.
410 C

```

Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

411 c      if ((char_reply .eq. '8') .and.                      ! OK
412 c      1      ((state(1:13) .ne. exceeded(1:13)) .or.
413 c      2      (state(1:13) .ne. unsuport(1:13))) STATE(1:13)=OK(1:13)
414 c
415 c      ".or." in JLH modification changed to ".and."      JXK -- 2/20/95
416 c      if ((char_reply .eq. '8') .and.                      ! OK
417 c      1      ((state(1:13) .ne. exceeded(1:13)) .and.
418 c      2      (state(1:13) .ne. unsuport(1:13))) STATE(1:13)=OK(1:13)
419 c
420 c      jxk 12/94-2/95 if state of a reagent blank sample has already
421 c      been determined, code transfers to here
422 299 continue
423 c      jxk 12/94-2/95
424
425

```

C-----

```

426 c      reviewer's initial's ! not currently implemented
427

```

C-----

```

428
429      write(1,101)sloctn,sident,time_str(:20)
430      1      ,stime,squant,stitle,spltname
431      2      ,stype,activunits,sunits,sspl
432      3      ,ssprstr5,ssp2,prsp1,prsp2
433      4      ,ssprstr4,ssprstr6,SSPRSTR3
434 C
435 C Modified format statement 101 to increase ssprstr5 output field from
436 C A6 to A15.  JLH -- 9/12/94
437 C
438 101      format('A','A10',' ',a6,' ',a20,' ',
439 1      ,a20,' ',F10.4,' ',a12,' ',a1,' ',
440 2      ,a2,' ',a3,' ',a8,' ',0pf5.0,' ',
441 3      ,a15,' ',f6.2,' ',f4.2,' ',f4.2,' ',
442 4      ,a8,' ',a8,' ',a4,' ')
443
444      write(1,102)sloctn,sident,time_str(:20)
445      1      ,recovery,state,detname,avrgeff*100
446      2      ,astime,LTIME,tracer_fwhm
447      3      ,SAMPLE_ACT,BKG_FILENAME
448
449 102      format('A','A10',' ',a6,' ',a20,' ',
450 1      ,f6.2,' ',a13,' ',a3,' ',f5.2,' ',
451 2      ,a20,' ',f7.0,' ',f5.1,' ',
452 3      ,1PE10.3,' ',A13)
453
454 C      OPEN BACKGROUND FILE
455
456      if(.not. cam_open(bkg,'areas')) call exit
457
458 C      FIND NUMBER OF NUCLIDES

```

Appendix 2.C Listing of FORTRAN code Y12.FOR, file version as of November 20, 1995

```

459
460      if (.not. cam_countrec(d,cam_cls_nucl,nbr)) then
461      type *, ' Nid has not been run yet.'
462      call exit
463      endif
464
465      C      TYPE *, ' NUMBER OF NUCLIDES FOUND=',NBR
466
467      do xnumb=1,nbr
468
469      s=cam_gnucl(D,xnumb,hlif,nucl,sbhdr,hunits)!get next nuclide
470
471      nuclide=nucl                      ! nuclide name
472
473      i=1
474      s=cam_gnucl_1(D,xnumb,i,engy)    ! get peak number
475
476      s=cam_gpeak(bkg,peak,iter)        ! fetch bkg peak info
477      BKG_AREA = CTSS * LTIME
478      C      TYPE *, ' BKG ENERGY = ',ENER
479
480      s = cam_gpeak(d,peak,iter)        ! fetch sample peak info
481      sample_area = area
482      C      TYPE *, ' SAMPLE ENERGY = ',ENER
483
484      sample_act = wtmean * activmult ! activity
485      sample_err = wtmaer * activmult ! error
486
487      WRITE(1,51)sloctn,sident,time_str(:20),
488      1
nuclide,sample_area,bkg_area,sample_act,sample_err,mda,mpc
489      C
490      C Modified format statement 51 to decrease sident output field from
491      C      A10 to A6.  JLH -- 1/5/95
492      C
493      51      format ('B,',a10,',',a6,',',a20,',',a6,',',f7.2,',',f6.2,',',
494      1          4(1pe10.3,','))
495
496      end do
497
498      c      Close config and file
499
500      if(.not.cam_close(bkg)) call exit
501      if(.not.cam_close(d)) call exit
502      close(1,dispose='keep')
503      call exit
504
505      9999      print *, '          Error reading releases file '
506      end

```


APPENDIX 2.D LISTING OF FORTRAN CODE BKGD_HIST.FOR, FILE VERSION AS OF JANUARY 4, 1996

File is located on system B disk at dub0:[000000.nd_root.ndamscust.for]

Mon Jan 8 11:21:45 EST 1996

\$ cat -n bkghisk6.for

```

1 C          ***** bkgd_hist PROGRAM *****
2 c program to process background files and place in history file
3 c program written by jxk 4/95-5/95
4 c
5 c variable definitions taken from alpha_mda.for.  a lot of them are
6 c unnecessary, but it is easier to include them than to go through
7 c and eliminate them
8     options /g_float/extend
9     implicit integer*4 (a-z)
10    INCLUDE '($FORIOSDEF)'
11    include 'lib_cam:camdef.for'
12    include 'lib_cam:campardef.for'
13
14    integer*4 hlif(2),nbr,nrec,peak,DLIV(2)
15    INTEGER*4 pgm_stat
16
17    character*80 head1          !header line
18    character*16 dext,sbhdr,hlfu,name,hunits,nucl,xnucl,xconf,lib
19    character*16 nuclib,CER_FILENAME
20 c    character*16 PU,U,TH,AM,NP,RA
21    character*16 SIDENT,BKGIDENT,SUNITS,tracer_name
22    character*60 elive,time_str
23    CHARACTER*64 ASTIME,STIME,header_file,spec,bkg,cer_name
24    character*20 stitle
25    CHARACTER*8 DEBUG,actunits,isac,REGION,matrix,CONTROL_LIB
26    character*1 positive,recount
27
28    real *4 val,VAL_CORR,Squant,yield,LTIME,BKGAREA,AVRGEFF
29    real *4 lambda_value,TRACER_FWHM
30    real *4 mpc,crit,gamma,beta,q,mac,afrac,sp1,sp2,inval
31    real *4 cent,backg,fwhm,area,ener,ctss,perr,peff,efer,
32    1 fit,flg,psp1,psp2,pdum1,pdum2
33    real *4 engy,abun,spo,factor,actmult
34
35    real *8 act,err,nlactvty          !,actmult
36    real *8 mda,decay,wtmean,wtmaer,value,corfac,trerr,saerr
37    real *8 final,toterr,sac
38
39 c    Tracer certificate parameters
40
41    integer*4 cer_date(2)
42    real*4 cer_convert, cer_quant
43    character*8 cer_units
44    integer*4 cer_half(2)

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

45      character*8 cer_halfunits
46      character*8 cer_NUCL
47      real*4      cer_rate
48      real*4      cer_error
49      real*4      cer_abun
50      real*4      ndl_prntdecy
51
52      c      tracer decay calc parameters
53
54      real*4      hl_seconds, hl_secs2, tracer_decay
55      integer*4   hl_delta(2), samp_time(2), hl_timestamp(2), af_len
56
57      c..     parameters for lld, confid changes
58
59      real*4      lld_constant, conf_level
60
61      c..     chain of custody number   llnl special
62
63      character*16 chain_cust
64      character*16 batch_id
65      character*64 alpha0_file
66
67      data dext/' .nlb' /
68
69      common/nline/engy,abun,peak,act,err,nucl,home,lflag,
70      1 sesc,desc,bcks,comp,sum,spo,dum1,dum2
71      common/nnucl/hlif,mpc,mda,gamma,beta,q,mac,afrac,
72      1 decay,wtmean,wtmaer,nflag,key,sp1,sp2,dum3,dum4
73      common/peak/iter,cent,left,width,backg,fwhm,area,
74      1 ener,ctss,perr,peff,efer,fit,flg,psp1,psp2,pdum1,pdum2
75      c
76      c      jxk 12/19/94-3/??/95 variables for new MDA and Lc
77      real*4 sbblnk,rbblnk,sbbkgd,bkgcts,bkgtim,wtmn4,blkerr,fnlerr
78      real*4 sbtotl,lsubc
79      real*4 dpm_alarm
80      CHARACTER*4 y12_bioassay_output
81      character*64 bkgbatred
82      character*24 bkgbat_id
83      character*16 ssprstr3
84      c      jxk 12/19/94-3/??/95
85
86      S=LIB$GET_SYMBOL('DEBUG',DEBUG,IS_LEN)
87      IF(.NOT.S) CALL EXIT(S)
88      CALL STR$UPCASE(DEBUG,DEBUG)
89      c      type *, ' debug', debug !db type
90
91      S=LIB$GET_SYMBOL('time_str',time_str,IS_LEN)
92      IF(.NOT.S) CALL EXIT(S)
93      c      type *, ' time_str',time_str !db type
94

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

95  c      S=LIB$GET_SYMBOL('CONTROL_LIB',CONTROL_LIB,IS_LEN)
96      S=LIB$GET_SYMBOL('actinide',CONTROL_LIB,IS_LEN)
97      call str$upcase(control_lib,control_lib)
98      IF(.NOT.S) CALL EXIT(S)
99  c      type *,' control_lib',control_lib !db type
100
101  C. . . .OPEN CONFIG's
102
103  c rather than looking for symbol 'bkg', I look for bkgfilnam
104      s=lib$get_symbol('bkgfilnam',bkg,is_len)
105      call str$upcase(bkg,bkg)
106  c      type *,' bkg',bkg !db type
107      if ( .not. s) then
108          bkg = 'old_work'
109      endif
110  c      type *,' bkg',bkg !db type
111
112      IF(DEBUG(1:1).EQ.'Y')type *,' bkg = ',bkg
113
114  c however, i open alpha0
115  c      if(.not. cam_open(d,bkg)) call exit
116      if(.not. cam_open(d,'alpha0')) call exit
117
118  C      GET SAMPLE ID FOR BACKGROUND CONFIGURATION
119
120      if(.not. cam_getp(D,CAM_T_SIDENT,BKGIDENT))call exit
121      call str$upcase(bkgident,bkgident)
122  c      type *,' bkgident ',bkgident !db type
123
124  C      FIND ELAPSED LIVE TIME
125
126      s=cam_getp(d,cam_x_elive,dliv)
127      call ndl_dt2fs(dliv,LTIME)
128  c      type *,'ELAPSED LIVE TIME=',LTIME !db type
129      IF(DEBUG(1:1).EQ.'Y')type *,'ELAPSED LIVE TIME=',LTIME
130
131  C      FIND NUMBER OF NUCLIDES
132
133      if (.not. cam_countrec(d,cam_cls_nucl,nbr)) then
134          type *,' Nid has not been run yet.'
135          call exit
136      endif
137  c      type *,'number of nuclides=',nbr !db type
138
139      IF(DEBUG(1:1).EQ.'Y')TYPE *,'NUMBER OF NUCLIDES FOUND=',NBR
140
141  c get background batch i.d.
142  c      s=lib$get_symbol('backgnd',bkgbatred,is_len)
143      s=lib$get_symbol('bkgfilnam',bkgbatred,is_len)
144      call str$upcase(bkgbatred,bkgbatred)

```


Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

145 c      type *, 'bkgbatred=', bkgbatred !db type
146      call ndl_rjust(bkgbatred)
147 c      type *, 'bkgbatred=', bkgbatred !db type
148      bkgbat_id(1:24)=bkgbatred(41:64)
149 c      type *, 'bkgbat_id=', bkgbat_id !db type
150
151 c      also, initialize background history file information
152      call hbkgini(debug,nbr,bkgbat_id,bkgident,time_str)
153 c
154      do xnumb=1,nbr
155      s=cam_gnucl(d,xnumb,hlif,xnucl,sbhdr,hunits)!get next nuclide
156      i=1
157      s=cam_gnucl_1(d,xnumb,i,engy)           ! get peak #
158
159      if (peak .NE. 0) GOTO 9905           ! peak is a 0
160
161      WRITE(6,70) XNUCL
162 70      FORMAT(1X,A6,5X,'MISSING, NOT IDENTIFIED BY NID,',
163 1 'CHECK REGIONS & ENERGY TOLERANCE')
164      WRITE(6,35)
165 35      FORMAT(1X)
166
167      GOTO 9900
168
169 9905 continue
170
171      s=cam_gpeak(d,peak,iter)           !get area, eff
172 c
173 c      if this is a new background, finish running sums for sb and
174 c      calculate average sb
175 c      bkgcts=ctss*ltime
176 c      units passed to background history file are counts/time
177 c      type *, 'ctss=', ctss !db type
178      bkgcts=ctss
179      bkgtim=ltime
180      if (debug(1:1).eq. 'Y') type *, ' ctss,ltime passed to hbkginf:
181 1 ctss,ltime
182      call hbkginf(debug,xnumb,xnucl,bkgcts,bkgtim,bkgbat_id,bkgident)
183      s=cam_gpeak(d,peak,iter)           !get yield,eff
184 c
185 9900 continue
186 c      before writing the changed information such
187 c      as corrected activity, mda, lsubc
188 c      to the sample data file
189 c      check to see that the history files can successfully be written
190 c      if not, file check routines will ask if alpha_mda and
process.com
191 c      should be terminated before the cam_pnucl statement writes the
192 c      changed information to the sample data file

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

193
194         end do
195 c
196 c         if this is a new background, write background
197 c         history information back to background history file, including
198 c         info from this sample
199         call hbkgwri(debug,nbr,bkgbat_id,bkgident)
200         if(.not.cam_close(d)) call exit
201         call exit (pgm_stat)
202         end
203 c
204 c - - subroutine hbkgnd - - - - -
205         subroutine hbkgnd
206 c         subroutine for processing background history files and
information
207 c
208         save
209 c
210 c         implicit integer*4 (a-z)
211         integer*4 hlif(2),nbr,nrec,peak,DLIV(2)
212         character*16 dext,sbhdr,hlfu,name,hunits,nucl,xnucl,xconf,lib
213         character*16 SIDENT,BKGIDENT,SUNITS,tracer_name
214         character*60 elive,time_str
215         CHARACTER*8 DEBUG,actunits,isac,REGION,matrix,CONTROL_LIB
216         real *4 val,VAL_CORR,Squant,yield,LTIME,BKGAREA,AVRGEFF
217         real *4 cent,backg,fwhm,area,ener,ctss,perr,peff,efer,
218         1 fit,flg,psp1,psp2,pdum1,pdum2
219 c
220 c         allow space for 21 background samples--20 read off of file and
221 c         21st newly calculated.
222         character*24 bkgbat_id
223         character*102 bkghfil
224         character*80 bkg_hist_path
225         character*1 chyno
226         integer*4 bkghun,lenchmb,lenctlb,lenbpa
227 c         allow for up to 10 nuclides for each library
228         parameter (nucele=10)
229         character*8 nuclid(nucele)
230         character*16 bkgid(21)
231         character*24 bkgbid(21)
232         real*4 ltimbk(21)
233         real*4 nucact(21,nucele),sbebk(21,nucele)
234         character*20 bkgpdat(21)
235         real*8 smxsq20(nucele),smx20(nucele),smxrt
236         integer*4 ismx20
237         real*4 sbbkgd,bkgcts,bkgtim
238         character*3 chamber,chamtmp
239         character*16 bkgidl
240         character*24 bkgbidl
241         logical*1 lflbkg,lflchk,lbkdup

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

242      integer*4 nsbwarn
243      integer*4 numb,xnumb,n1,n2,nisnum
244      integer*4 nsmpmn
245      data nsmpmn /4/
246      character*64 jxk_temp_bkmsg
247      integer*4 bkmsun
248      data bkmsun /13/
249      c
250      c      note that units of background history are counts/time
251      c - - -
252      entry hbkgini(debug,nbr,bkgsbat_id,bkgident,time_str)
253      c      initial entry for background history
254      c      8/9/95 open file for background messages
255      s=lib$get_symbol('jxk_temp_bkmsg',jxk_temp_bkmsg,is_len)
256      open (unit=bkmsun,file=jxk_temp_bkmsg,
257 1 status='unknown',form='formatted',access='append')
258      c      initialize flag to say that file not yet checked
259      if (debug(1:1) .eq. 'Y') then
260      type *, ' from hbkgini: bkgsbat_id,bkgident,bkgbid(1),bkgid(1)',
261 1 'bkgbid1,bkgid1'
262      type *,bkgsbat_id,bkgident
263      type *,bkgbid(1),bkgid(1)
264      type *,bkgbid1,bkgid1
265      end if !debug
266      lflchk=.false.
267      c      initialize warning counter
268      nsbwarn=0
269      c      initialize duplicate sample flag
270      lbkdup=.false.
271      c      get chamber and library for history file name
272      S=LIB$GET_SYMBOL('chamber',chamber,lenchmb)
273      call str$upcase(chamber,chamber)
274      c      call ndl_rjust(chamber)
275      c      construct a full 3 character chamber i.d. padded w/ zeroes
276      chamtmp(1:3)='000'
277      if (lenchmb.le.3 .and. lenchmb.gt.0) then
278      chamtmp(3-lenchmb+1:3)=chamber(1:lenchmb)
279      else
280      chamtmp(1:3)=chamber(1:3)
281      end if
282      chamber(1:3)=chamtmp(1:3)
283      lenchmb=3
284      S=LIB$GET_SYMBOL('CONTROL_LIB',CONTROL_LIB,lenctlb)
285      call str$upcase(control_lib,control_lib)
286      c
287      c      construct background history file name
288      c      background history file name
289      S=LIB$GET_SYMBOL('bkg_hist_path',bkg_hist_path,lenbpa)
290      call str$upcase(bkg_hist_path,bkg_hist_path)
291      c

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

bkghfil=dub1:[alpha.alusr.histry.bkgd]'control_lib'_'chamber'_'bkgnd.his
292     bkghfil(1:40)='
293     bkghfil(40+1:40+12)='
294     if (lenchmb+1+lenctlb+10 .le. 22) then
295     bkghfil(1:lenbpa)=bkg_hist_path(1:lenbpa)
296     bkghfil(lenbpa+1:lenbpa+lenctlb)=control_lib
297     bkghfil(lenbpa+lenctlb+1:lenbpa+lenctlb+1)='_ '
298     bkghfil(lenbpa+lenctlb+2:lenbpa+lenctlb+1+lenchmb)=chamber
299     bkghfil(lenbpa+lenctlb+2+lenchmb:lenbpa+lenctlb+1+lenchmb+10)=
300     1 ' 'bkgnd.his'
301     bkgghun=98
302     if (debug(1:1) .eq. 'Y') then
303     type *, ' i.d. of current background',
304     1 ' sample ', bkgbat_id, bkgident
305     type *, ' background history file opened'
306     type *, bkghfil
307     type *, bkg_hist_path
308     end if !debug
309     open
(unit=bkgghun, file=bkghfil, status='unknown', form='formatted')
310 c     read i.d. of first background history sample and live time
311     read (bkgghun, '(1x,a24,1x,a16,g15.8,a20)', end=981)
bkgbid1, bkgidl,
312     1 ltimbk(1), bkgpdat(1)
313     call str$upcase(bkgbid1, bkgidl)
314     call str$upcase(bkgidl, bkgidl)
315     call str$upcase(bkgpdat(1), bkgpdat(1))
316     if (debug(1:1) .eq. 'Y') then
317     type *, ' i.d. of first background',
318     1 ' history sample ', bkgbid1, bkgidl
319     type *, ' live time ', ltimbk(1), ' process date ', bkgpdat(1)
320     end if !debug
321     go to 989
322 c end of file before finishing first line read in background history
323     981 continue
324     bkgid1=' eof981bkg
325     bkgid(1)=' eof981bkg
326     bkgbid1=' eof981bkg
327     bkgbid(1)=' eof981bkg
328     ltimbk(1)=0.
329     bkgpdat(1)=time_str
330     nisnum=0
331 c     3/20/95 decided that this is not a serious error, but rather a
332 c     startup problem. Messages only in debug mode
333     if (debug(1:1) .eq. 'Y') then
334     type *, ' *** notice -- problem with background history file '
335     type *, ' End of file on background history file before finish'
336     type *, ' reading first line of information'
337     type *, ' Therefore, there is no background history information'
338     type *, ' Background history file probably empty or nonexistent'

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

339      type *,' '
340      type *,'                                CONTACT TECHNICAL SUPPORT'
341      type *,' '
342      type *,' Hit return to acknowledge this notice and continue...'
343      call belrng(1)
344      read (*,'(a1)') chyno
345      end if !debug
346 c      end of file on first read means create new history file
347 c      create new background history file from scratch
348      rewind (bkghun)
349      if (debug(1:1) .eq. 'Y') then
350      type *,' new background history information will be put in file'
351      type *,bkghfil
352      end if ! debug
353      989 continue
354 c      if i.d. of first background history sample
355 c      is same as current background, load history info into mem
356 c      location 1
357      if (bkgid1 .eq. bkgident .and. bkgbid1.eq.bkgbat_id) then
358      nisnum=1
359      bkgid(1)=bkgid1
360      bkgbid(1)=bkgbid1
361      do xnumb=1,nbr
362 c read activity (counts/time) and sb for each nuclide
363      read (bkghun,'(1x,2g15.8)',end=991)
364      1 nucact(nisnum,xnumb),sbebk(nisnum,xnumb)
365      if (debug(1:1) .eq. 'Y') then
366      type *,' background activities (counts'
367      1 ,'/time) for nuclide ',xnumb
368      type *,' act, sb ',nucact(nisnum,xnumb),sbebk(nisnum,xnumb)
369      end if !debug
370      end do
371      go to 999
372 c end of file before finishing first set read in background history
373      991 continue
374      bkgid1='          bkg eof991'
375      bkgid(1)='          bkg eof991'
376      bkgbid1='          bkg eof991'
377      bkgbid(1)='          bkg eof991'
378      ltimbk(1)=0.
379      bkgpdat(1)=time_str
380      nisnum=0
381      if (debug(1:1).eq. 'Y') then
382      type *,' *** notice -- problem with background history file '
383      type *,' actinide ',control_lib
384      type *,' End of file on background history file before finish'
385      type *,' reading first set of information'
386      type *,' Therefore, there is no background history information'
387      type *,' Background history file probably faulty (incomplete)'
388      type *,' '

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

389      type *, '                                CONTACT TECHNICAL SUPPORT'
390      type *, ' '
391      type *, ' Hit return to acknowledge this notice and continue...'
392      call belrng(1)
393      read (*, '(a1)') chyno
394      c      create new background history file from scratch
395      rewind (bkghun)
396      type *, ' new background history information in file'
397      type *, bkghfil
398      end if !messages to bkmsun anyway ! else !debug
399      write (bkmsun, *),
400      1 ' *** notice -- problem with background history file '
401      write (bkmsun, *), ' actinide ', control_lib
402      write (bkmsun, *),
403      1 ' End of file on background history file before finish'
404      write (bkmsun, *), ' reading first set of information'
405      write (bkmsun, *),
406      1 ' Therefore, there is no background history information'
407      write (bkmsun, *),
408      1 ' Background history file probably faulty (incomplete)'
409      write (bkmsun, *), ' '
410      write (bkmsun, *),
411      1 '                                CONTACT TECHNICAL SUPPORT'
412      write (bkmsun, *), ' '
413      c      write (bkmsun, *), ' Hit return to acknowledge this notice and
continue...'
414      c      call belrng(1)
415      c      read (*, '(a1)') chyno
416      c      create new background history file from scratch
417      rewind (bkghun)
418      write (bkmsun, *), ' new background history information in file'
419      write (bkmsun, *), bkghfil
420      c      end if      ! debug
421      999 continue
422      else                                ! if bkgidl .eq.
bkgident
423      c
424      c      if first background history i.d. does not match current
425      c      background i.d., read old background history information,
426      c      count the number of samples, and put information in memory
427      c      into mem locations 2-21 to leave location 1 for new information
428      c      sums for sb
429      do xnumb=1,nbr
430      smx20(xnumb)=0.
431      smxsq20(xnumb)=0.
432      end do
433      ismx20=0
434      c      put i.d. from sample into background id(1)
435      bkgid(1)=bkgident
436      bkgbid(1)=bkgbat_id

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

437      ltimbk(1)=0.
438      bkgpdat(1)=time_str
439      nisnum=1
440 c      rewind history file so code can reread first line of i.d. and
441 c      load it into mem location 2
442      rewind (bkghun)
443      do num=2,21
444 c      read history sample i.d.
445 c      note: history samples are loaded in the order of newest to
446 c      oldest
447 c      this sample is a new background, therefore load history samples
448 c      from 2 to 21 to leave room for this sample in mem location 1
449      read (bkghun,'(1x,a24,1x,a16,g15.8,a20)',end=1009)
450      1 bkgbid(nisnum+1),bkgid(nisnum+1),ltimbk(nisnum+1),
451      1 bkgpdat(nisnum+1)
452      call str$upcase(bkgbid(nisnum+1),bkgbid(nisnum+1))
453      call str$upcase(bkgid(nisnum+1),bkgid(nisnum+1))
454      call str$upcase(bkgpdat(nisnum+1),bkgpdat(nisnum+1))
455 c      type *, ' after read background id s,time ',nisnum
456 c      type *,bkgbid(nisnum+1),
457 c      1 bkgid(nisnum+1),ltimbk(nisnum+1)
458      nisnum=nisnum+1
459      if (debug(1:1) .eq. 'Y') then
460      type *, ' background sample no. ',nisnum
461      type *, ' i.d. from history ',bkgbid(nisnum),bkgid(nisnum)
462      1 , ' live time ',ltimbk(nisnum), ' process date ',bkgpdat
463      end if !debug
464      do xnumb=1,nbr
465 c read activity (counts/time) and sb for each nuclide
466      read (bkghun,'(1x,2g15.8)',end=1001)
467      1 nucact(nisnum,xnumb),sbebk(nisnum,xnumb)
468      go to 1002
469      1001 continue
470      if (debug(1:1) .eq. 'Y') then
471      type *, ' actinide ',control_lib
472      type *, ' abnormal end of file on background history file'
473      end if !messages to bkmsun anyway ! else !debug
474      write (bkmsun,*), ' actinide ',control_lib
475      write (bkmsun,*),
476      1 ' abnormal end of file on background history file'
477 c      end if !debug
478      nisnum=nisnum-1
479      go to 1009
480      1002 continue
481      if (debug(1:1) .eq. 'Y') then
482      type *, ' background activities (counts'
483      1 ,'/time) for nuclide ',xnumb
484      type *, ' act, sb ',nucact(nisnum,xnumb),sbebk(nisnum,xnumb)
485      end if !debug
486 c      sums for sb

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

487      if (ismx20.lt.19) then
488      smx20(xnumb)=smx20(xnumb)+nucact(nisnum,xnumb)
489      smxsq20(xnumb)=smxsq20(xnumb)+nucact(nisnum,xnumb)**2
490      if (xnumb.eq.nbr) ismx20=ismx20+1
491      end if
492      end do                                     ! do
xnumb=1,nbr
493  c      compare current sample i.d. to one just read to check for
duplicate
494  c      don't bother to check if duplicate already found or if nisnum=1
495      if (nisnum.gt.1 .and.
496      1      bkgid(nisnum).eq.bkgid(1)
497      1      .and. bkgbid(nisnum).eq.bkgbid(1) .and. .not.lbkdup)
then
498      lbkdup=.true.
499      if (debug(1:1) .eq. 'Y') then
500      type *, ' background sample 1 id:'
501      type *,bkgbid(1),bkgid(1)
502      type *, ' duplicates sample ',nisnum
503      type *,bkgbid(nisnum),bkgid(nisnum)
504      end if !debug
505  cjkxktestC      TEST REFUSE TO NOTICE DUPLICATES
506  cjkxktest      LBKDUP=.FALSE.
507      end if
508      end do                                     ! do
num=2,21
509  c      end of file on background history
510  1009 continue
511      if (debug(1:1) .eq. 'Y') type *, ' background history end of ',
512      1 'file, ',
513      1 ' sample info sets 2 thru',nisnum,' read'
514      if (nisnum .lt. 1) then
515      if (debug(1:1) .eq. 'Y') then
516      type *, ' actinide ',control_lib
517      type *, ' background history end of file ',
518      1 'reached ',
519      1 'before any info sets read'
520      end if !messages to bkmsun anyway ! else !debug
521      write (bkmsun,*), ' actinide ',control_lib
522      write (bkmsun,*), ' background history end of file ',
523      1 'reached ',
524      1 'before any info sets read'
525  c      end if !debug
526      nisnum=0
527      end if
528  c      if the current i.d. duplicates any others, put information from
529  c      mem location 2 into location 1--no std dev will be calculated
530      if (lbkdup) then
531      bkgid(1)=bkgid(2)
532      bkgbid(1)=bkgbid(2)

```


Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

533      ltimbk(1)=ltimbk(2)
534      bkgpdat(1)=bkgpdat(2)
535      do xnumb=1,nbr
536      nucact(1,xnumb)=nucact(2,xnumb)
537      sbekbg(1,xnumb)=sbekbg(2,xnumb)
538      end do
539      end if
540      endif                                ! if bkgidl .eq.
bkgident
541      lflbkg=.true.
542      else                                ! if lenchmb+1+lenctlb+10
.le. 27
543 c      background history file name too long--can't open file and read
544 c      history info
545      type *, ' *** background history file name too long, matrix',
546      1 ' name length ',lenchmb
547      type *, ' library name length ',lenctlb, ' ***'
548      lflbkg=.false.
549 c      ask if alpha_mda should be terminated immediately
550      type *, '      ***'
551      type *, ' background history file can not be written'
552      type *, ' because usable history file name can not be
constructed'
553      type *, '      ***'
554      type *, ' this may be a serious problem'
555      type *, ' do you want to terminate alpha_mda before writing'
556      type *, ' any changes to the sample data files? [yes]'
557      type *, ' '
558 c      type *, ' any response except n or N is considered a yes'
559 c      type *, ' (i.e. terminate)'
560      call belrng(3)
561      read (*,'(a1)') chyno
562      if (chyno .ne. 'n' .and. chyno .ne. 'N') then
563      call sftexi(bkghun)
564      end if
565      endif                                ! if lenchmb+1+lenctlb+10
.le. 27
566 c
567      return
568 c
569 c - - -
570      entry hbkginf(debug,numb,xnucl,bkgcts,bkgtim,bkgbat_id,bkgident)
571 c      finish running sums for sb and calculate standard deviation
572      xnumb=numb
573      nuclid(xnumb)=xnucl(1:8)
574      if (debug(1:1) .eq. 'Y') then
575      type *, ' from hbkginf: bkgbat_id,bkgident,bkgbid(1),bkgid(1),',
576      1 'bkgbid1,bkgid1,lbkdup'
577      type *,bkgbat_id,bkgident
578      type *,bkgbid(1),bkgid(1)

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

579      type *,bkgbid1,bkgid1,lbkdup
580      end if !debug
581 c      if background i.d. does not match first line read from history
582 c      file and no other duplicates, finish running sums for sb
583      if ((bkgid1.ne.bkgident .or. bkgbid1.ne.bkgbat_id)
584 1 .and. .not.lbkdup) then
585      if (debug(1:1) .eq. 'Y') type *, ' background sample(=record 1).

586      1 ' nuclide ',xnumb,' counts/sec ',bkgcts,' time ',bkgtim
587      nucact(1,xnumb)=bkgcts
588      ltimbk(1)=bkgtim
589      smx20(xnumb)=smx20(xnumb)+nucact(1,xnumb)
590      smxsq20(xnumb)=smxsq20(xnumb)+nucact(1,xnumb)**2
591 c      increment counter for sum of 20. do this on first
592 c      nuclide
593      if (xnumb .eq. 1) then
594      ismx20=ismx20+1
595      end if
596 c      calculate std dev
597 c      if (ismx20.gt.1) then
598 c      1/12/95 decision made that standard deviation for fewer than
nsmppmn
599 c      (=4) samples not worthwhile, so make special provisions
600      if (ismx20.ge.nsmppmn) then
601      smxrt=(smxsq20(xnumb)-smx20(xnumb)**2/
602 1 dfloat(ismx20))/dfloat(ismx20-1)
603      if (debug(1:1).eq. 'Y') then
604      type *, ' terms for backgr std dev for ', 'nuclide ',xnumb
605      type *, ' smxsq20,smx20,ismx20,sum term'
606      type *,smxsq20(xnumb),smx20(xnumb),ismx20,smxrt
607      end if !debug
608 c      check to see that std deviation will be real
609      if (smxrt.lt. 0.) then
610      smxrt=0.
611 c      if sum of terms for root is small, then negative value is
probably due
612 c      to truncation error
613      if (dabs(smxrt).gt. 1.d-8*nucact(1,xnumb)**2) then
614      if (debug(1:1).eq. 'Y') then
615      type *, ' * * * * * '
616      type *, ' actinide ',control_lib
617      type *, ' backg standard deviation not real for nuclide ',xnumb
618      type *, ' zero will be returned'
619      type *, ' this may be a serious problem'
620      type *, ' '
621      type *, ' Hit return to acknowledge this notice and continue...'
622      call belrng(1)
623      read (*,'(a1)') chyno
624      end if !messages to bkmsun anyway ! else !debug
625      write (bkmsun,*) , ' * * * * * '

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

626      write (bkmsun,*), ' actinide ',control_lib
627      write (bkmsun,*),
628      1 ' backg standard deviation not real for nuclide ',xnumb
629      write (bkmsun,*), ' zero will be returned'
630      write (bkmsun,*), ' this may be a serious problem'
631      write (bkmsun,*), ' '
632      c      write (bkmsun,*), ' Hit return to acknowledge this notice and
continue...'
633      c      call belrng(1)
634      c      read (*,'(a1)') chyno
635      c      end if !debug
636      end if
637      end if
638      sbekbg(1,xnumb)=dsqrt(smxrt)
639      if (debug(1:1).eq. 'Y') then
640      type *, ' background std dev calculated ', 'for nuclide ',xnumb
641      type *, ' background std dev ',sbekbg(1,xnumb)
642      end if !debug
643      else
644      c      not enough samples for usable standard deviation
645      c      type *, ' background standard deviation = 0 for nuclide ',xnumb
646      c      sbekbg(1,xnumb)=0.
647      c      1/12/95 pass root of total number of counts for std dev
648      c      pass negative value to flag that this was done
649      sbekbg(1,xnumb)=-sqrt(bkgcts*bkgtim)
650      if (debug(1:1).eq. 'Y') then
651      type *, ' * * * * * '
652      type *, ' actinide ',control_lib
653      type *, ' square root(background counts) passed for nuclide ',
654      1 xnumb
655      type *, ' square root of counts = ',-sbekbg(1,xnumb),
656      1 ' replaces std dev'
657      type *, ' number of samples = ',ismx20,' < ',nsmppmn
658      type *, ' * * * * * '
659      c      it is only necessary to acknowledge the warning the first time
660      if (xnumb.eq.1) then
661      type *, ' '
662      type *, ' Hit return to acknowledge this notice and continue...'
663      call belrng(1)
664      read (*,'(a1)') chyno
665      end if
666      end if !messages to bkmsun anyway ! else !debug
667      write (bkmsun,*), ' * * * * * '
668      write (bkmsun,*), ' actinide ',control_lib
669      write (bkmsun,*),
670      1 ' square root(background counts) passed for nuclide ',
671      1 xnumb
672      write (bkmsun,*), ' square root of counts = ',-sbekbg(1,xnumb),
673      1 ' replaces std dev'
674      write (bkmsun,*), ' number of samples = ',ismx20,' < ',nsmppmn

```

Appendix 2.D Listing of FORTRAN code BKGD HIST.FOR, file version as of January 4, 1996

```

675      write (bkmsun,*), ' * * * * * '
676 c      it is only necessary to acknowledge the warning the first time
677      if (xnumb.eq.1) then
678      write (bkmsun,*), ' '
679 c      write (bkmsun,*), ' Hit return to acknowledge this notice and
continue...'
680 c      call belrng(1)
681 c      read (*,'(a1)') chyno
682      end if
683 c      end if !debug
684      end if
685 c      if no background data read, but this sample is ok, set nisnum=1
686      if (nisnum.lt.1) nisnum=1
687      end if                                ! if
bkgidl.eq.bkgident
688      return
689 c
690 c - - -
691      entry gtsbbkg (numb,sbbkgd,debug)
692 c      return background standard deviation for this nuclide
693      xnumb=numb
694      sbbkgd=sbebkg(1,xnumb)
695 c      if std dev is negative, this flags that the value is the root
696 c      of a number in counts. Therefore, divide by live time to get
697 c      counts/time
698      if (sbebkg(1,xnumb).lt.0.) then
699      sbbkgd=-sbebkg(1,xnumb)/ltimbk(1)
700      end if
701 c      if no usable data available, write error message and set result
702 c      to -1.1e25 as a flag
703      if (nisnum.lt.1 .or. .not.lflbkg) then
704      if (debug(1:1).eq. 'Y') then
705      type *, ' * * * * * '
706      type *, ' actinide ', control_lib
707      type *, ' from get background standard deviation'
708      if (nisnum.lt.1) type *, ' number of usable entries = ',
709      1 nisnum, ' < 1'
710      if (.not.lflbkg) type *, ' no background file available'
711      type *, ' insufficient usable background history information ',
712      1 'available'
713      type *, ' no standard deviation returned'
714      type *, ' this may be a serious problem'
715      type *, ' * * * * * '
716 c      it is only necessary to acknowledge the warning the first time
717      if (nsbwarn.lt.1) then
718      type *, ' '
719      type *, ' Hit return to acknowledge this notice and continue...'
720      call belrng(1)
721      read (*,'(a1)') chyno
722      end if

```

Appendix 2.D Listing of FORTRAN code BKGD HIST.FOR, file version as of January 4, 1996

```

723             end if !messages to bkmsun anyway ! else !debug
724             write (bkmsun,*),' * * * * * '
725             write (bkmsun,*),' actinide ',control_lib
726             write (bkmsun,*),' from get background standard deviation'
727             if (nisnum.lt.1) write (bkmsun,*),' number of usable entries =
',
728             1 nisnum,' < 1'
729             if (.not.lflbkg) write (bkmsun,*),' no background file
available'
730             write (bkmsun,*) ,
731             1 ' insufficient usable background history information ',
732             1 'available'
733             write (bkmsun,*),' no standard deviation returned'
734             write (bkmsun,*),' this may be a serious problem'
735             write (bkmsun,*),' * * * * * '
736 c             it is only necessary to acknowledge the warning the first time
737             if (nsbwarn.lt.1) then
738             write (bkmsun,*),' '
739 c             write (bkmsun,*),' Hit return to acknowledge this notice and
continue...'
740 c             call belrng(1)
741 c             read (*,'(a1)') chyno
742             end if
743 c             end if !debug
744             nsbwarn=nsbwarn+1
745             sbbkgd=-1.1e25
746             end if
747             if (debug(1:1).eq.'Y') type *, ' from gtsbbkg: background ',
748             1 'standard deviation for nuclide ',xnumb,' is ',sbbkgd
749             return
750 c
751 c - - -
752             entry hbkgchk(debug,bkgbat_id,bkgident)
753 c             see if this file has already been checked
754             if (debug(1:1).eq.'Y') then
755             type *, ' from hbkgchk: bkgbat_id,bkgident,bkgbid(1),bkgid(1)',
756             1 'bkgbid1,bkgid1,lflchk,lflbkg,lbkdup'
757             type *,bkgbat_id,bkgident
758             type *,bkgbid(1),bkgid(1)
759             type *,bkgbid1,bkgid1,lflchk,lflbkg,lbkdup
760             end if !debug
761             if (lflchk) then
762 c             if so, don't check it again
763             return
764             else
765             lflchk=.true.
766             end if
767 c             check to see whether the background history file can be opened
768             if (.not. lflbkg) then
769             return

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

770      else                                     ! if (.not.
lflbkg
771 c      if background i.d. does not match first line read from history
772 c      and there are no duplicates
773 c      write background
774 c      history information back to background history file, including
775 c      info from this sample
776      if ((bkgidl.ne.bkgident .or. bkgbidl.ne.bkgbat_id)
777      1 .and. .not.lbkdup) then
778 c      make sure nisnum > 0
779      if (nisnum.lt.1) then
780 c      if not, ask if alpha_mda should be terminated immediately
781      if (debug(1:1).eq. 'Y') then
782      type *,'          ***'
783      type *,' actinide ',control_lib
784      type *,' no usable background sample data available for history'
785      type *,' empty history file will be written'
786      type *,'          ***'
787      type *,' this may (or may not) be a serious problem'
788      type *,' do you want to terminate alpha_mda before writing'
789      type *,' any changes to the sample data files? [yes]'
790      type *,' '
791 c      type *,' any response except n or N is considered a yes'
792 c      type *,' (i.e. terminate)'
793      call belrng(3)
794      read (*,'(a1)') chyno
795      if (chyno .ne. 'n' .and. chyno .ne. 'N') then
796      call sftexi(100+bkghun)
797      end if
798      end if !messages to bkmsun anyway ! else !debug
799      write (bkmsun,*) ,'          ***'
800      write (bkmsun,*) ,' actinide ',control_lib
801      write (bkmsun,*) ,
802      1 ' no usable background sample data available for history'
803      write (bkmsun,*) ,' empty history file will be written'
804      write (bkmsun,*) ,'          ***'
805      write (bkmsun,*) ,' this may (or may not) be a serious problem'
806      write (bkmsun,*) ,
807      1 ' do you want to terminate alpha_mda before writing'
808      write (bkmsun,*) ,' any changes to the sample data files? [yes]'
809      write (bkmsun,*) ,' '
810 c      write (bkmsun,*) ,' any response except n or N is considered a
yes'
811 c      write (bkmsun,*) ,' (i.e. terminate)'
812 c      call belrng(3)
813 c      read (*,'(a1)') chyno
814 c      if (chyno .ne. 'n' .and. chyno .ne. 'N') then
815 c      call sftexi(100+bkghun)
816 c      end if
817 c      end if !debug

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

      818          end if
      819          end if                                ! if bkgidl.ne.bkgident .and.
.not.lbkdup
      820          end if                                ! if (.not.
lflbkg
      821          return
      822  c
      823  c - - -
      824          entry hbkgwri(debug,nbr,bkgsat_id,bkgident)
      825  c          check to see whether the background history file can be opened
      826          if (debug(1:1).eq. 'Y') then
      827          type *, ' from hbkgwri: bkgsat_id,bkgident,bkgsid(1),bkgid(1),',
      828  1 'bkgsid1,bkgidl,lflbkg,lbkdup'
      829          type *,bkgsat_id,bkgident
      830          type *,bkgsid(1),bkgid(1)
      831          type *,bkgsid1,bkgidl,lflbkg,lbkdup
      832          end if !debug
      833          if (.not. lflbkg) then
      834          if (debug(1:1).eq. 'Y') then
      835          type *, '      ***'
      836          type *, ' actinide ',control_lib
      837          type *, ' background history file can not be written'
      838          type *, '      ***'
      839          end if !messages to bkmsun anyway ! else !debug
      840          write (bkmsun,*), '      ***'
      841          write (bkmsun,*), ' actinide ',control_lib
      842          write (bkmsun,*), ' background history file can not be written'
      843          write (bkmsun,*), '      ***'
      844  c          end if !debug
      845          else                                ! if (.not.
lflbkg
      846  c          if background i.d. does not match first line read from history
      847  c          and there are no duplicates
      848  c          write background
      849  c          history information back to background history file, including
      850  c          info from this sample
      851          if ((bkgidl.ne.bkgident .or. bkgsid1.ne.bkgsat_id)
      852  1 .and. .not.lbkdup) then
      853  c          make sure 1 <= nisnum <= 20
      854          if (nisnum.lt.1) then
      855          if (debug(1:1).eq. 'Y') then
      856          type *, ' actinide ',control_lib
      857          type *, ' no usable background sample data available for history'
      858          type *, ' empty history file written'
      859          end if !messages to bkmsun anyway ! else !debug
      860          write (bkmsun,*), ' actinide ',control_lib
      861          write (bkmsun,*),
      862  1 ' no usable background sample data available for history'
      863          write (bkmsun,*), ' empty history file written'
      864  c          end if !debug

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

865      rewind (bkghun)
866      endfile (bkghun)
867      return
868      end if
869      nisnum=min0(nisnum,20)
870      if (debug(1:1).eq. 'Y') then
871      type *, ' background history file ', 'write starting'
872      type *,bkghfil
873      type *,nisnum, ' sample info sets to be written '
874      end if !debug
875      rewind (bkghun)
876      do num=1,nisnum
877      write (bkghun,'(1x,a24,1x,a16,g15.8,a20,1x,a22)') bkgbid(num),
878      1 bkgid(num),ltimbk(num),bkgpdat(num),bkghfil(31:52)
879      if (debug(1:1).eq.'Y') then
880      type *, ' info set no. ',num,
881      1 ' sample i.d. ',bkgbid(num),bkgid(num), ' live time
      ',ltimbk(num)
882      type *, ' process date ',bkgpdat(num)
883      end if !debug
884      do xnumb=1,nbr
885      write (bkghun,9002)nucact(num,xnumb),sbebk(num,xnumb),
886      1 nuclid(xnumb)
887      9002 format (1x,2g15.8,' act,std dev(counts/sec)',a8)
888      if (debug(1:1).eq.'Y') then
889      type *, ' nuclide, activity (counts/time),', ' sb ', ' name'
890      type *,xnumb,nucact(num,xnumb),sbebk(num,xnumb),nuclid(xnumb)
891      end if !debug
892      end do
893      end do
894      end if ! if bkgidl.ne.bkgident .and.
      .not.lbkdup
895      end if ! if (.not.
lflbkg
896      return
897      c
898      end
899      c
900      c - - subroutine reimpak - - - - -
901      subroutine reimpak(relnum,intnum)
902      real*4 relnum,rnum,rexpon
903      integer*4 intnum,inum,iexpon
904      c pack a real number into an integer
905      c in effect, i am taking a lpe13.6 format, moving the exponent to the
906      c 8th digit from the right and higher and leaving the number itself
907      c in the right 7 digits with the decimal suppressed
908      c in other words, i.jklmnoe+ab becomes abijklmno, and
909      c i.jklmnoe-ab becomes -abijklmno
910      c it should be easy to look at one of these numbers and tell what it
is

```


Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

911 c
912 c      pack the real into an integer
913 c      do not pack a negative number, set result=0
914 c      if (relnum.le. 0.) then
915 c          intnum=0
916 c          go to 999
917 c      end if
918 c      rexpon=alog10(relnum)
919 c      if (relnum .lt. 1.) then
920 c numbers < 1 ==> negative integers returned
921 c "small" numbers mean returning a large negative integer
922 c underflow and too small numbers control
923 c      if (relnum.lt. 1.e-25) then
924 c          intnum=-25*(10**7)-0900000
925 c          go to 999
926 c      end if
927 c      iexpon=rexpon-1
928 c      rnum=relnum*10.**float(-iexpon)*1.e6
929 c      inum=int(rnum+0.4999)
930 c      intnum=inum-(10**7)*iexpon
931 c      if (iexpon.lt.0) intnum=-inum+(10**7)*iexpon
932 c      else
933 c numbers >= 1 ==> positive integers returned
934 c "large" numbers mean returning a large positive integer
935 c overflow and too large numbers control
936 c      if (relnum.gt. 1.e25) then
937 c          intnum=25*(10**7)+1100000
938 c          go to 999
939 c      end if
940 c      iexpon=rexpon
941 c      rnum=relnum*(10.**float(-iexpon))*1.e6
942 c      inum=int(rnum+0.4999)
943 c      intnum=inum+(10**7)*iexpon
944 c      end if
945 c 999 continue
946 c      write (*,*) ' real, integer ',relnum,intnum
947 c      return
948 c      end
949 c
950 c - - subroutine inreupk - - - - -
951 c      subroutine inreupk(relnum,intnum)
952 c          real*4 relnum,rnum,rexpon
953 c          integer*4 intnum,inum,iexpon
954 c pack a real number into an integer
955 c in effect, i am taking a lpe13.6 format, moving the exponent to the
956 c 8th digit from the right and higher and leaving the number itself
957 c in the right 7 digits with the decimal suppressed
958 c in other words, i.jklmnoe+ab becomes abijklmno, and
959 c i.jklmnoe-ab becomes -abijklmno
960 c it should be easy to look at one of these numbers and tell what it

```

is

```

961  c
962  c      unpack the integer and reconstruct the real
963  c      inputting a zero means returning a zero
964  c      if (intnum.eq.0) then
965  c          relnum=0.
966  c          go to 999
967  c      end if
968  c          iexpon=intnum/(10**7)
969  c          if (intnum.lt.0) then
970  c numbers < 1 ==> negative integers returned
971  c          inum=-intnum+(10**7)*iexpon
972  c          rnum=float(inum)/1.e6
973  c          rexpon=float(iexpon)
974  c          relnum=rnum*10.**rexpon
975  c      else
976  c numbers >= 1 ==> positive integers returned
977  c          inum=intnum-(10**7)*iexpon
978  c          rnum=float(inum)/1.e6
979  c          rexpon=float(iexpon)
980  c          relnum=rnum*10.**rexpon
981  c      end if
982  c      999 continue
983  c      write (*,*) ' real, integer ',relnum,intnum
984  c      return
985  c      end
986  c
987  c - - subroutine sftexi - - - - -
988  c      subroutine sftexi(iflexi)
989  c          integer*4 iflexi
990  c          character*1 chyno
991  c      soft exit subroutine
992  c      ask if the process.com should exit
993  c      type *, '      ***'
994  c      type *, ' alpha_mda is exiting at your request'
995  c      type *, ' do you want process.com to terminate also?'
996  c      type *, ' if not,'
997  c      type *, ' process.com will continue processing samples'
998  c      type *, ' '
999  c      type *, ' any response except n or N is considered a yes'
1000  c      type *, ' (i.e. terminate)'
1001  c      call belrng(3)
1002  c      read (*, '(a1)') chyno
1003  c      if (chyno .eq. 'N') chyno='n'
1004  c      write messages to tty and get flag symbol (alphaerr) ready to send
1005  c      back to process.com
1006  c          if (chyno.ne. 'n') then
1007  c              type *, ' you told process.com to quit'
1008  c          else
1009  c              type *, ' you told process.com to continue'

```

Appendix 2.D Listing of FORTRAN code BKGD_HIST.FOR, file version as of January 4, 1996

```

1010 c if process.com is not to terminate, send alphaerr='g' to tell
1011 c process.com to go to next spectrum
1012     chyno='g'
1013     end if
1014 c return the flag symbol (alphaerr) to process.com
1015     call lib$set_symbol('alphaerr',chyno)
1016     call exit(iflexi)
1017     end
1018 c
1019 c - - subroutine belrng - - - - -
1020     subroutine belrng(nring)
1021     character*1 bell
1022     data bell/7/
1023 c     ring the bell nring times w/ 1 sec(?) pause between rings
1024     do n=1,nring
1025     type *,bell
1026     call lib$wait(1.0)
1027     end do
1028     return
1029     end
1030 c     jxk 12/19/94-3/??/95

```

APPENDIX 2.E LISTING OF DCL FILE NDAL_BKGD_HISTRY.COM, FILE VERSION AS OF AUGUST 16, 1995

File is located on system B disk at dub0:[000000.nd_root.ndamscust]

Thu Aug 24 13:04:57 EDT 1995

\$ cat -n bkghist2.com

```

1  $! set ver
2  $!      jxk 4/95-5/95 process background file to make sure it goes
into
3  $!      history
4  $      if f$edit(f$extract(0,1,y12_bioassay),"upcase") .eqs. "Y" -
5      .or. f$edit(f$extract(0,1,new_reagent_calc),"upcase") .eqs.
"Y"
6  $      then
7  $      time_str = f$time()
8  $
9  $!      do an nid
10 $!      for reasons i do not understand, control_lib is used to store
date
11 $!      temporarily save and put back afterward
12 $      ctrllob_save = control_lib
13 $      control_lib = actinide
14 $      say ""
15 $      say "          System is now doing an nid using
"+bold_on+'control_lib'+bold_off+"
16 $
17 $      nid/lib=nd_ams_lib:'control_lib'/nolist ALPHA0
18 $
19 $!      construct background file name from concatenation of
nd_ams_archive_b
20 $!      and aconfig and .cnf
21 $!      show logical nd_ams_archive_b
22 $      archbnam = f$logical("nd_ams_archive_b")
23 $! show sym archbnam'
24 $! show sym aconfig
25 $      dotcnf = ".cnf"
26 $! show sym dotcnf
27 $      bkgfilnam = "'"archbnam"+"aconfig"+"dotcnf'"
28 $! show sym bkgfilnam
29 $!      say " total background file path and name "+ 'bkgfilnam'
30 $!      find most recent version of file
31 $      fny = f$search("'"bkgfilnam'")
32 $! show sym fny
33 $      bkgfilnam = fny
34 $! show sym bkgfilnam
35 $      say " total background file path and name and version "+
'bkgfilnam'
36 $! use of extraction to construct background file name like in
process.com 8/16/95
37 $      @nd_ams_com:ndal_extract ] . 'bkgfilnam'

```

Appendix 2.E Listing of DCL file NDAL_BKGD_HISTRY.COM, file version as of August 16, 1995

```

38 $! show sym extraction
39 $      testfilen = "nd_ams_archive_b:"+extraction+".cnf"
40 $! show sym testfilen
41 $      bkgfilnam = testfilen
42 $! show sym bkgfilnam
43 $      say " total background file path and name and version "+
''bkgfilnam'
44 $
45 $!      also, define sys$input to tty (sys$command) to pass from code
46 $!      to tty and back
47 $!
48 $      bkg_hist_path = f$logical("nd_ams_histbkgd")
49 $!      show sym bkg_hist_path
50 $!
51 $      DEFINE/USER SYS$INPUT SYS$COMMAND
52 $      alphaerr="n"
53 $
54 $      RUN nd_ams_EXE:bkgd_hist
55 $!      RUN DUB0:[000000.JOHNK]bkgd_hist
56 $
57 $!      reset control_lib
58 $      control_lib = ctrl-lib_save
59 $
60 $!      if bkgd_hist does a deliberate termination using soft exit,
61 $!      it asks if process.com should be terminated.  if not, alphaerr =
"n"
62 $
63 $      if alphaerr .nes. "n"
64 $      then
65 $!      if bkgd_hist is told to terminate, but not terminate process.com
66 $!      alphaerr = "g", which is a signal to go to the next spectrum
67 $      if alphaerr .eqs. "g"
68 $      then
69 $      say "      nd_ams_com:ndal_process.com jxk version to next
spectrum "
70 $      goto bkg_loop_exit
71 $      endif
72 $      say "      nd_ams_com:ndal_process.com jxk version aborting "
73 $      say "      after bkgd_hist as ordered"
74 $      goto abort_exit
75 $      endif
76 $      endif
77 $!      jxk 4/95-5/95
78 $! set nover
79 $      exit

```

**APPENDIX 2.F LISTING OF FORTRAN CODE FORTOPEN.FOR,
FILE VERSION AS OF JANUARY 4, 1996**

File is located on system B disk at dub0:[000000.nd_root.ndamscust.for]

Mon Jan 8 11:25:09 EST 1996

\$ cat -n fortopen.for

```
1  c this is a small fortran code whose mission is to open the
2  c file file_fortopen formatted with fortran file attributes.
3  c the intent is that one can write from both vms and fortran
4  c and have a file which will print correctly.
5  c the reason for this file's existence is that opening a file
6  c with the open command from vms creates a file with different
7  c record attributes from those from a fortran open.
8  c the result of the differences is that the lines from fortran
9  c do not have the "proper" carriage return-line feed sequence.
10 c as a consequence, trying to print a file which has been opened
11 c with vms and subsequently written in append mode with fortran
12 c creates very long lines without cr-lf to separate them.
13 c j.r. Kirkpatrick, lockheed martin (oak ridge national lab)
14 c (423) 574-8676 9/8/95
15     character*80 file_fortopen
16     s=lib$get_symbol('file_fortopen',file_fortopen,length)
17     open (unit=11,file=file_fortopen,
18     1 form='formatted')
19     close (unit=11,disp='keep')
20     call exit
21     end
```


APPENDIX 2.G INSTRUCTIONS FOR DEALING WITH REAGENT BLANK SAMPLE EXCEEDS ALARM LIMIT CONDITION

A blank sample exceeding the alarm limit is expected to be a rare condition. When the ALPHA_MDA program first begins to process a reagent blank sample, it asks the operator for a state of the sample. Possible states are "1) SAMPLE SPILLED," "2) CLOGGED RESIN," "3) CHARRING," "4) ACCIDENTAL SALVAGING," "5) REPROCESS," "6) RECOUNT," "7) OTHER," and "8) SAMPLE IS OK." The ALPHA_MDA program will check for exceeds alarm limit only if the operator has responded with "8) SAMPLE IS OK." One of the more likely causes of the exceeds alarm limit condition is that a regular sample is mistakenly labeled a reagent blank. That error would cause the sample to exceed the alarm limit because the alarm limit for reagent blanks is supposed to be lower than that for regular samples.

The ALPHA_MDA.FOR program allows the operator to make graceful exits when this condition is encountered. Five possible branches and sets of action are explained below. There may be other possible explanations for the condition or reasons for taking these branches. However, the steps to be taken represent the only branches that the author knows.

a. There is nothing wrong with the sample--the alarm limit is too low.

If this is really true, you should stop processing the sample and fix the alarm limit. The reasons for stopping immediately are as follows: (a) ALPHA_MDA.FOR will not put a blank sample that exceeds the alarm limit into the blank history file. Thus, this sample will not show up in its proper place in the blank history file, (b) Y12.FOR will flag the sample "EXCEEDS" in the "ddmmmyyy.RES" flat file.

To stop processing, hit "RETURN" at the "do you want to terminate alpha_mda right now?" message. Then hit "RETURN" again at the "do you want process.com to terminate also?" message.

After you have fixed the alarm limit, edit NAMES.DAT so that you will start at this sample when you resume processing.

b. I know what is wrong with the sample and need to fix it before I go on.

If this is true, you should stop processing the sample and fix it.

To stop processing, hit "RETURN" at the "do you want to terminate alpha_mda right now?" message. Then hit "RETURN" again at the "do you want process.com to terminate also?" message.

After you have fixed the sample, edit NAMES.DAT so that you will start at this sample (or skip it if that is what you decide to do) when you resume processing.

c. I know what is wrong with the sample, but I want to skip it and continue processing other samples.

Taking this branch implies that it does not matter if this sample does not go into the reagent blank history file because the sample is faulty, mislabelled, or something else. In this case, you will terminate ALPHA_MDA.FOR, but let PROCESS.COM continue.

To stop ALPHA_MDA but continue processing other samples, hit "RETURN" at the "do you want to terminate alpha_mda right now?" message. Then hit "n" or "N" at the "do you want

Appendix 2.G Instructions for Dealing with Reagent Blank Sample Exceeds Alarm Limit

process.com to terminate also?" message. PROCESS.COM will go to the **"are you ready go to the next spectrum ?? (y/n) #"** message.

After you have fixed the sample, edit NAMES.DAT so that you will start at this sample (or skip it if that is what you decide to do) when you resume processing.

d. I know what is wrong with the sample, but I want to process it, anyway.

Because this sample exceeds the alarm limit, it will not go into the reagent blank history file. It will show up in the ddmmyyyy.RES flat file with an "EXCEEDS" state. However, Y12.FOR will give you a chance to change this state to one of the error condition states, which are "1) SAMPLE SPILLED," "2) CLOGGED RESIN," "3) CHARRING," "4) ACCIDENTAL SALVAGING," "5) REPROCESS," "6) RECOUNT," and "7) OTHER."

To continue processing this sample, hit "n" or "N" at the **"do you want to terminate alpha_mda right now?"** message. In Y12.FOR, the system will again catch the exceeds alarm limit condition and pause. At this point, you can explain why the alarm limit was exceeded by changing the state to one of the faulty sample codes (i.e., "SAMPLE SPILLED," "CLOGGED RESIN," etc.). However, if you insist that "SAMPLE IS OK," then the state that is passed to the ddmmyyyy.RES flat file will be "EXCEEDS."

After you have fixed the sample, edit NAMES.DAT so that you will start at this sample (or skip it if that is what you decide to do) when you resume processing.

e. I am not sure what is wrong with the sample. I want to process it further to get more information.

After the end of the ALPHA_MDA.FOR program, the "ALPHA SPECTROSCOPY REPORT" is generated and printed. This report gives quite a bit of information about the sample. This information may help explain what is wrong with the sample. It is possible to keep the sample from showing up in the ddmmyyyy.RES flat file by killing the processing after the report is generated.

To continue processing this sample, hit "n" or "N" at the **"do you want to terminate alpha_mda right now?"** message. After the "ALPHA SPECTROSCOPY REPORT" is generated, you can stop the processing with a ctrl-y. In Y12.FOR, the system will again catch the exceeds alarm limit condition and pause. This is a convenient point to stop processing because the system pauses here. Note that breaking out with a ctrl-y stops all further processing.

After you have fixed the sample or whatever else you need to do, edit NAMES.DAT so that you will start at this sample (or skip it if that is what you decide to do) when you resume processing.

APPENDIX 2.H EFFECT OF TRUNCATION ERROR ON STANDARD DEVIATION

In some early tests of the modified ALPHA_MDA software, the author used a set of dummy reagent blank files that were created by copying a real blank file to files with names that clearly identified them as dummies. Except for their names, the files were identical. This was a test to demonstrate that the calculations for average and standard deviation in entry *hblkinf* were working correctly. The result of processing several identical sets of data should have been a zero value of standard deviation. Instead, some of the standard deviation calculations caused a square root of a negative number error. The other standard deviations were small, but non-zero. An explanation was wanted for the fact that the standard deviation of a series of nominally identical numbers was not zero (and, even worse, was sometimes imaginary). The answer lies in the accumulation of truncation errors in the passing of activities from the ALPHA_MDA code to the blank history file and back, plus the truncation error in the sums that are used to calculate standard deviation.

The standard deviation is as follows:

$$\sigma = \sqrt{\sum_{n=1}^N x_n^2 - \frac{1}{N} \left(\sum_{n=1}^N x_n \right)^2} / (N-1) \quad (3)$$

Suppose that all the x_n are identical and equal to some value x . Thanks to truncation error, the true value of x_n is not known within some percentage error ϵ . In other words,

$$x(1 - \epsilon) < x_n < x(1 + \epsilon) \quad (4)$$

If one constructs the standard deviation in a form that leads to the largest accumulation of truncation errors, the result is as follows:

$$\sigma_{\max} = \sqrt{\sum_{n=1}^N x^2(1 + \epsilon)^2 - \frac{1}{N} \left(\sum_{n=1}^N x(1 - \epsilon) \right)^2} / (N-1) \quad (5)$$

Doing the algebra, the value of standard deviation becomes

$$\sigma_{\max} = 2x \sqrt{\epsilon \frac{N}{(N-1)}} \quad (6)$$

For a real*8 variable, a very approximate estimate of the truncation error is $\epsilon \approx 10^{-14}$, which gives

$$\sigma_{\max}/x_{\text{real*8}} \approx 2 \times 10^{-7} \quad (7)$$

For a real*4 variable, a very approximate estimate of the truncation error is $\epsilon \approx 10^{-7}$, which gives

Appendix 2.H Effect of Truncation Error on Standard Deviation

$$\sigma_{\max}/x)_{\text{real}*4} \approx 6 \times 10^{-4} \quad (8)$$

The truncation error for a standard deviation calculation in ALPHA_MDA is more complicated than this simple model because the activities are passed back and forth from the history file using a (g15.8) format. The rounding operations needed to write the activities to the history file and read them back again cause an additional level of truncation. Some experiments were run on a short piece of code on an IBM RS/6000 workstation to see just how truncation errors accumulate in "real" calculations. A value of $N = 10$ was set and standard deviations were calculated a large number of different values of x . The values of x were kept in real*8, and standard deviations were calculated in real*8. In addition, the values of x were truncated to real*4, passed to a disk file using the (g15.8) format, and read back into a real*4 variable with the same format. A second standard deviation was calculated using the value read back, but accumulating the sums in real*8 arithmetic (real*8 arithmetic was used because the sums for the standard deviation in entry *hblkinf* are accumulated in real*8). The code calculated the maximum "truncation" error [i.e., $1 - (\text{the value of } x \text{ read back from the disk file carried in real*4}) / (\text{the original value of } x \text{ in real*8})$]. The maximum "truncation" error was about 8×10^{-8} . This would yield a value of $\sigma_{\max}/x$ of about 5.7×10^{-4} . In theory, the maximum "truncation" error could have gone as high as 10×10^{-8} which would yield a value of $\sigma_{\max}/x$ of about 6.3×10^{-4} . The maximum value of $\sigma_{\max}/x$ found in the calculational experiment was 6.8×10^{-4} . This value is within 8% of the value for the theoretical maximum "truncation" error and within 20% of the theoretical value for the actual maximum "truncation" error. As a footnote, the maximum value of standard deviation did not occur for the maximum "truncation" error. Life in the computational world is apparently not that simple.

From the theory and calculated results discussed in this appendix, it is clear that small values of standard deviation cannot be trusted. In particular, if the standard deviation is not at least 6×10^{-4} times the activity, then the standard deviation is too low to be believable—that is, one knows that the standard deviation is small, but not precisely how small.

The background and blank standard deviations are used to calculate MDA and L_c . Therefore, one must conclude that the errors in MDA and L_c are at least as large as those in the underlying standard deviations. Because the blank and background values are added to get MDA and L_c , the combination of errors increases. On the theory that the root of the sum of the squares of two identical errors is the square root of 2 times the error, the maximum percentage error due to "truncation" for MDA and L_c becomes nearly 10^{-3} ($6 \times 10^{-4} \times 1.4 = 9.5 \times 10^{-4}$).

The conclusion to be drawn from this appendix is that small values of MDA and L_c should not be trusted. In particular, if MDA and L_c are not at least 10^{-3} times the activity, then the values are too low to be believable—that is, one knows that they are small, but not precisely how small. Thanks to the $3/ERTA$ term in the expression for MDA, it is unlikely that MDA will be small enough to not be believable. Moreover, in real measurements in which the activities vary from sample to sample, the standard deviations of the blanks and backgrounds should be large compared to the threshold discussed in this appendix. Nevertheless, one must be aware that this threshold of believability does exist and should know the magnitude of the threshold.

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