

CP3

LOW BACKGROUND ALPHA/BETA COUNTER

PART A

INTRODUCTION

The low background alpha/beta instrument consists of a gas-flow proportional detector with a thin window, a sample changer, computer, and Eclipse software from Canberra.

The specific instrumentation used in this lab is a Canberra/Tennelec Low Background Alpha/Beta Counter.

Initial setup of new equipment should be done by the vendor. New operators should be trained by experienced laboratory personnel. After learning the fundamentals, reference 1 should be consulted for additional detail. Particularly difficult operating problems should be discussed with a system analyst or the vendor.

PRINCIPLE

Samples are placed in a planchet either through direct application or after precipitation. The planchet is placed in a numbered carrier and loaded on the sample changer. The system analyst selects the computer option previously programmed to count the isotope(s) of interest, e.g.; Sr-90, Tc-99, Ra-228, etc. The alpha/beta radiation in the sample is detected when the emitted particles ionize the counting gas in the detector.

REFERENCE

1. Instruction Manual for the Canberra/Tennelec Low Background Alpha/Beta Counter.
2. Eclipse software Operation Manual by Canberra Instruments.
3. ANSI N42.25 *"Calibration and Usage of Alpha/Beta Proportional Counters"* .

CERTIFICATION RECORD FOR

CP3

LOW BACKGROUND ALPHA/BETA COUNTER

CHECKPOINTS

- | | | | |
|----|----------------------------------|-------|-------|
| 1. | JOB HAZARD ANALYSIS (JHA) | _____ | _____ |
| 2. | MSDS/HAZARD DISCUSSION | _____ | _____ |
| 3. | COUNTING SET-UP | _____ | _____ |
| 4. | DATA ACQUISITION | _____ | _____ |
| 5. | BKG CHECK | _____ | _____ |
| 6. | QC CHECK | _____ | _____ |

ANALYST'S SIGNATURE: _____

CERTIFIED BY: _____

DATE BY: _____

COMMENTS: _____

PART B

1.0 PURPOSE AND SCOPE

This section provides an outline of the procedure for acquiring and analyzing gross alpha and gross beta information, as well as specific beta emitting isotopes. This should be combined with the standard operating instructions and hands on training for greater detail.

2.0 APPARATUS

Canberra/Tennelec LB5100W low background alpha/beta counting system
NIST traceable standards
P-10 counting gas

3.0 DAILY QUALITY CONTROL (QC)

Before proceeding, you must be certified as indicated in QCP1 of this manual and Section 3 of the QA Manual. See page two for a copy of the certification record.

- 3.1 The Eclipse software is a Microsoft Access based program. The program is accessed by way of the Eclipse icon on the computer desktop.
- 3.2 Once the Eclipse software is enabled the menu bar will appear for operation of the software. The entire counting system can be operated from this selection.
- 3.3 Load the group plate with the alpha and beta daily QC samples and then load the group plate for the background daily QC sample. Place an end plate after the background daily QC sample.
- 3.4 Click on the green (GO) button on the menu bar. Once the GO button is selected a window with defined analyses will appear. Select the QC analysis option.
- 3.5 After the counting procedure is selected, a window with group plate options will appear. Click on the group plate name (A-J) that matches the lead group plate selected for the alpha and beta daily QC samples and click OK. The samples will begin counting and the sample count data will appear in the count window.
- 3.6 Repeat steps 3.4 and 3.5 except select the BKG analysis option.
- 3.7 When the samples have finished counting, close the counting window for the batch. **DO NOT CLOSE THE ECLIPSE COUNTING SOFTWARE. THIS WOULD STOP OTHER PROCEDURES THAT MAY BE COUNTING.**

- 3.8 To process the data after counting, select the Eclipse LB Utilities icon from the computer desktop. Select the macro button defined to print the daily QC values.
- 3.9 In the "ALPHA" window of the Canberra system, type QAD <cr>. This will take the operator to the directory with the LB1 QC data file.
- 3.10 Type LB1 to access the QC data file
- 3.11 When the QC file menu appears, type "6" and then "5". The data entry screen will appear.
- 3.12 Enter the data requested on the screen. After data entry is complete, press the PF3 key to save the data. Exit the QC file.
- 3.13 Type "Q1" to generate the daily QC review sheet. Type "P" to print the review sheet.

NOTE: The parameters are set-up initially based on 30 counts of each QC sample. The Canberra software automatically calculates the limits that establish the acceptance criteria. Investigation limits are between 2 and 3 sigma. The action limit is greater than 3 sigma.

- 3.14 When an "ACTION" flag is generated, the daily QC sample must be run two more times and all parameters must pass both times for the detector to be used to count samples.
- 3.15 If an "ACTION" flag is generated for either of the two QC parameters on the next two QC counts, the instrument is taken out of service until the problem is resolved.
- 3.16 The operator will sign and date the daily QC review sheet whether or not samples are to be counted on the detector.

4.0 SAMPLE COUNTING

Before proceeding, you must be certified as indicated in QCP1 of this manual and Section 3 of the QA Manual. See page two for a copy of the certification record.

- 4.1 The Eclipse software is a Microsoft Access based program. The program is accessed by way of the Eclipse icon on the computer desktop.
- 4.2 Once the Eclipse software is enabled the menu bar will appear for operation of the software. The entire counting system can be operated from this selection.

- 4.3 Samples will be delivered from the laboratory in numbered carriers. Load carriers into the sample changer following a lead carrier known as a group plate. The groups are A-J. Place an end plate (end plates do not have holes) following the samples on the sample changer.
- 4.4 Once the samples are loaded, set the counting parameters. This is accomplished using the Eclipse "GO" button on the menu bar. Once the "GO" button is selected a window with analysis options will appear. Analyses that can be selected are as follows:
- | | |
|--------|--------------------|
| GAB | (gross alpha/beta) |
| Sr | (total strontium) |
| Ra-228 | (radium-228) |
- Additional analyses that are not presently on this list, may be made available as analytical need arises.
- 4.5 After the counting procedure is selected, a window with group plate options will appear. Click on the group plate name (A-J) that matches the lead group plate selected when loading the samples on the sample changer and click OK. The samples will begin counting and the sample count data will appear in the count window.
- 4.6 While samples are counting, double click on the first sample and enter the analysis batch name. Click on the box that applies the batch name to all samples.
- 4.7 When the samples have finished counting, close the counting window for the batch and answer Yes to the save data question. **DO NOT CLOSE THE ECLIPSE COUNTING SOFTWARE. THIS WOULD STOP OTHER PROCEDURES THAT MAY BE COUNTING.**
- 4.8 To process the data after counting, select the Eclipse LB Utilities icon from the computer desktop. Select the desired processing option from the tool bar of the database. Data may be printed or imported into other software types.

5.0 CALCULATIONS

- 5.1 All calculations for this instrument are performed in validated Excel spreadsheets. The calculations for samples counted on this instrument are in the analytical procedures for each specific analysis type.
- 5.2 The minimum detectable concentration (MDC) is calculated by the following equation:

$$MDC = \frac{3 + 4.65\sqrt{B}}{E*Q*T} = pCi/unit$$

Where:

B	=	background counts
E	=	counting efficiency, cpm/pCi
MDC	=	minimum detectable concentration
Q	=	quantity, L or g
T	=	counting time, minutes

60 CALIBRATION

- 6.1 Calibration of this instrument is analysis specific and is defined in the analytical procedures.
- 6.2 The standards for each specific analysis calibration should be counted so that each will have at least 10,000 counts.
- 6.3 The calibration standards must be prepared in the same geometry in which routine samples are to be counted.

7.0 CALIBRATION ACCEPTANCE CRITERIA

- 7.1 If the detector was previously calibrated for a given geometry, the efficiencies are to agree within the limits of the total propagated uncertainties for the new efficiency to be acceptable.
- 7.2 The efficiency data for a new detector window or a repaired detector are to agree within the limits of the total propagated uncertainties for the new efficiency to be acceptable.
- 7.3 The calibration of this system for a new isotope must be verified by analyzing a minimum of 3 laboratory control samples of the isotope from a separate source. The calibration will be deemed acceptable when the measured values agree with the known values within the limits of the total propagated uncertainties.
- 7.4 The Laboratory Manger must review and approve the efficiency for each isotope for which the instrument is calibrated.

8.0 RECORDS

- 8.1 Reference QC manual for records requirements.
- 8.2 The Eclipse database is backed up to the ORISE network on a nightly basis.