USTUR 620: ROUTINE ENERGY CALIBRATION, EFFICIENCY CALIBRATION, AND BACKGROUND COUNTS.

Purpose	Calibration of alpha spectrometry system	Method Number	USTUR620
Original Date	10/10/95	Author	USTUR Radiochemistry Staff
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SAFETY NOTE: Improper use of spectroscopy equipment can result in damage to components.

1. Principle of Method

1.1. Alpha spectrometry procedures for routine energy calibration efficiency calibration and background counts are described.

1.2. Energy calibration of alpha spectrosopy equipment is performed using the α peaks from multi-nuclide secondary standards.

1.3. Efficiency calibration of alpha spectroscopy equipment is performed using the isotopic ^{242}Pu activity on a secondary standard.

1.4. Routine background measurements are performed weekly and the results for each isotopic region of interest (ROI) checked to assure appropriate detector performance.

2. Apparatus

2.1. Alpha spectrometer: 4 unit ORTEC Octete PC, 4096-channel analyzer.

2.2. Vacuum pump.

2.3. 450 mm^2 EG&G ORTEC ULTRA silicon surface barrier detectors.

2.4. Alphavision software V.4.02.

2.5. Maestro for Windows V.5.0.

3. Energy Calibration of Alpha Spectrometry System

NOTE: To preserve geometry, all chambers typically use shelf 2. This may be modified based on the needs of the analyst.

3.1. Energy calibrations are routinely performed on one entire MCB (8 chambers) at a time. Energy calibrations shall be performed at least once per month.

3.2. Alpha spectrometry calibration sources are prepared according to USTUR 630. These eight sources are used in a specific chamber within a MCB in order to facilitate monitoring of detector performance.

3.3 Insert the correct calibration source onto the appropriate shelf.

3.4. Use the calibration analysis (energy only checked) in Alphavision.

NOTE: See Procedure 010 for naming conventions.

4.   Efficiency Calibration of Alpha Spectrometry System

4.1. Efficiency calibrations are routinely performed on one entire MCB (8 chambers) at a time.

4.2. The file used for energy calibration may be used for efficiency calibration.

4.3. Alpha spectroscometry calibration sources are prepared according to USTUR 610. These eight sources are used in a specific chamber within a MCB in order to facilitate monitoring of detector performance.

Example: The first source is used for calibration of chambers 1, 9, 17, and 25.

4.4. Insert the correct calibration source onto the appropriate shelf.

4.5. The acquisition of efficiency calibration spectra is carried out according to USTUR 660 (Absolute Analysis) with the following settings.

4.5.1. Under Analyze select Calibration and follow "load samples" on screen directions, click OK.

4.5.2. In the "Calibration Analysis – ALPHA Spec MCB" window open the Calibration Type drop down window and select the detector efficiency calibration source. Leave "Sample Description" as is.

4.5.3. Use the "F10" key to accept the settings.

4.5.4. The file names for the efficiency calibration spectra are based on procedure USTUR 010. Efficiency calibration spectra file names always start with an "F". Enter the appropriate name in the path window.

Example: F0195145 is an efficiency calibration for detector 01, 1995, julian day 145.

4.5.5. Uncheck "Calibrate Energy" and make sure "Calibrate Efficiency" is checked.

4.5.6. Click on begin and repeat process for the next detector.

4.6. Following completion of the efficiency calibration, each spectra is individually re-analyzed using QA, Tests, Calibration procedure in the AlphaVision 32 menu.

4.6.1. An Efficiency Calibration Acceptance screen will then appear (see Figure 2) and the operator will verify that the Detector efficiency is reasonable based on past detector performance (see USTUR 800).

4.6.2. If the efficiency calibration is deemed satisfactory, record the results and accept using the OK button.

4.7. If the efficiency calibration is deemed unsatisfactory, hit the "Esc" key to escape, and check the spectrum to insure the system is performing correctly and compare with previous spectra to insure the source is undamaged

4.8. Routine efficiency calibrations are required to be signed by the operator and another individual.

4.9. Routine efficiency calibrations are stored in files for each detector and retained indefinately.

5. Background Counts

5.1. Background counts are routinely performed every month.

5.2. The acquisition of background spectra is carried out according to USTUR 660 with the following settings.

5.2.1. Load the chambers with unused planchettes.

5.2.2. Select "Analyze, Background" and follow the onscreen directions.

5.2.3. In "Background Analysis" window select the background type and enter the file name as per USTUR 010 in the path window. The file names for the background spectra are based on procedure USTUR 010. Background spectra file names always start with an "B".

Example: B0195145 is a background for detector 01, 1995, julian day 145.

5.2.4. Click on "Begin" to start the background analysis.

5.3.   Following completion of background acquisition, the operator checks that the counts in each nuclide ROI are appropriate. The background levels are specific for each detector but are routinely less than 15 per ROI in 300,000 seconds. A QA/QC chart is maintained for each detector and is periodically updated. Detectors which have backgrounds which are not acceptable shall be deemed out of control and will not be used for analysis until the backgrounds have been satisfactorily reduced. Actions which may be taken to correct high background are decontamination, declaring a cool down period, running a new background, and/or replacement of the detector.

5.4.   Routine backgrounds are required to be signed by the operator and another individual.

5.5.   Backgrounds are stored in files for each detector and retained indefinately to prevent subtraction of background counts on the report.

6.   Literature Sources

6.1.   AlphaVision V.4.02, 1999 Software Reference Manual.

6.2.   Maestro for Windows V.5.0., 1999.