NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE

TECHNICAL PROCEDURE

TITLE:	Revision: 0
DIFFERENTIAL SPECTROMETRY (K, U, T) FOR CORE, CUTTINGS AND OTHER SAMPLES	Date: 11-06-00 Page: 1 of 4
PROCEDURE No.:	**SUPERSEDES:**
TP-8.9	DRAFT, 02-24-95
APPROVAL LW Braddock 12.11.00 Project Manager Date	**CONCURRENCE** Principal Investigator Date 15 DEC 2000 Project Quality Assurance Officer Date

1.0 PURPOSE

The purpose of this procedure is to describe the use of the differential spectrometer for acquiring radioanalysis of Uranium (eU), Thorium (eTh), and Potassium (k). These data are used for reconnaissance surveying in the field, and the qualitative screening of drill core and cuttings samples. This information may have value in respect to obtaining background information for the Yucca Mountain tuff formations and for characterizing the different formations to stratigraphic position and/or spatial location.

2.0 SCOPE

This procedure will be used in studying gamma energies that are originating from rocks. This activity is set up for a GRS-500 differential Spectrometer/Scintillometer that has a total of five channels: TC_1 = 0.08 MeV, TC_2 = 0.40 MeV, K (^{40}K) = 1.46 MeV, U (^{214}Bi) = 1.76 MeV, and Th ($^{208}T1$) = 2.62 MeV. An additional channel is used for calibration (Barium –133 isotope). These data are collected for the purpose of characterizing Yucca Mountain tuffs through each stratigraphic formation. Other instruments can be used to obtain this information as long as the individual channels are available. Different instruments will have different degrees of sensitivity.

2.1 APPLICABILITY

This procedure applies to NWRPO principal investigators (PI) performing radiographic analysis of Yucca Mountain tuffs and sediments analyses for the NWRPO.

2.2 TRAINING

The preparer of this procedure is deemed as qualified user and can train other personnel to this procedure. GMI personnel trained in this procedure by the PI shall use this procedure.

3.0 DEFINITIONS

N/A

4.0 RESPONSIBILITIES

4.1 The Principal Investigator is responsible for the preparation of this procedure.

4.2 The PI has the responsibility of performance of this procedure, unless those operations are assigned to other trained personnel – in which case the Principal Investigator is responsible for the oversight of the operations. A *Geophysics Analysis* form (TP-8.8) is used to collect data along with a scientific (field and/or laboratory) notebook.

5.0 PROCESS

5.1 Calibration

Calibration is required for the use of the GRS-500 differential Spectrometer/ Scintillometer.

5.1.1 Rotate the Barium source holder in a ccw direction to remove it from the housing.

5.1.2 Observe the serial and count rate. Record both numbers.

5.1.3 Set the mode switch to the Cal position. Place the source next to the source sampling position (cavity) on the unit.

5.1.4 Observe and record the count rate displayed. Take a minimum of ten (10) readings. Take the average of theses readings and record that number. The count rate should be the same as the calibration count rate number within 55 counts per second (cps). If so, terminate the calibration procedure and return the calibration source to its holder cavity.

5.1.5 If the observed count rate is different from the source number, the instrument requires either an increase or a decrease in gain (cw rotation of positive increase

gain, ccw for negative). Insert a screwdriver or coin into the slot of the 11-position calibration control, Apply a + 2% gain increase and observe the displayed count rate 10 times. Take notice that this calibration control is a fine adjustment. Continue to increase the gain in increments of + 2% to determine the direction of the observed count rate. Continue until the observed count rate is equal to the count rate number, within 55 cps. If negative results are obtained by applying a + 2 % increment, repeat the procedure with – 2 % gain increments. If both + and – 2 % gain increment adjustments result in negative results go to 5.5.6.

5.1.6 Long Term Gain Adjustment Control:
Reset the calibration switch to 0.
Set the mode selector to Cal.
Below the mode selector is a screw type blanking cap.
Remove the cap with a screwdriver to expose a slotted potentiometer adjustment shaft.
Unscrew the calibration source, insert in the calibration cavity and hold it by hand against the housing (as in 5.1.3).
With the calibration source in position, rotate the shaft slowly and gradually cw and ccw, using a screwdriver, until the reading on the display matches the proper calibration number on the unit. If this does not work; return instrument to the factory. Record all activity.

5.2 Environmental Conditions

No special environmental conditions are necessary for this procedure.

5.3 GRS-5000 Differential Spectrometer

A GRS-500 Differential Spectrometer will be used to acquire five channels of gamma energies:
TC_1 = Total Count above 0.08 MeV.
TC_2 = Total Count above 0.40 MeV.
K = All gamma energies between 1.35 and 1.59 MeV.
U = All gamma energies between 1.65 and 1.87 MeV.
T = All gamma energies between 2.45 and 2.79 MeV.
A calibration channel is also provided:
CAL = Measures barium-133 photo peak at 0.352 MeV. A source is supplied and is rated at activity 0.5 μ Ci.

The serial number of the unit will be recorded in the field and /or laboratory notebooks and on the *Geophysics Analysis* form.

5.4 Parameters

The detector is a Nal (TI) crystal and a high stability photomultiplier tube with a mu-metal (magnet) shield. The detector volume is 124cc (7.5 cu. in.)
The unit has a resolution of typically 8% FWHM in a 2 π ^{137}Cs Field at an observed count rate of 6000 cps over an energy interval from 80 kev to 700 kev. The resolution deterioration as a function of count rate is less than 1% at an observed count rate of 6, 000 to 50, 000 cps over an energy interval from 80 kev to 700 kev.
The spectral shift is less than 1% from 1, 000 to 25, 000 cps and less than 2% from 25, 000 to 50, 000 cps integrated over an energy interval from 80 kev to 3 Mev. The specific count rated are observed count rates and are subject to dead time corrections (i.e., 50, 000 observed = 62, 5000 cps actual). Dead time is 4 microseconds.
Observed count rates are subject to corrections due to dead time.
Actual count rate equals:
$C_A = C_o/(1-C_oT_d)$ where: C_o is the observed count rate, and
T_d is the dead time.

5.5 Unit Operation

5.5.1 Turn on Unit and follow calibration procedure.

5.5.2 Set sample rate 1.0 or 10.0 seconds. Record the setting.

5.5.3 Set to an energy channel. Record the setting.

5.5.4 Place unit on sample. Use the same sampling location on the unit each time (near source sampling location). Read the five-digit liquid crystal display (LCD). Insure the battery charge status bars exhibit 3 bars for a full charge. Take a statistically meaningful number of readings. Record <u>all</u> readings taken.

5.5.5 Set unit to another energy channel. Record the setting and continue to take data and obtain additional energy channel data as desired until data collection is complete. When complete turn off Unit.

6.0 REFERENCES

NWRPO Quality Assurance Program Plan

7.0 RECORDS

Notebook for KUT spectrometer data collection.
Master logbook notation of sample or split sample.
Geophysics Analysis form

8.0 ATTACHMENTS

N/A