

RESL TECHNICAL PROCEDURE

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CHEM-TP-GA/B.1

GROSS ALPHA AND BETA IN WATER

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RESL TECHNICAL PROCEDURE

TITLE: CHEM-TP- GA/B.1, GROSS ALPHA AND BETA IN WATER

PURPOSE

The purpose of this procedure is to describe the method used to measure gross alpha and beta activities in INEEL groundwater.

APPLICABILITY

This procedure is applicable to the measurement of gross alpha and beta activities in 500-mL samples that have been acidified and evaporated to 10 mL.

RESPONSIBILITIES

RESL staff responsible for implementing this procedure are:

Radiochemist(s)

DEFINITIONS

None.

PROCEDURE

- 1 **ABSTRACT** - Aliquants equivalent to 100 mL for alpha and 250 mL for beta are transferred to plates and planchets for counting. Average salt contents are used in the calculations to correct for self-absorption. Self-absorption of alpha and beta particles affects counting efficiencies and must be taken into account (see CHEM-TP-CA.2). This is done by using average absorber weights for clean INEEL production well samples. For other types of water samples, individual absorber weights must be determined. The reference nuclide for alpha activity is ^{239}Pu and for beta activity ^{137}Cs .

- 2 **SAFETY PRECAUTIONS**
 - 2.1 Wear safety glasses or a face shield, a lab coat, and appropriate chemical resistant gloves to protect the skin and eyes. Handle the nitric acid carefully to avoid spills.
 - 2.2 Use extra caution when using the hotplate and heat lamp to avoid burns.

- 3 **EQUIPMENT**
 - 3.1 Fume hood
 - 3.2 Hotplate, 3600-W, 46 x 61 cm covered with a 1.6-mm thick fiberglass mat
 - 3.3 Heat lamp(s), 250 W
 - 3.4 Plates, 4.76-cm diameter by 0.06-cm thick, flat, type 304 stainless steel

RESL TECHNICAL PROCEDURE

3.5 Planchets, 5.08-cm diameter, serrated, type 304 stainless steel with a 0.32-cm wall

3.6 Gross alpha and beta counters (See CHEM-TP-CA.2).

4 SAMPLE PREPARATION

4.1 Transfer the 500-mL sample from the bottle into a 600-mL beaker. Rinse the bottle with 10 mL of concentrated HNO₃, add the rinse to the sample, and evaporate the sample on the covered hotplate to very near dryness.

NOTE: IF THE SAMPLE WAS MADE 2% (v/v 16 M) HNO₃ AT THE TIME OF COLLECTION, OMIT THE BOTTLE RINSE.

4.2 Transfer the sample from Step 4.1 to a 10-mL volumetric flask using demineralized water, dilute to volume, and mix thoroughly.

4.3 Pipet 2 mL (equivalent to 100 mL of original sample) of the solution onto a flat, 4.76-cm stainless steel plate and dry under a heat lamp.

4.4 Heat the dried plate for 5 min on the bare surface of the hotplate (350 to 400°C) to eliminate any remaining moisture and convert the salts, as much as possible, to oxides.

4.5 Cool the sample to room temperature and mount it under a prebackgrounded ZnS(Ag) phosphor. Allow at least 4 hr after mounting for decay of any radon daughters. Count the sample for 60 min in an alpha scintillation counter. (See CHEM-TP-GA.1)

4.6 Pipet 5 mL (equivalent to 250 mL of original sample) of the solution onto a 5.08-cm serrated planchet with a 0.32-cm wall and dry under a heat lamp.

4.7 Heat the dried planchet for 5 min on the bare surface of a hotplate (350 to 400°C).

4.8 Cool the planchet and count the sample for 20 min on the Tennelec beta counter (see CHEM-TP-GB.1).

5 CALCULATIONS Calculate the results and their uncertainties using the VAX computer menu-prompted RESULT program for gross alpha and beta. The average absorber weights for salts from 100 mL and 250 mL of INEEL groundwater are stored in the program. The average absorber weights are called up automatically when the sample is from USGS and the volume is 100 mL for alpha and 250 mL for beta. Use a yield of 98% because of the transfers that have taken place. Other data required are the gross count, the background count, and the counting time. The count time must be the same for sample and background. For other water samples, determine the appropriate absorber weights using tared plates and planchets and enter the actual weights in place of the displayed averages (see CHEM-ACP-TP-GA/B.2).

RESL TECHNICAL PROCEDURE

REFERENCES

CHEM-TP-CA.2 Gross Alpha and Beta Counting Efficiencies - Liquids
CHEM-TP-GA/B.2 Gross Alpha and Beta Counting in Water and Waste Water
CHEM-TP-GA.1 Gross Alpha Counter Operating Procedure
CHEM-TP-GB.1 Tennelec Beta Counter Operating Procedure

QUALITY RECORDS

Hard copy record of results.