

UNITED STATES TRANSURANIUM AND URANIUM REGISTRIES
ANALYTICAL PROCEDURE MANUAL

USTUR 710: Measurement of Isotopic Th by Radiochemical Neutron Activation Analysis

| | | | |
|------------------------|--|----------------------|----------------------------|
| Purpose | Chemical recovery calculation for Radiochemical Neutron Activation Analysis (RNAA) | Method Number | USTUR 710 |
| Original Date | 01/31/01 | Author | USTUR Radiochemistry Staff |
| Revision Number | 0 | Approved By | Jim Elliston |
| Effective Date | 01/31/01 | Approval Date | 1/31/01 |

This procedure is no longer in use – see previous version of the Procedures Manual if you wish to review this procedure.

UNITED STATES TRANSURANIUM AND URANIUM REGISTRIES
ANALYTICAL PROCEDURE MANUAL

RNAA Calculations

Recovery

Initial count rate of tracer in standard

$$C_t = \frac{\dot{C}_{o,t}}{\lambda} (1 - e^{-\lambda t_{r,t}})$$

C_t = tracer counts in standard

$\dot{C}_{o,t}$ = initial tracer count rate in standard (counts/s)

λ = $\frac{\ln 2}{t_{1/2,t}}$ = tracer decay constant (S⁻¹)

$t_{1/2,t}$ = tracer half-life (d)

$t_{r,t}$ = count time for tracer recovery in standard (seconds)

$$\therefore \dot{C}_{o,t} = \frac{C_t \lambda}{(1 - e^{-\lambda t_{r,t}})}$$

Initial count rate of tracer in sample

$$\dot{C}_{o,s} = \frac{C_s \lambda}{1 - e^{-\lambda t_{s,t}}}$$

$C_{o,s}$ = tracer counts in sample

$t_{s,t}$ = count time for tracer recovery in sample

Recovery

$$R = \frac{\dot{C}_{o,s}}{\dot{C}_{o,t} e^{-\lambda t}} = \frac{C_s \cdot (1 - e^{-\lambda t_{r,t}})}{[C_t \cdot (1 - e^{-\lambda t_{r,t}})] \cdot e^{-\lambda t}}$$

t = time (seconds from initiating standard count and sample count for recovery)

A_i ≡ isotopic activity in aliquot

$$= \left(\frac{\text{dpm tracer added}}{\text{decay corrected initial count rate}} \right) \left(\frac{\text{initial count rate in sample}}{R} \right) \times \frac{\text{Bq}}{60 \text{ dpm}}$$

$$= \left[\frac{A_o * V_r}{\left(\frac{C_r \lambda}{1 - e^{-\lambda t_r}} \right) e^{-\lambda t_d}} \right] \left[\frac{C_s \lambda}{1 - e^{-\lambda t_s}} \right] \times \frac{\text{Bq}}{60 \text{ dpm}}$$

$$= \frac{A_o V_r C_s (1 - e^{-\lambda t_r})}{C_r (1 - e^{-\lambda t_s}) e^{-\lambda t_d} R} \times \left(\frac{\text{Bq}}{60 \text{ dpm}} \right)$$