

A Rapid Method for Actinides and
Strontium in Bioassay Samples Using
Eichrom's Resin Cartridges

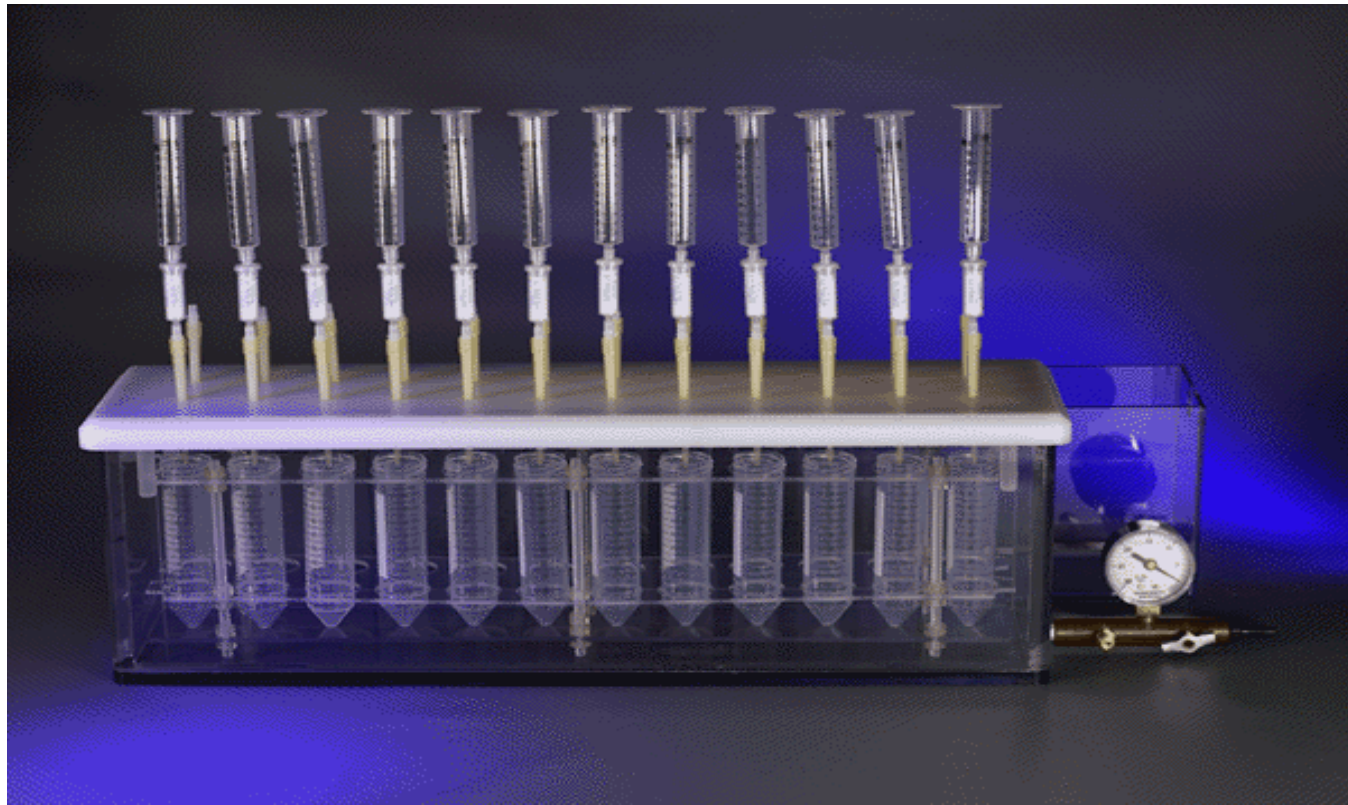
Anil Thakkar

Eichrom Users' Group Meeting

December 9th, 2005

Manchester, UK

Eichrom Vacuum Box System



Cartridge & Reservoir



Inner & Outer Tips



Resin Cartridge

- Dry packed with 50-100 micron
- 2 mL of resin
- Cartridges with Luer fittings
- Ease of tandem arrangement for sequential analysis

Color Coded Label

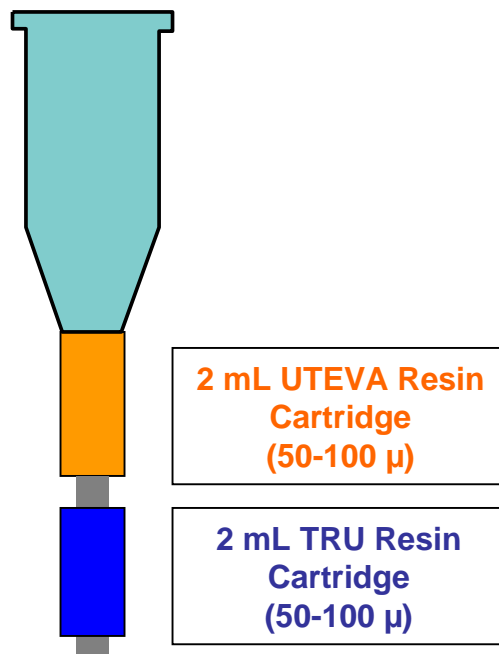


Flow rate

- Sample load: Typically 1 mL/minute
- Rinse solution: 2-3 mL/minute
- Strip solution: 1 mL/minute
- Achievable with vacuum pump

Am, Pu, U on UTEVA/TRU Resin Cartridge

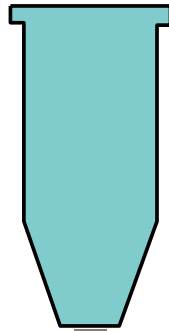
- 1) Redissolve in 10 mL 3M HNO_3 - 1M $\text{Al}(\text{NO}_3)_3$
- 2) Add 2 mL 0.6M Ferrous Sulfamate
- 3) Add 1 mL 1.0M Ascorbic Acid



Am, Pu, U on UTEVA/TRU Resin Cartridge

U Elution

15 mL of 1.0 M HCl

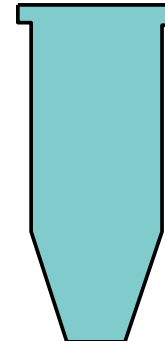


2 mL UTEVA Resin
Cartridge
(50-100 μ)

U Fraction

Am Elution

3 mL 9M of HCl +
20 mL of 4M HCl



2 mL TRU Resin
Cartridge
(50-100 μ)

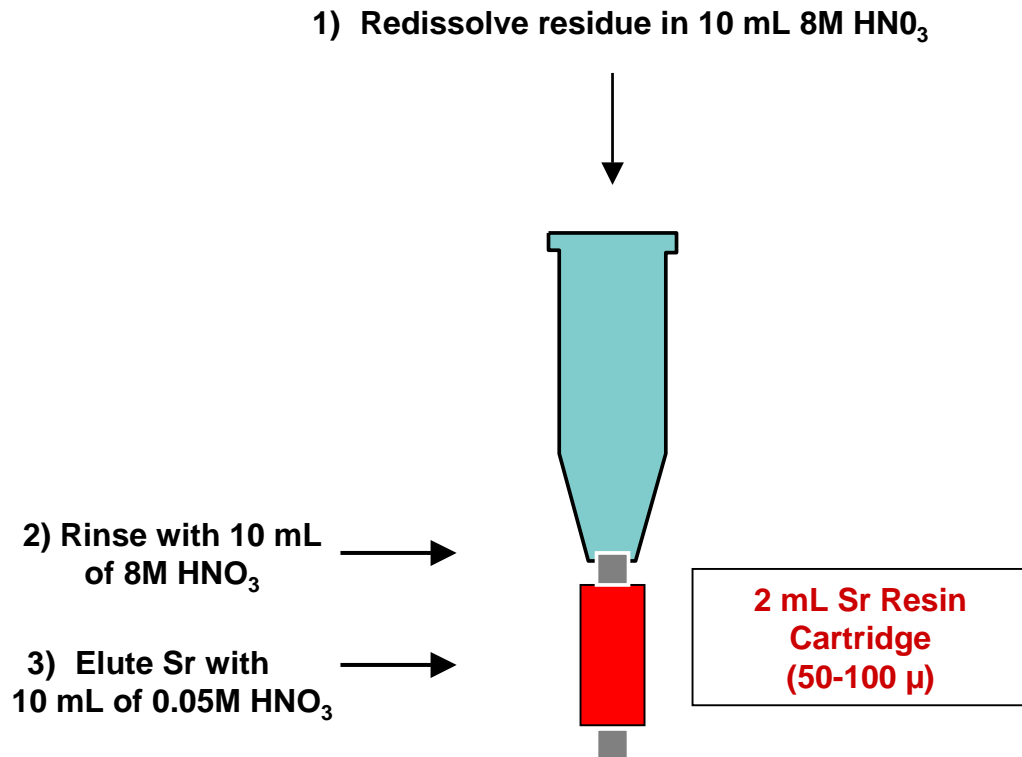
Am Fraction

Pu Elution

10 mL 0.1M
ammonium bioxalate

Pu Fraction

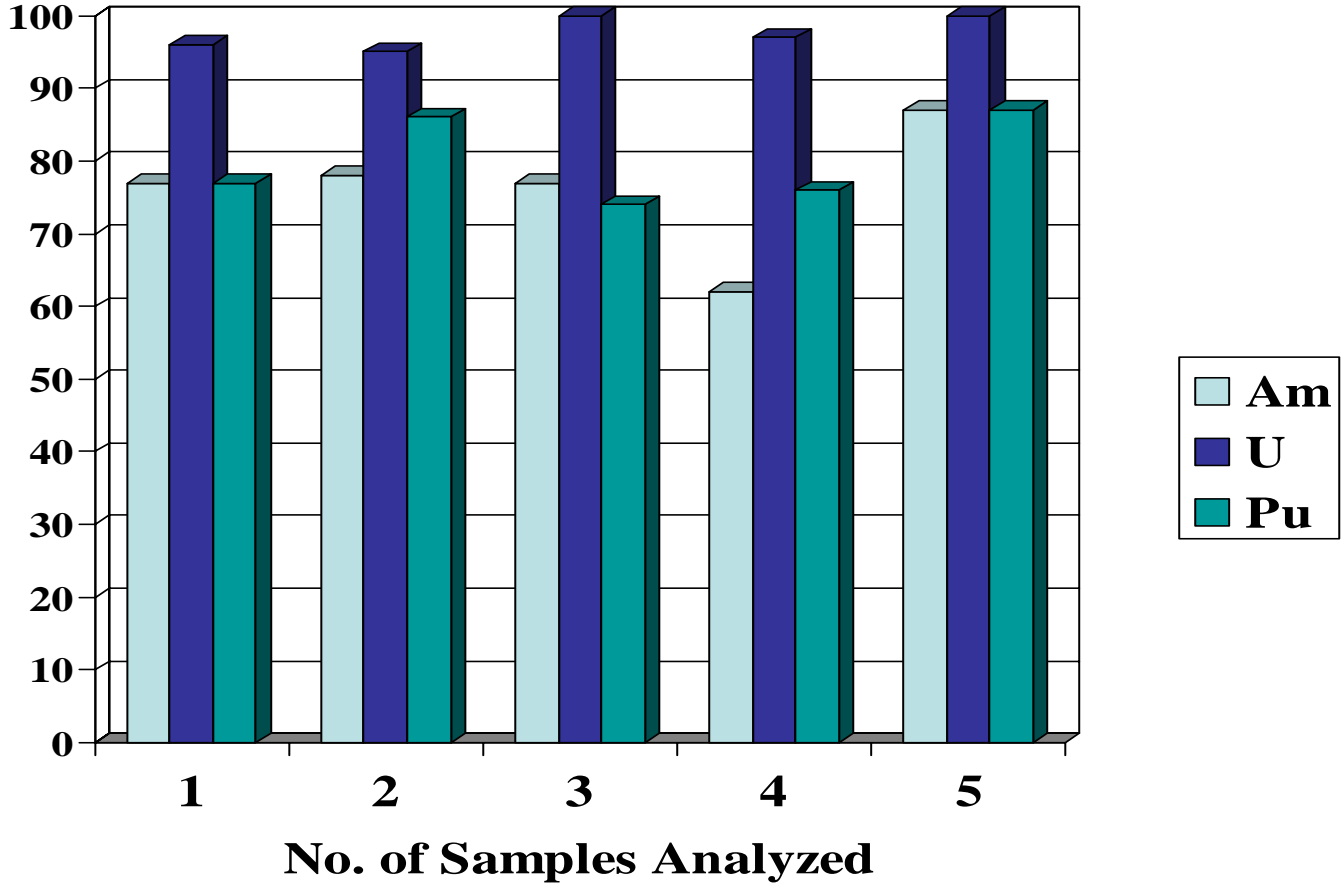
Sr-90 on Sr Resin Cartridge



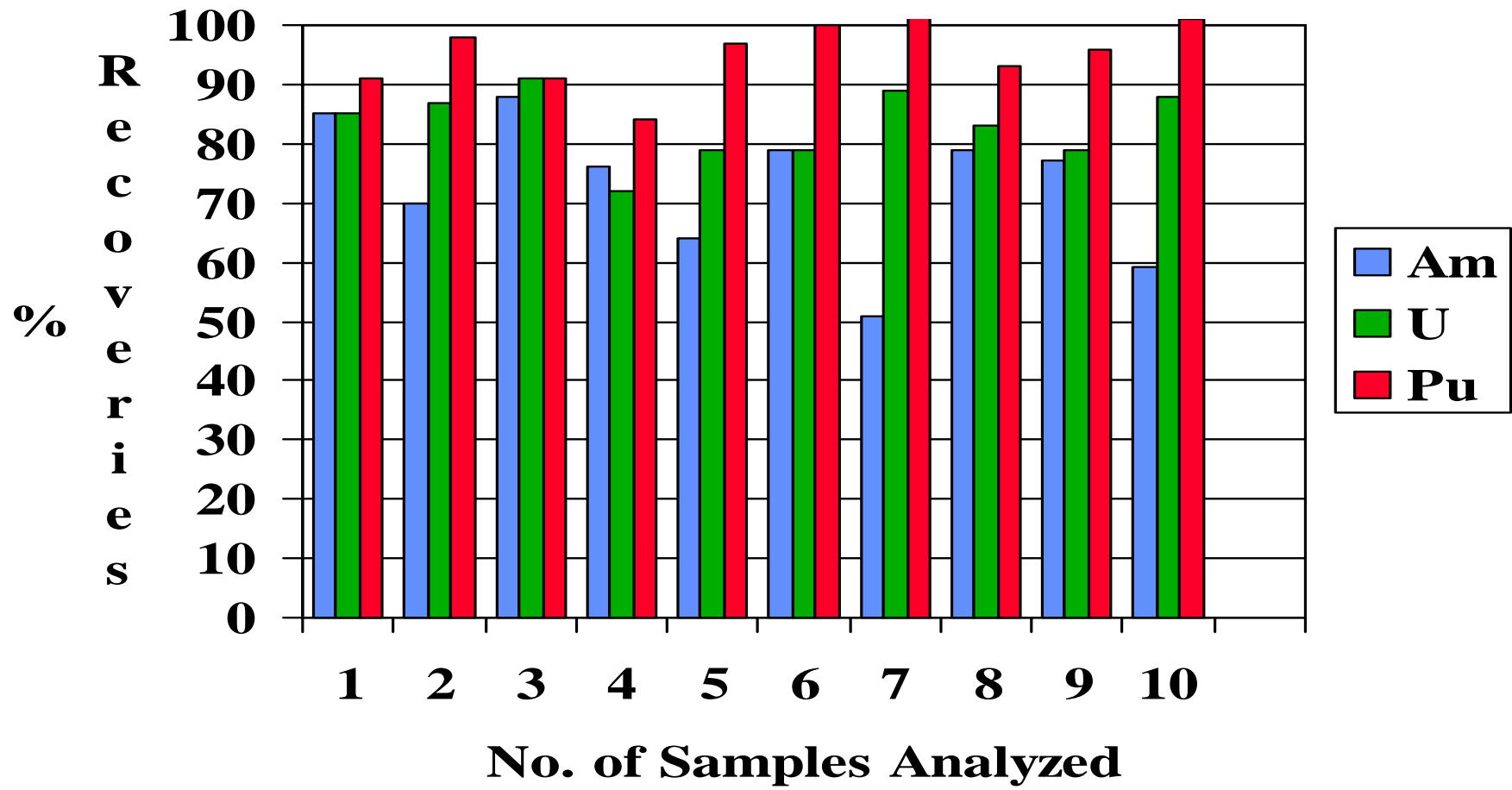
Decontamination Factor

| <u>Actinide</u> | <u>DF in U fraction</u> | <u>DF in Pu fraction</u> | <u>DF in Am fraction</u> |
|-----------------|-------------------------|--------------------------|--------------------------|
| U-232 | N/A | 7300 | >5800 |
| Pu-239/240 | 12,000 | N/A | 7000 |
| Am-241 | >6600 | 20,000 | N/A |
| Th-229 | 15,000 | 10,000 | >10,000 |
| Np-237 | 3500 | 7000 | >12,000 |

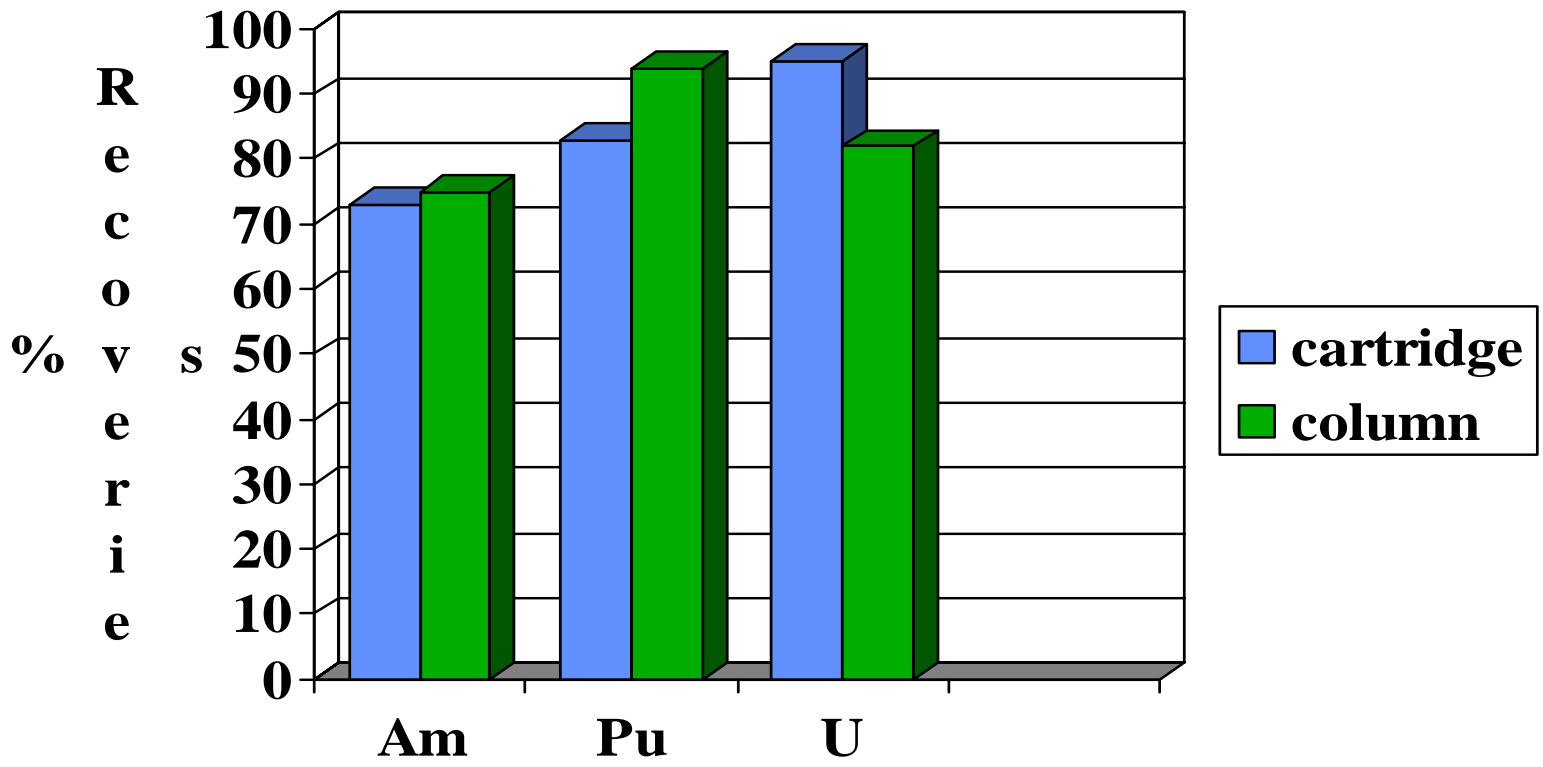
Synthetic Urine Samples



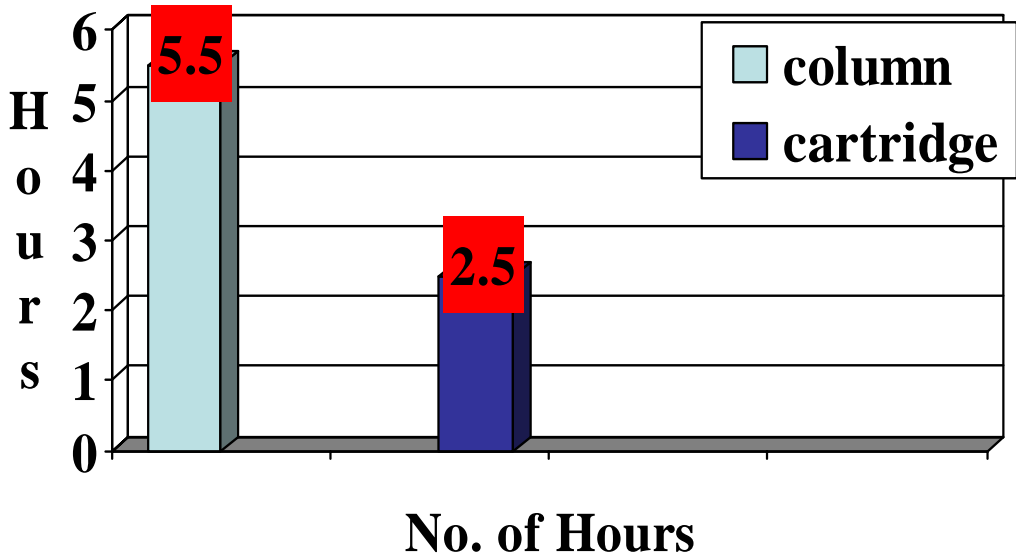
Real Urine Samples



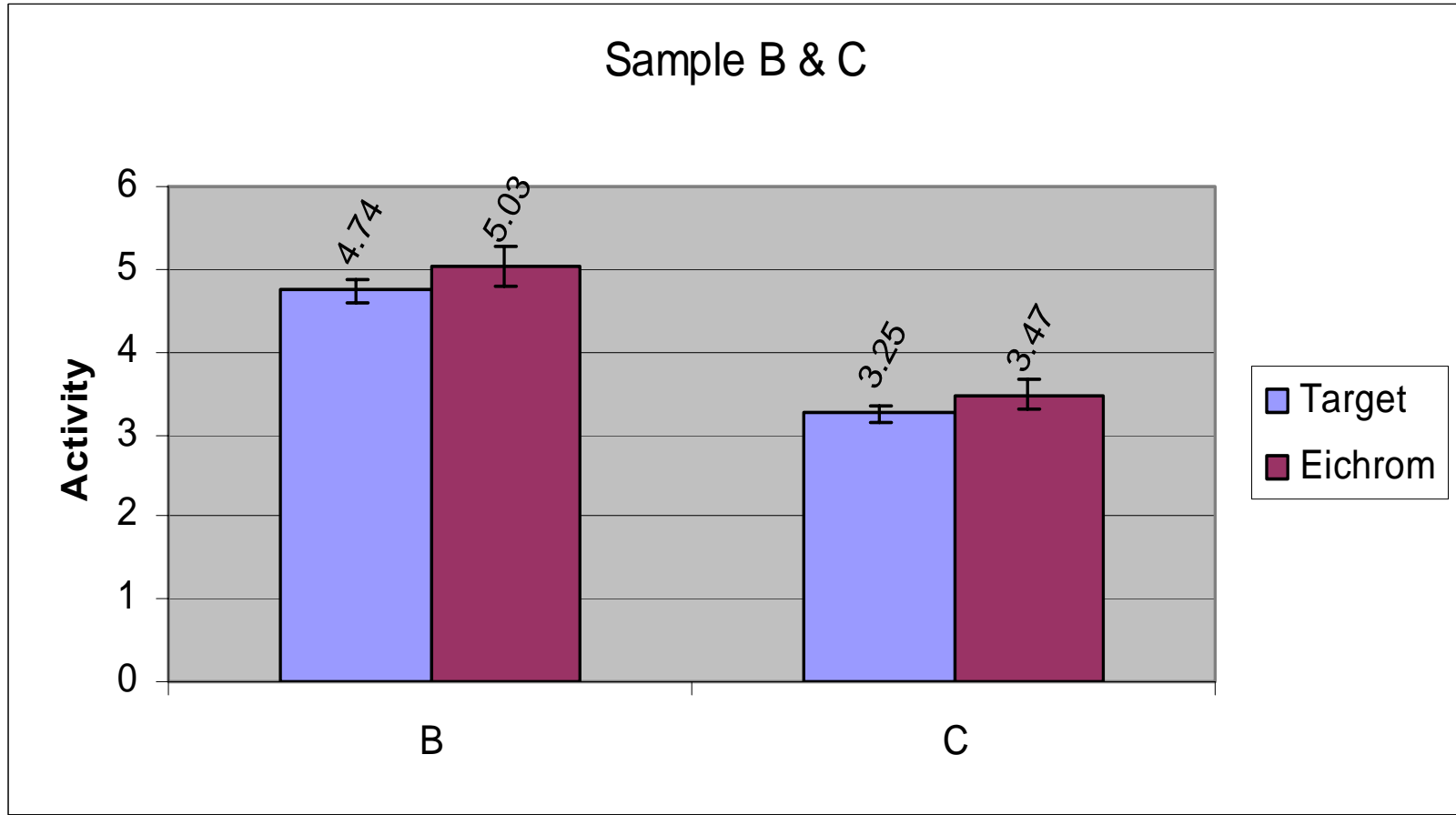
Column Vs Cartridge- Real Urine Samples



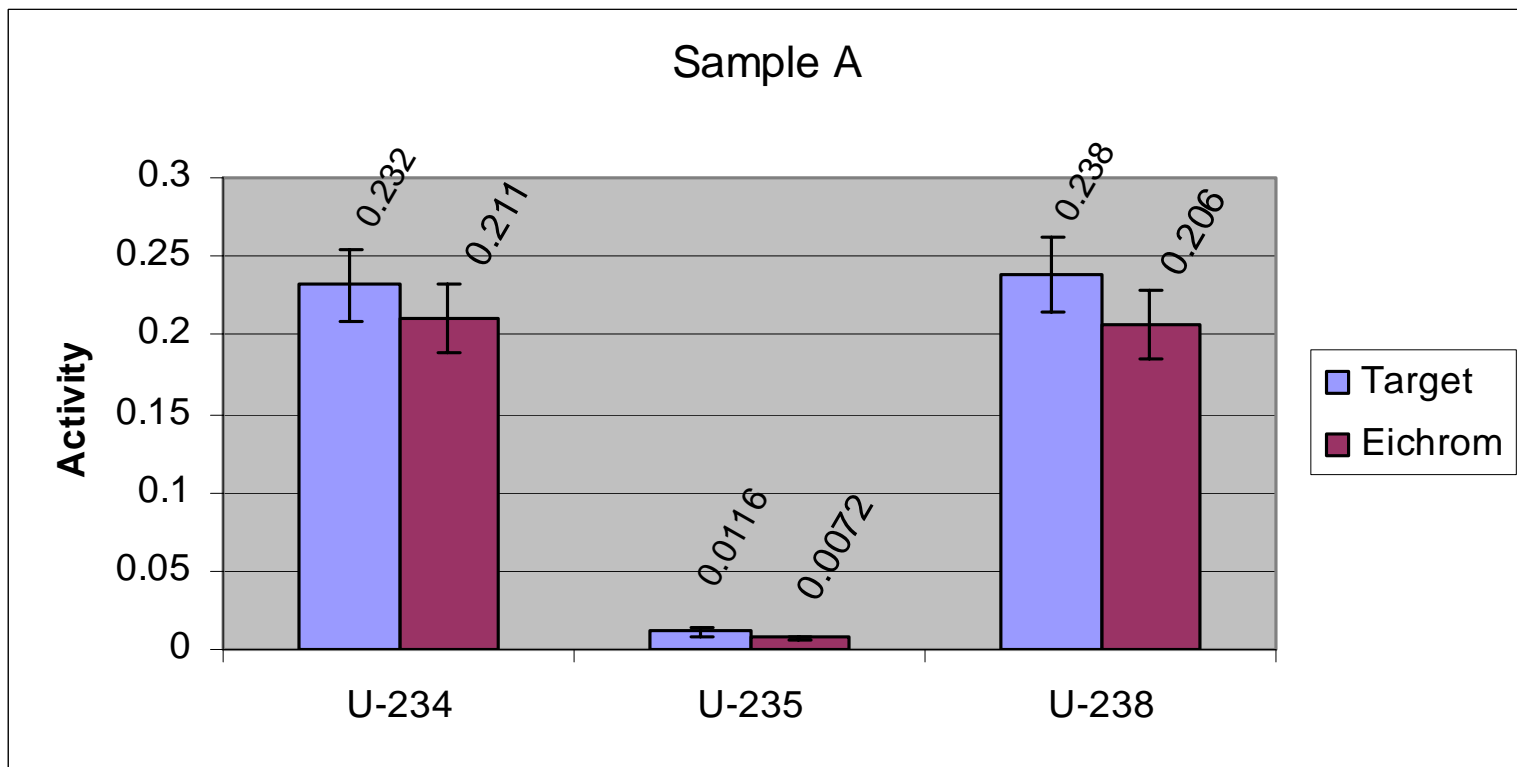
No. of Hours Required for the Analysis



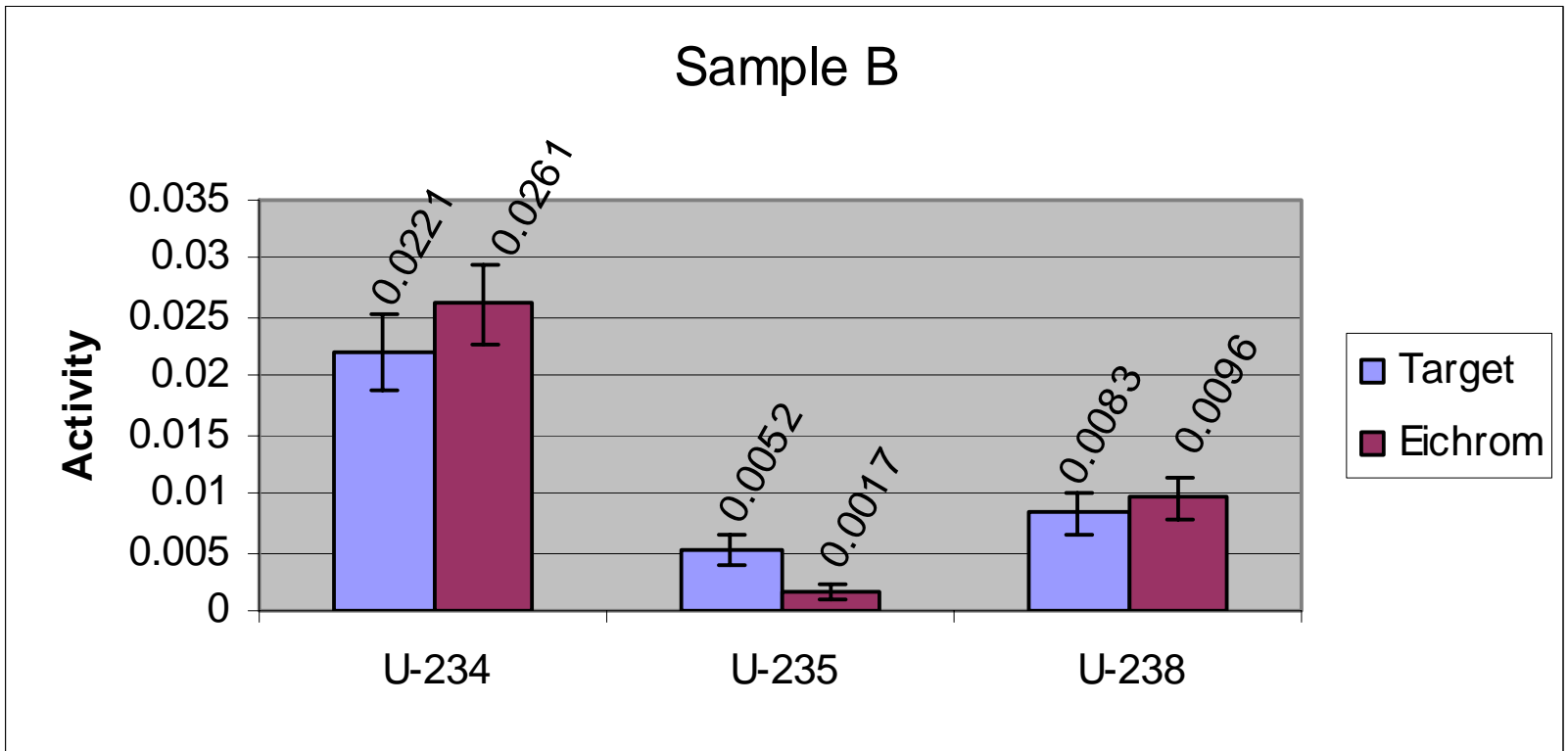
PROCORAD 2000- Sr-90 in Urine



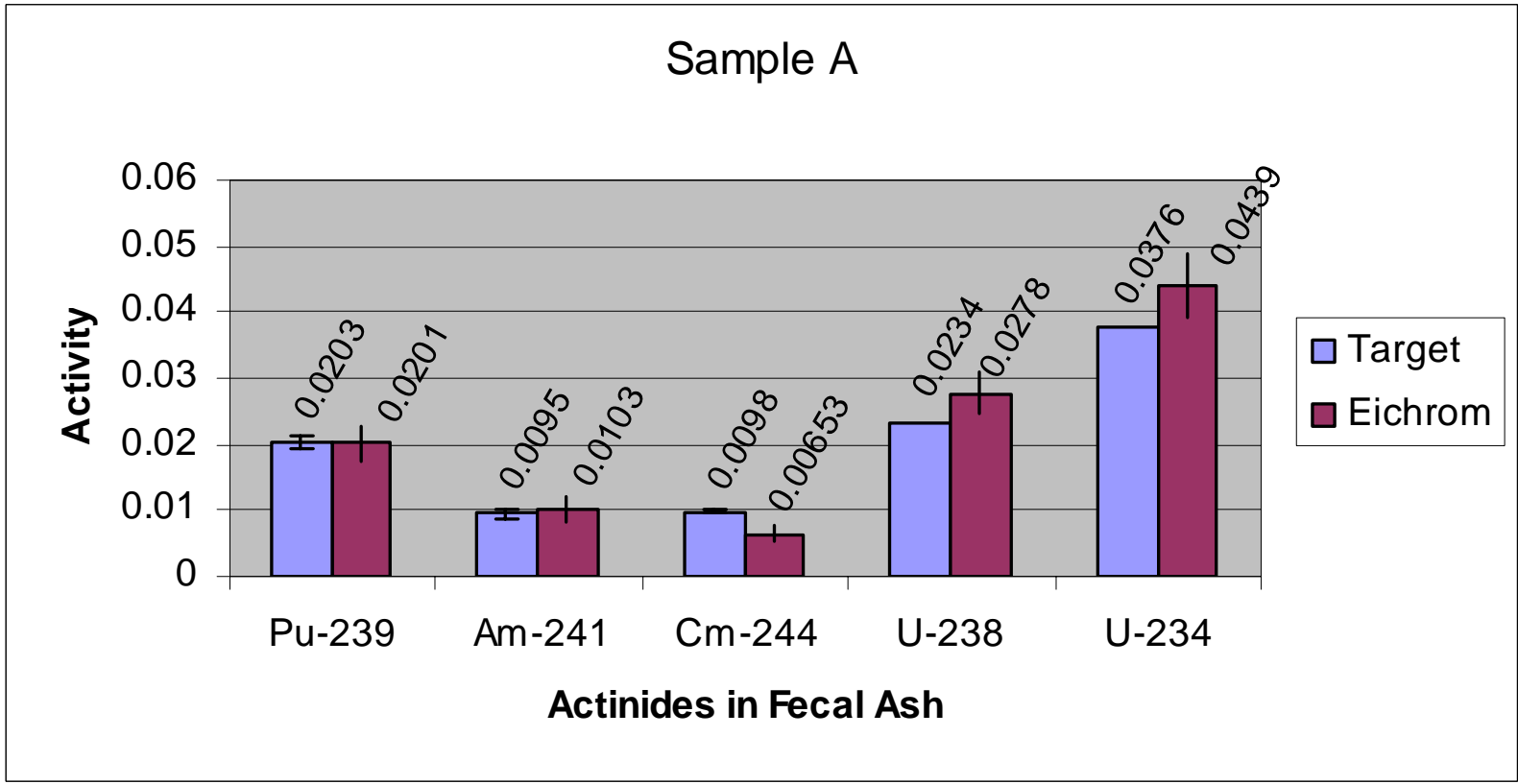
PROCORAD 2000-Uranium in Urine



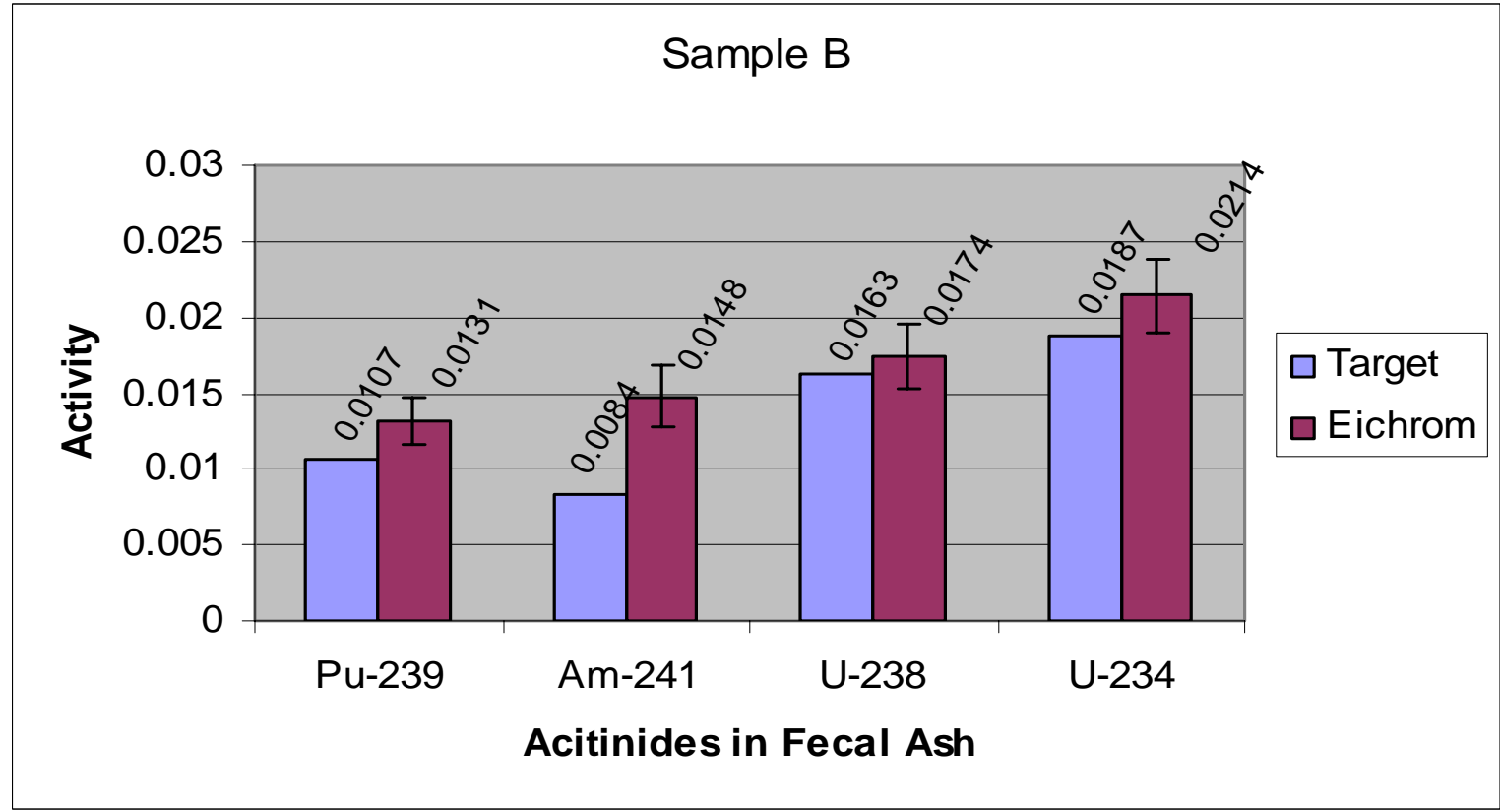
PROCORAD 2000-Uranium in Urine



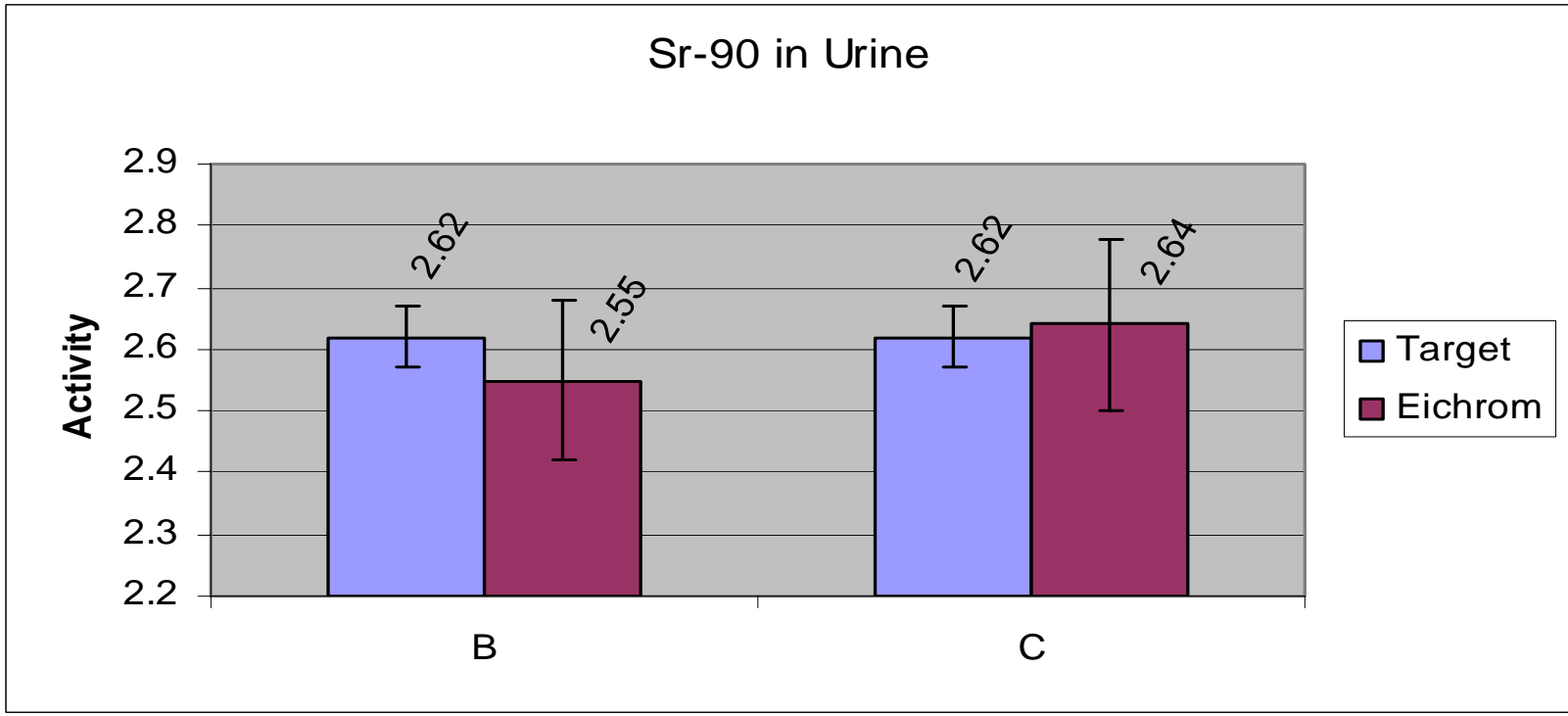
PROCORAD 2000-Actinides in Fecal Ash



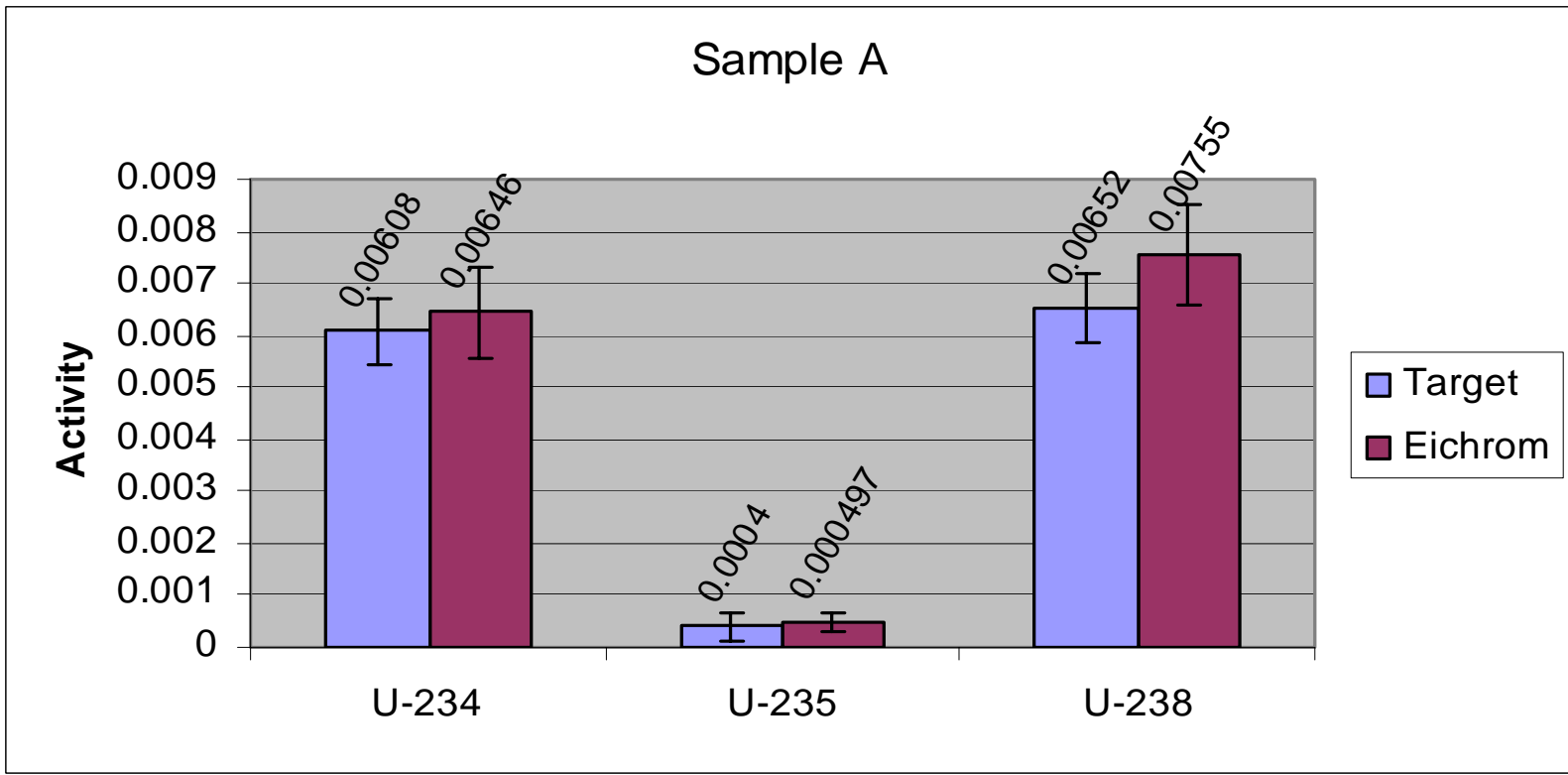
PROCORAD 2000-Actinides in Fecal Ash



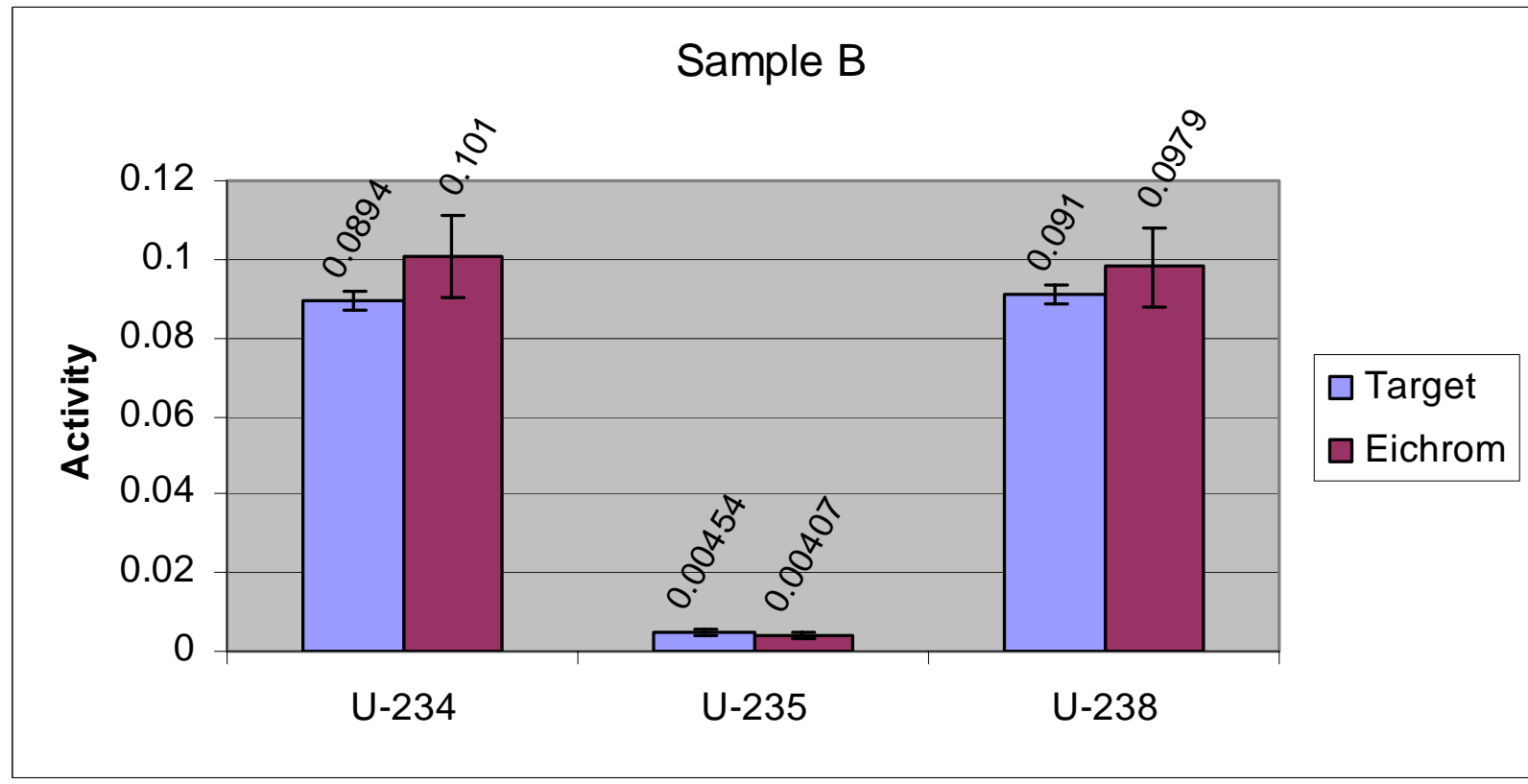
PROCORAD 2002-Sr-90 in Urine



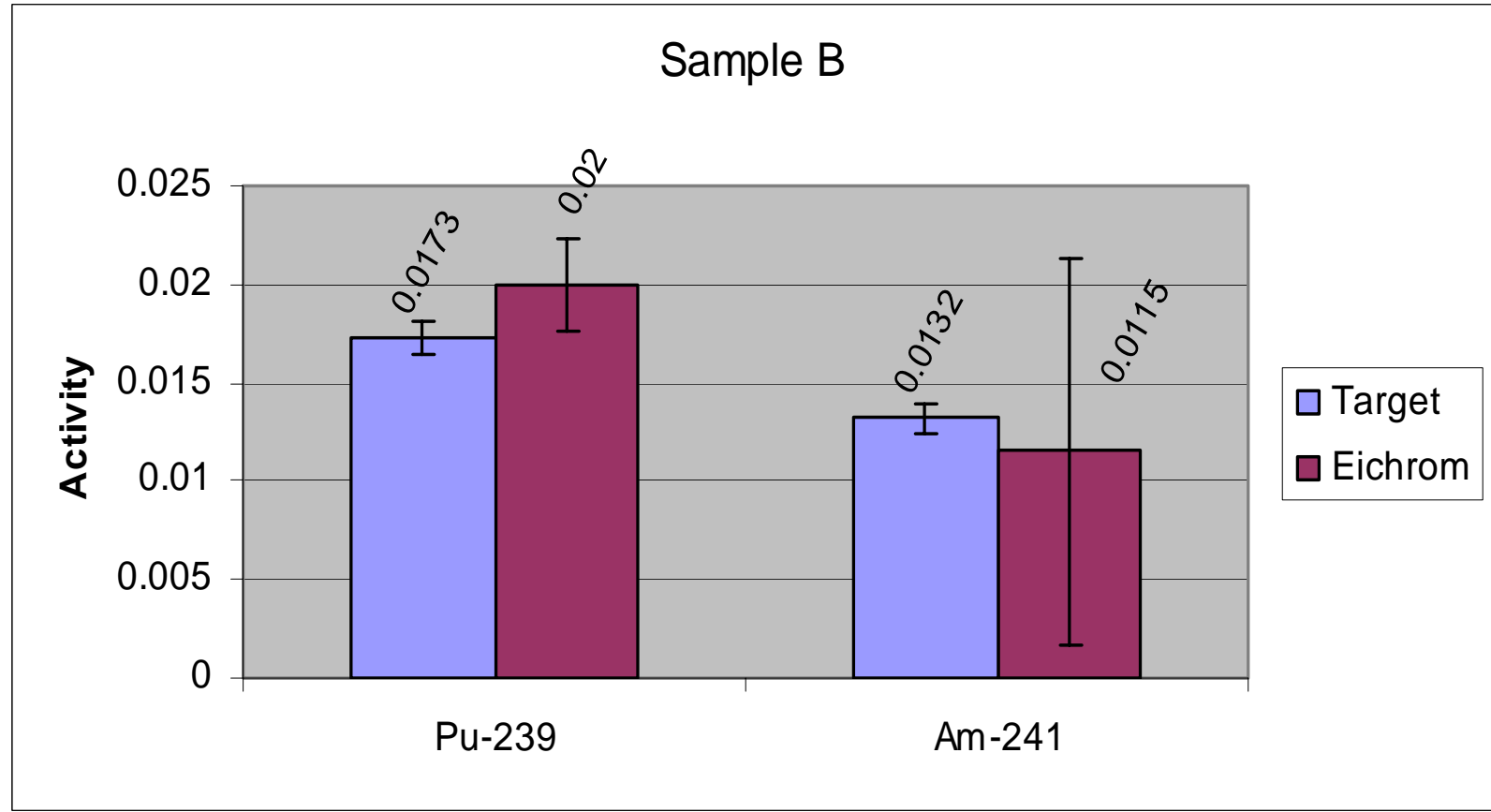
PROCORAD 2002-Uranium in Urine



PROCORAD 2002-Uranium in Urine



PROCORAD 2002-Actinides in Fecal Ash



Methods used at Savannah River Site

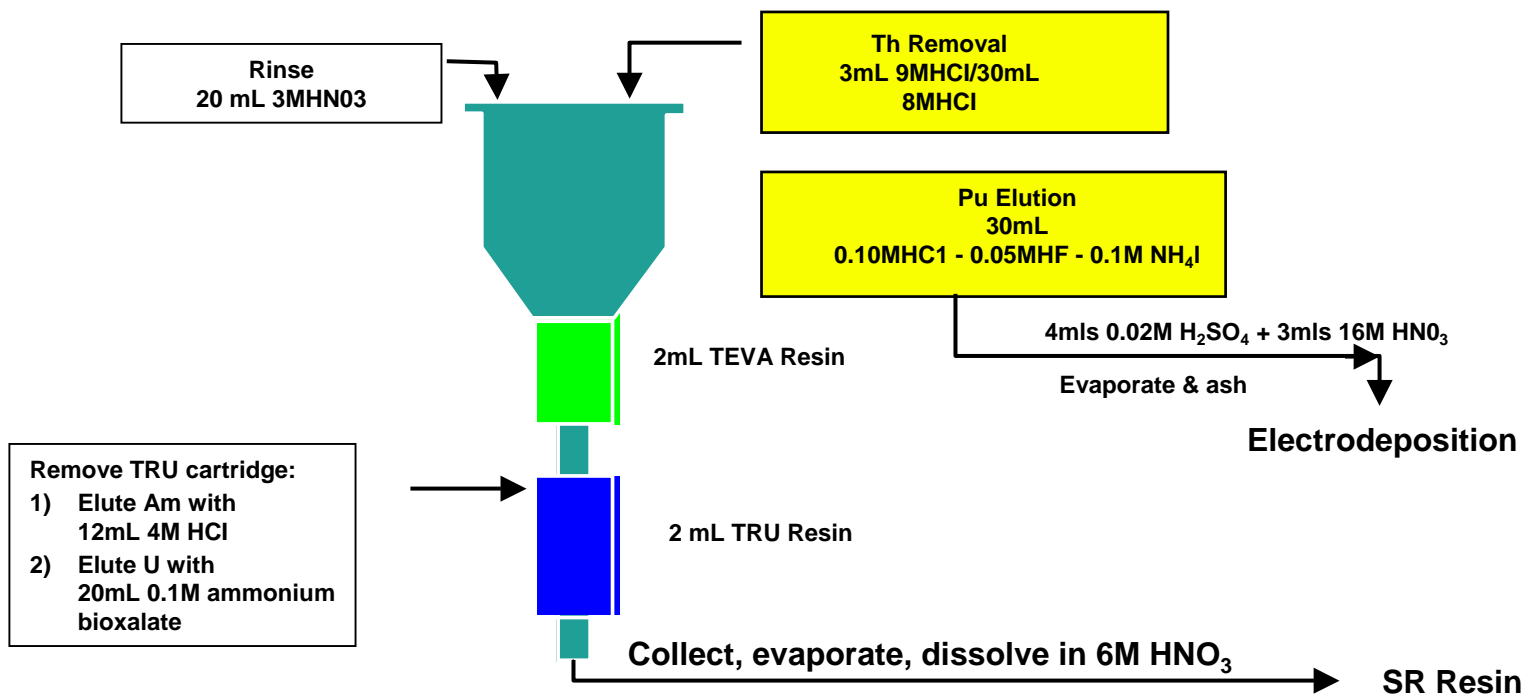
Courtesy

S. L. Maxwell, III and D. J. Fauth

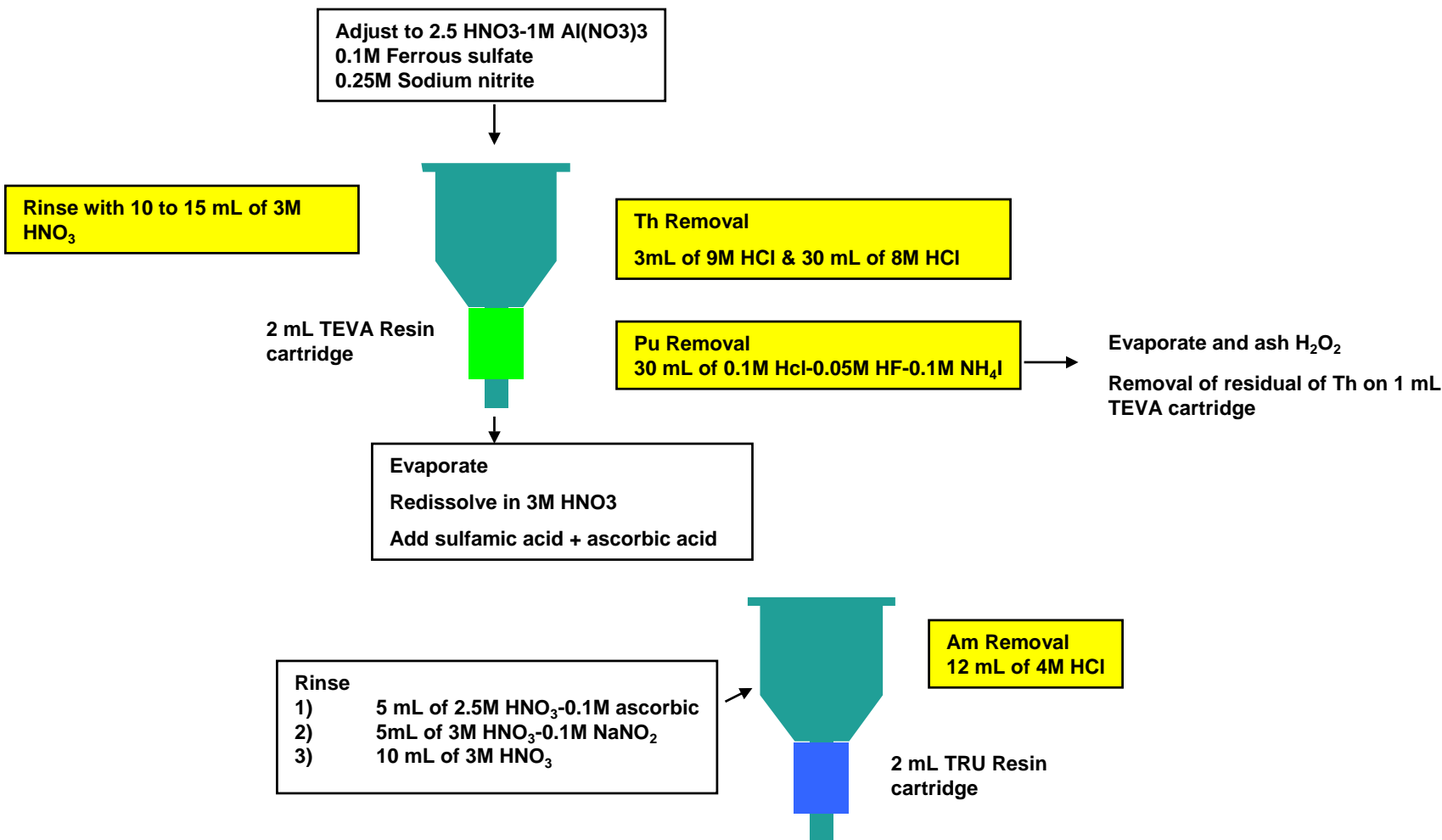
Westinghouse Savannah River Site

Pu, Np/Am, U, Sr on TEVA/TRU RESIN (URINE METHOD)

- 1) Adjust to 2.5M HNO_3 - 1M $\text{Al}(\text{NO}_3)_3$
- 2) 0.05M Sulfamic Acid + 0.2M Ascorbic Acid
- 3) 0.4 to 0.5M Sodium Nitrite

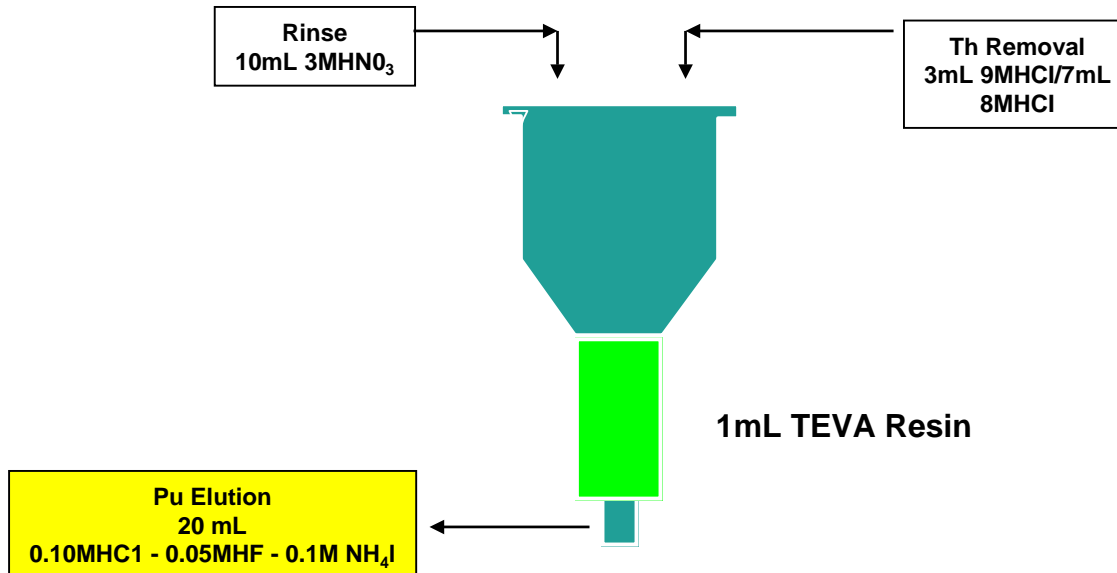


Pu, Am on TEVA & TRU Resin (FECAL METHOD)



Pu on TEVA RESIN (2nd Column to Remove all Th-228)

- Redissolve in 7.5mL 3M HNO₃ + 1mL 2.5M Al(NO₃)₃
- Add 0.5mL 1.5M Ferrous Sulfate + 1mL 1.5M Ascorbic Acid
- Add 1mL 3.5M Sodium Nitrite
- Add 1mL 16M Nitric Acid



Summary

- Eichrom Resin cartridges provide fast separation for strontium and actinides
- Good, reproducible and consistent recoveries achievable
- Rapid turn-around possible