



Optimization of Radiochemistry Lab Performance



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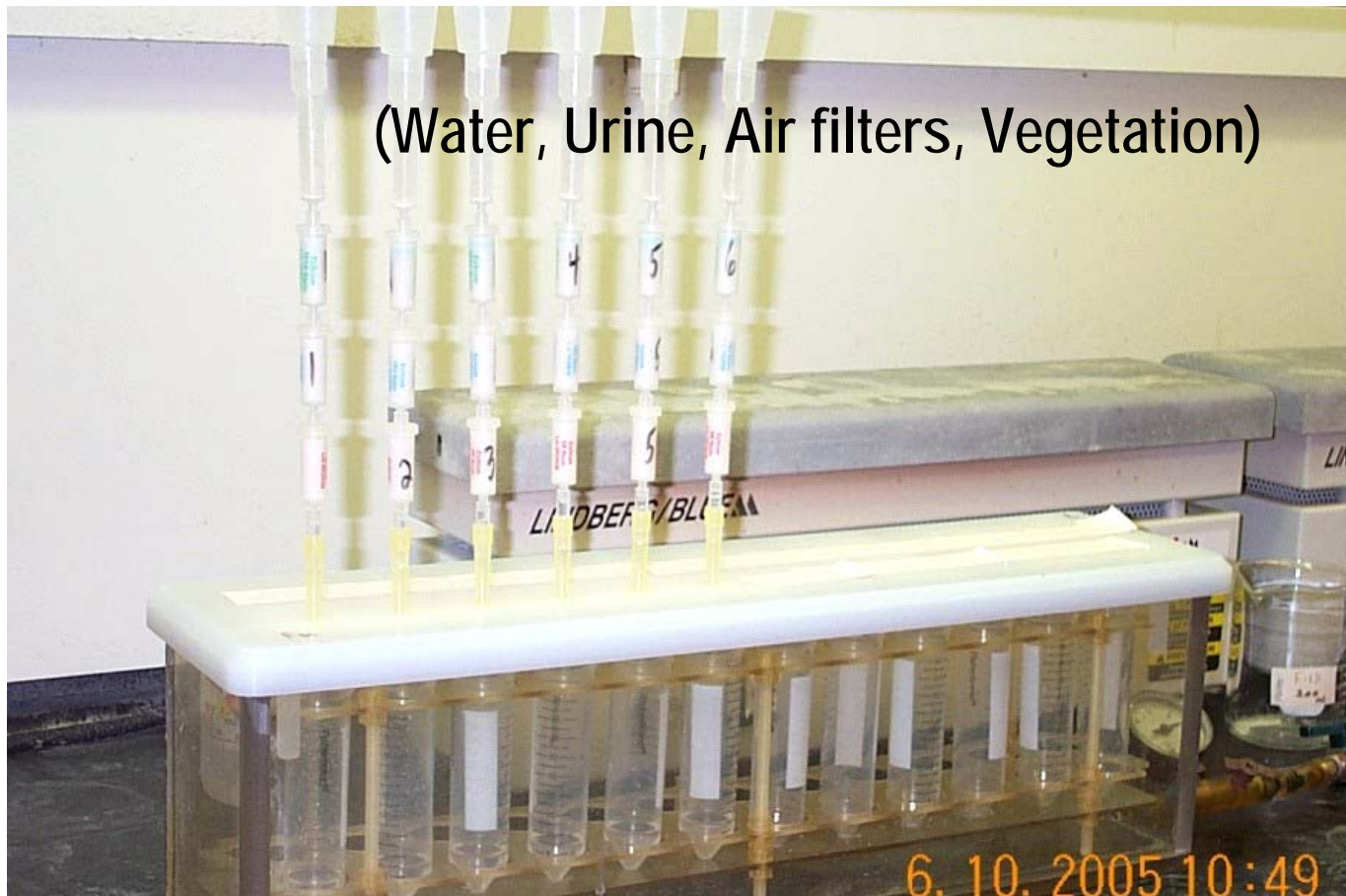
Optimization

- Rapid sample preparation
 - Removal of interferences
 - Consistent tracer/carrier recoveries
 - Ease of use
- Less labor/cost
- Faster TAT
- Speed and Quality...can we do both?
- Competitive edge

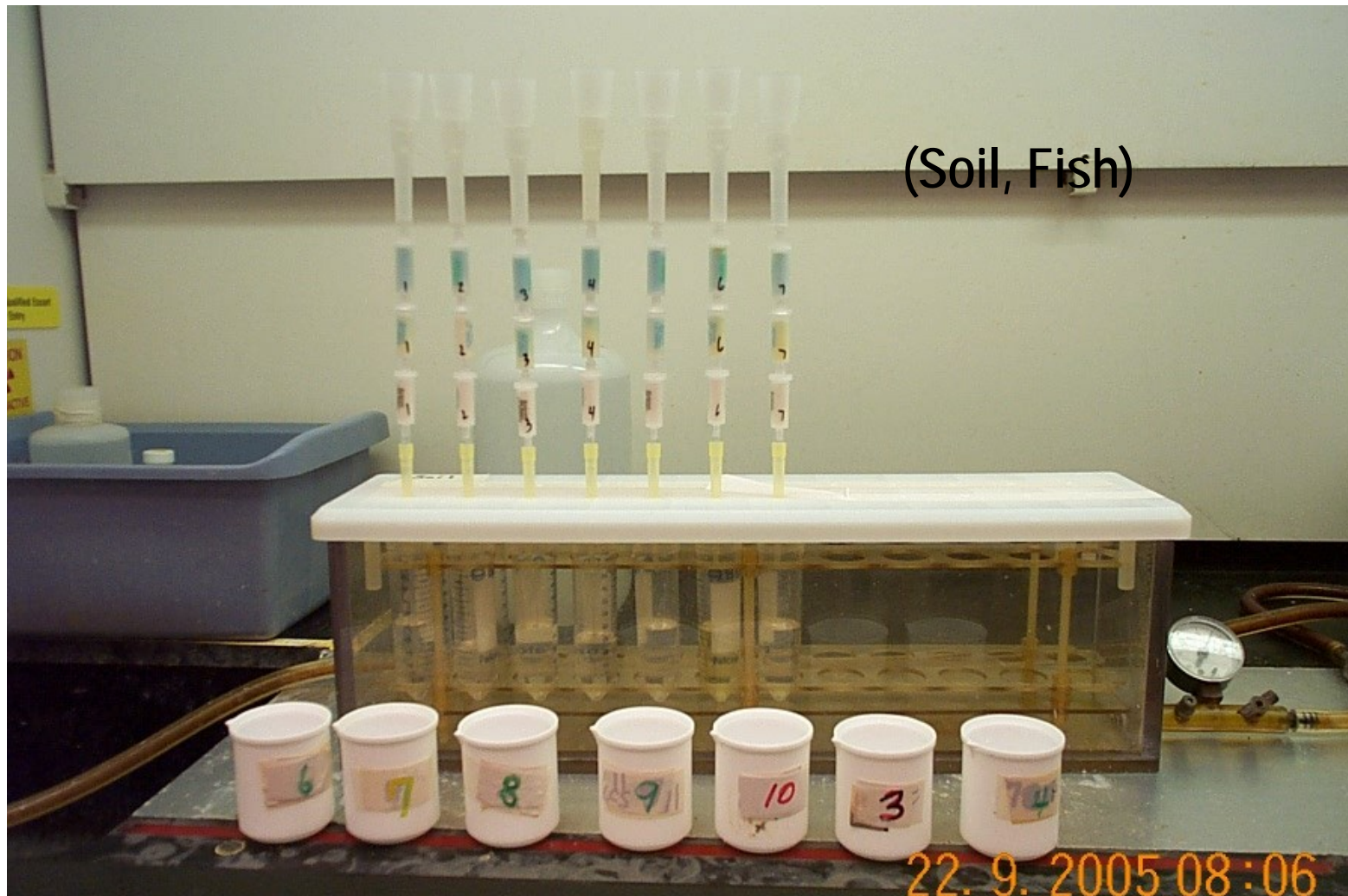
Optimized Lab Performance at SRS

- SRS Environmental Bioassay Lab
 - Streamlined actinide and Sr-89/90 methods using stacked resin cartridges
 - Rapid, sequential
- TEVA + TRU + Sr
 - water, air filters, vegetation, fruit, urine
- TEVA + TRU + DGA
 - soil, animal tissue

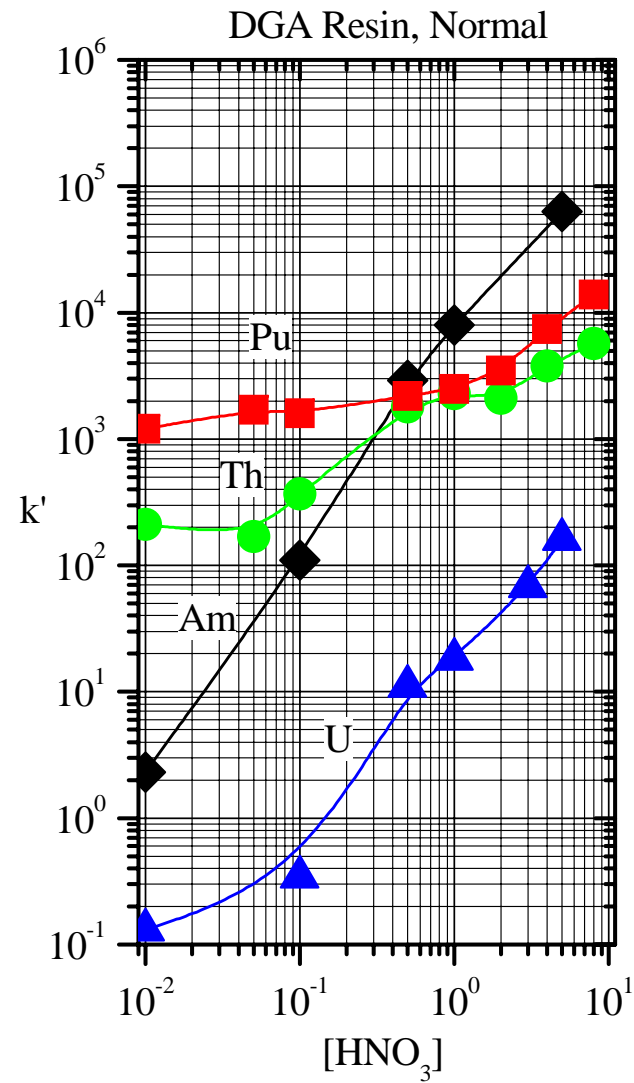
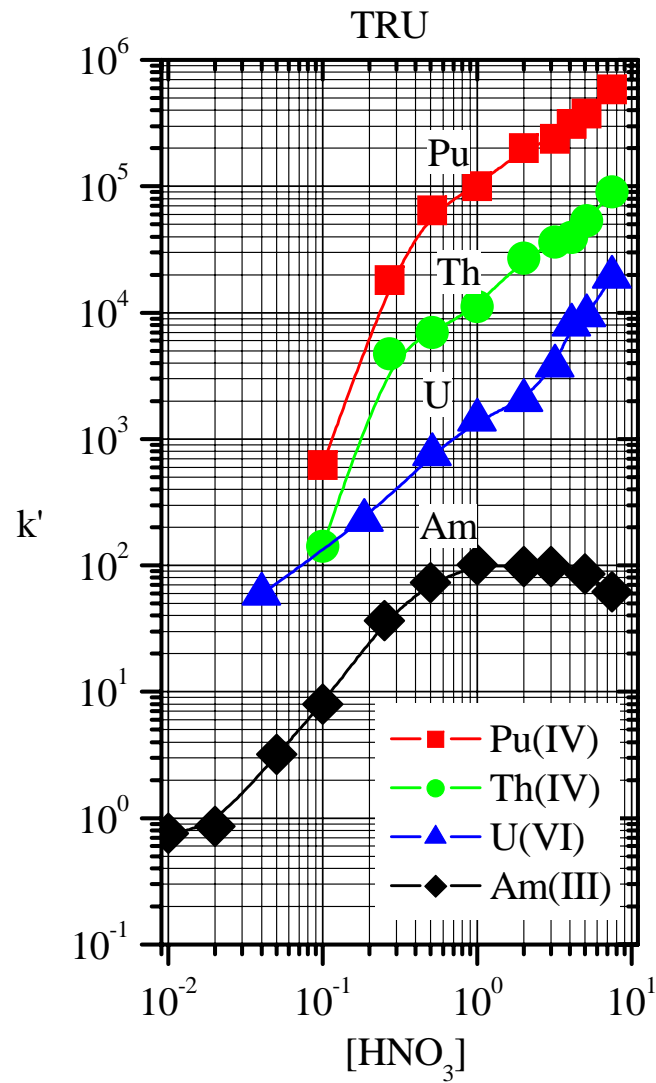
TEVA+TRU+Sr Resins



TEVA+TRU+DGA Resins



Comparison of TRU and DGA Resins



Water/Urine/Filters/Fruit/Vegetation Method

- TEVA+TRU+SR Resins (stacked)
- NRIP 06 performance
 - only lab to complete actinides, Sr-90<8 hrs-water, urine
- MAPEP performance

Water/Urine/Filters Method

- Method Updates
 - Eliminate Pre-filter resin
 - use same dilution of final column strip solution
 - Resolve Filters
 - Calcium and pH important for Sr-89/90 precipitation

Pre-filter Cartridges: Update

- Pre-filter cartridge used at SRS to improve alpha resolution to eliminate ashing
 - before we started using Resolve filters for CeF3
- Anil Thakkar (Eichrom) tests
 - Eliminate Pre-filter cartridges to remove extractant that bleeds off so no ashing required
 - Th 9M HCl
 - Am 4M HCl
 - Confirmed/implemented in SRS Environmental lab
 - Use same dilution we used before-Resolve® Filters
 - 15mL 4M HCl diluted to 30 ml with water + 50 ug Ce + 3 ml con. HF
 - 20-25mL 9M HCl diluted to 45 ml with water + 50 ug Ce + 5 ml con. HF

Am-Cm Spectra

Environmental & Bioassay Laboratories

Filename: S 500007176\$300259818 AM Detector: 34

Chemical Yield: 102.48%

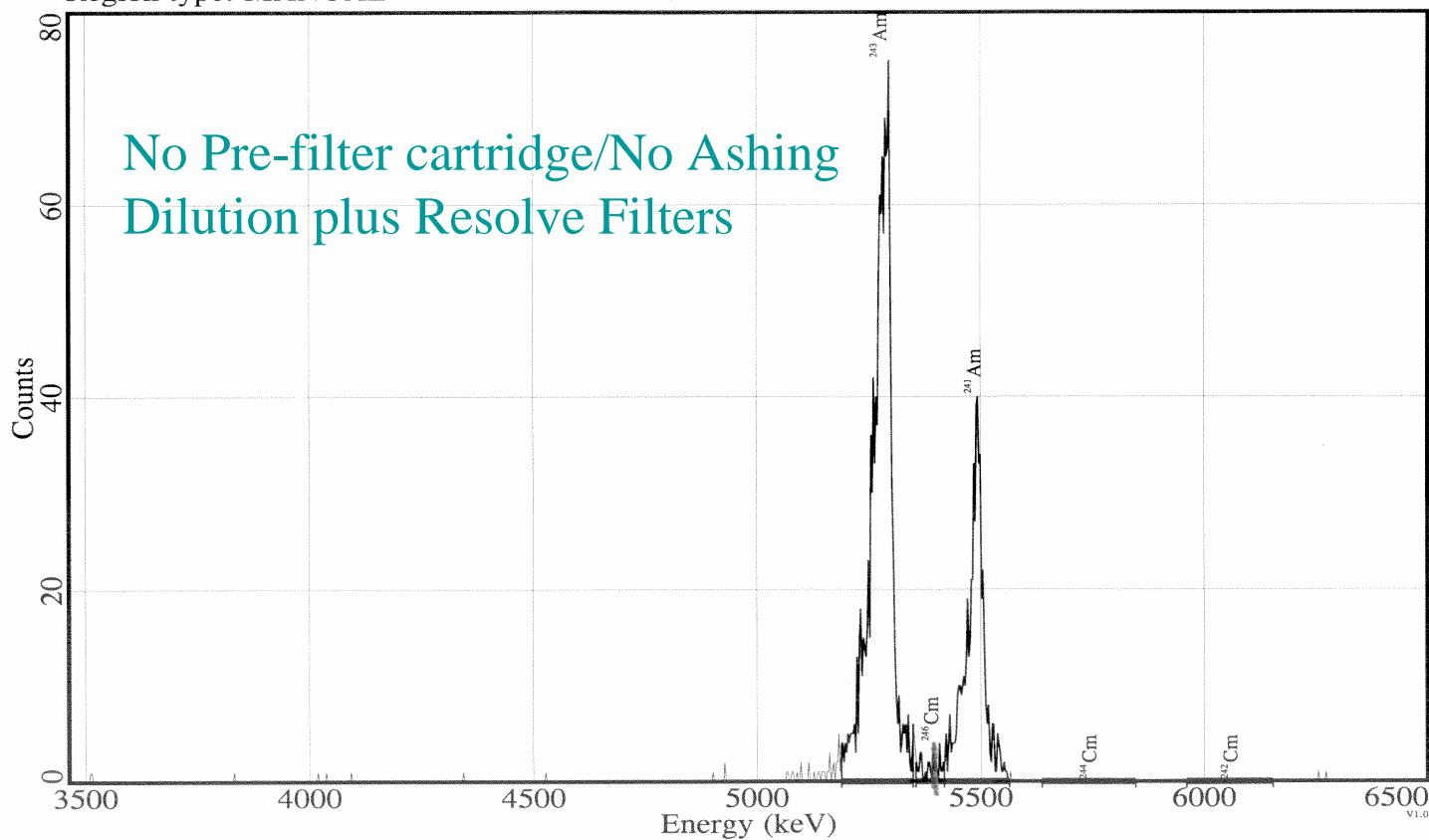
Acquisition Start: 5-SEP-2006 15:41:30.

Count Time: 0 16:00:01

Region type: MANUAL

Tracer ID: am243-444

Tracer FWHM: 43.981



Calcium Phosphate Precipitation

- Urine in Bioassay Lab
 - Calcium and pH important for Sr-89/90 precipitation
 - 120 mg Ca
 - pH >9.75 instead of just >pH 9 has improved Sr carrier recoveries
- Water in Environmental Lab
 - 100 mg Ca
 - pH~10 (dark pink phenolphthalein)
- Improves Sr recoveries

MAPEP MAW-15 Performance

	SRS	REF.	Ratio
Pu-238	0.95	0.91	1.04
Pu-239	0.004	0.007	ND
Am-241	1.27	1.30	0.98
U-234	2.04	2.09	0.98
U-238	2.11	2.17	0.97
Sr-90	12.9	13.16	0.98

Water Results in Bq/L

ND=non detect

MAPEP RDF-15 Performance

	SRS	REF.	Ratio
Pu-238	0.067	0.067	1.00
Pu-239	0.00023	0.0041	ND
Am-241	0.093	0.093	1.00
U-234	0.0181	0.020	0.90
U-238	0.0183	0.021	0.87
Sr-90	0.77	0.792	0.97

Air Filter Results in Bq/filter

ND=non detect

MAPEP RDV-15 Performance

	SRS	REF.	Ratio
Pu-238	0.128	0.137	0.94
Pu-239	0.159	0.164	0.97
Am-241	0.142	0.156	0.91
U-234	0.226	0.208	0.91
U-238	0.222	0.216	0.97
Sr-90	1.49	1.561	0.95

Vegetation Results in Bq/smp

Actinides in Soil Methods

- 5-10 g method
 - TEVA+TRU+DGA
 - >90% recoveries for Pu, Am, U
- 100-200 g method
 - >80% recoveries for Pu, Am-200 g sample

Actinides in Soil Methods

- 5-10 g method
 - Lower MDA, rugged even for refractory soil
 - NaOH Fusion/cerium fluoride precipitation (TEVA+TRU+DGA)
 - Pu, Np, Am, Cm, U, Th
 - “Rapid Column Extraction Method for Actinides in Soil”, Journal of Radioanalytical and Nuclear Chemistry, Vol. 270, No. 3 (December, 2006)
 - MAPEP performance

Actinides in Soil Methods

- 100-200g method
 - Pu and Am/Cm
 - High recoveries (Pu, Am 80-90% for 200 g samples)
 - MAPEP performance

MAPEP MAS-14 Performance

	SRS	REF.	Ratio
Pu-238	59.8	60.8	0.984
Pu-239	0.53 +/-0.2	ND	ND
Am-241	73.9	81.1	0.911
U-234	57.7	52.5	1.099
U-238	189	168	1.125

Results in Bq/kg

5 gram sample analyzed

ND=Non-detect

MAPEP MAS-15 Performance

	SRS	REF.	Ratio
Pu-238	56.9	61.15	0.93
Pu-239	41.0	45.85	0.89
Am-241	51.1	57.08	0.90
U-234	35.6	37.00	0.95
U-238	38.9	38.85	1.00

Results in Bq/kg
5 gram sample analyzed

200 g Samples with MAPEP-05-S14 Soil Standard Added

Soil Sample	Pu-242 Tracer Recovery	Pu-238 Measured/ Reference	Am-243 Tracer Recovery	Am-241 Measured/ Reference
200g + 3 g S14	82.1 %	1.00	96.6%	0.80
200g + 3 g S14	81.4%	1.04	90.0%	0.82
Avg.	81.8%	1.02	93.3%	0.81

Unspiked sample=0.120 Pu-238 Bq/kg and 0.152 Am-241 Bq/kg

0.0608 Bq Pu-238 and 0.0811 Bq Am-241 added per 1 gram of S14

Ra-226/228 –MnO₂ Resin

- MnO₂ plus Ln/DGA-SRS method
 - Rugged for 1500 ml sample aliquot
 - Rapid Method for Ra-226 and Ra-228 in Water Samples” Journal of Radioanalytical and Nuclear Chemistry, Vol. 270, No. 3 (December, 2006)
- MnO₂ resin plus DGA only
 - New Eichrom procedure RAW04
 - Uses DGA Rinsing instead of LN resin

Summary

- Optimization saves time and money
- New analytical tools are available
- Rapid methods are needed not only for Homeland Security but to reduce costs and optimize lab performance
- Speed and quality are achievable
- New tools are (stacked cartridges, DGA, MnO₂ methods now available)