

# A New, Safe, Rapid Digestion Method For Uranium Exploration Using ColdBlock™ Digestion Technology



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# Presentation Agenda

- Uranium Industry
- Digestion Technology And Introduction To ColdBlock™ Digestion
- Overview Of Studied Materials
- Summary And Future Work

# Uranium Industry

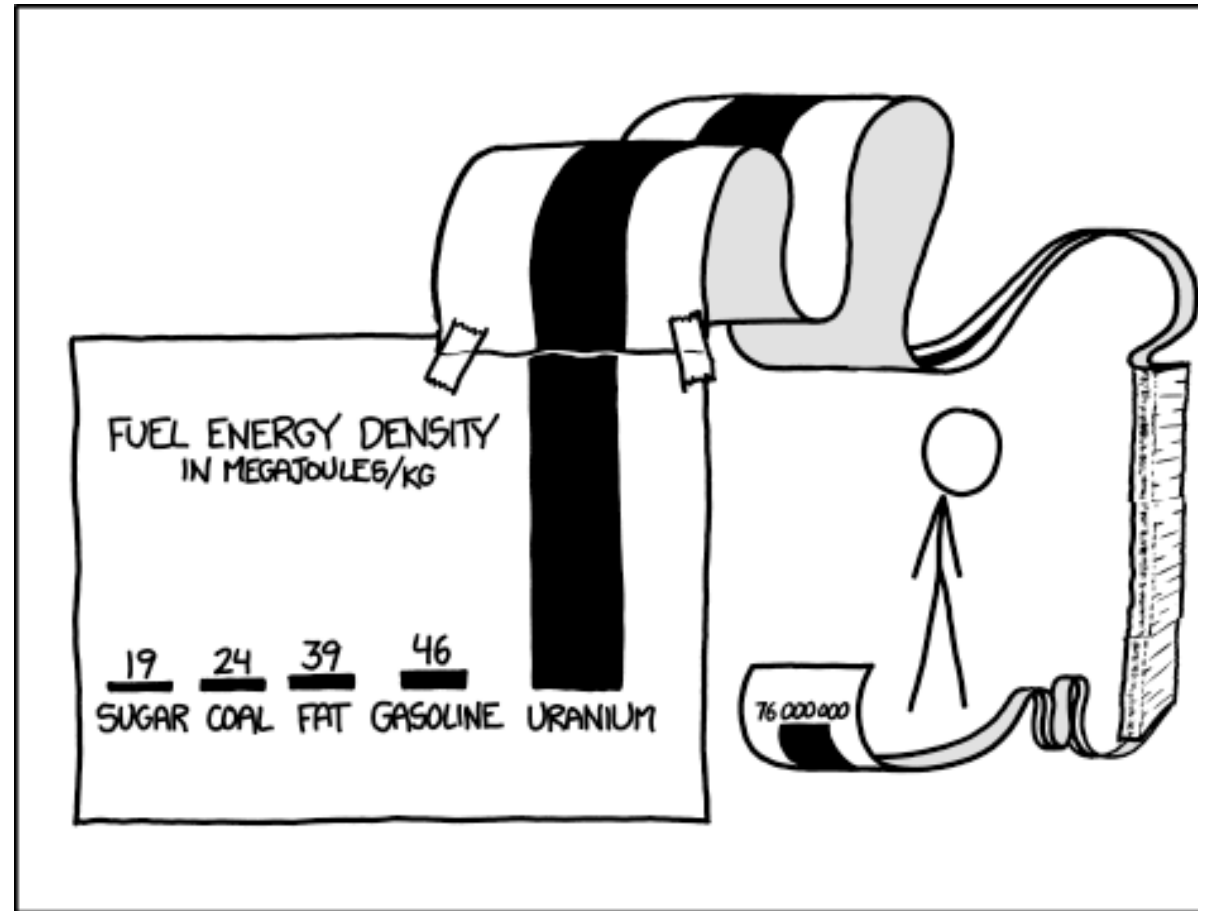
- 70% of the world's production coming from only three countries: Kazakhstan, Canada, and Australia.
- Canada is world's 2nd largest producer of uranium at 15% of total world production.
- Canada has the world's largest deposits of high-grade uranium with grades up to 20% uranium, which is 100 times greater than the world average.
- Most of Canada's reserves are located in the Athabasca Basin of northern Saskatchewan.



"Uranium In Canada | Canadian Uranium Production - World Nuclear Association". *World-nuclear.org*. N.p., 2016. Web. 13 Sept. 2016.

# Uranium Industry Cont'd.

- According to the "Uranium Market Outlook - Q4 2015", global nuclear power capacities are projected to increase by 44% between 2015 and 2030.
- As of January 1, 2016, 66 nuclear reactors were under construction in 14 countries.



SCIENCE TIP: LOG SCALES ARE FOR QUITTERS WHO CAN'T FIND ENOUGH PAPER TO MAKE THEIR POINT *PROPERLY*.

# Digestion Technology

## Conduction/Convection

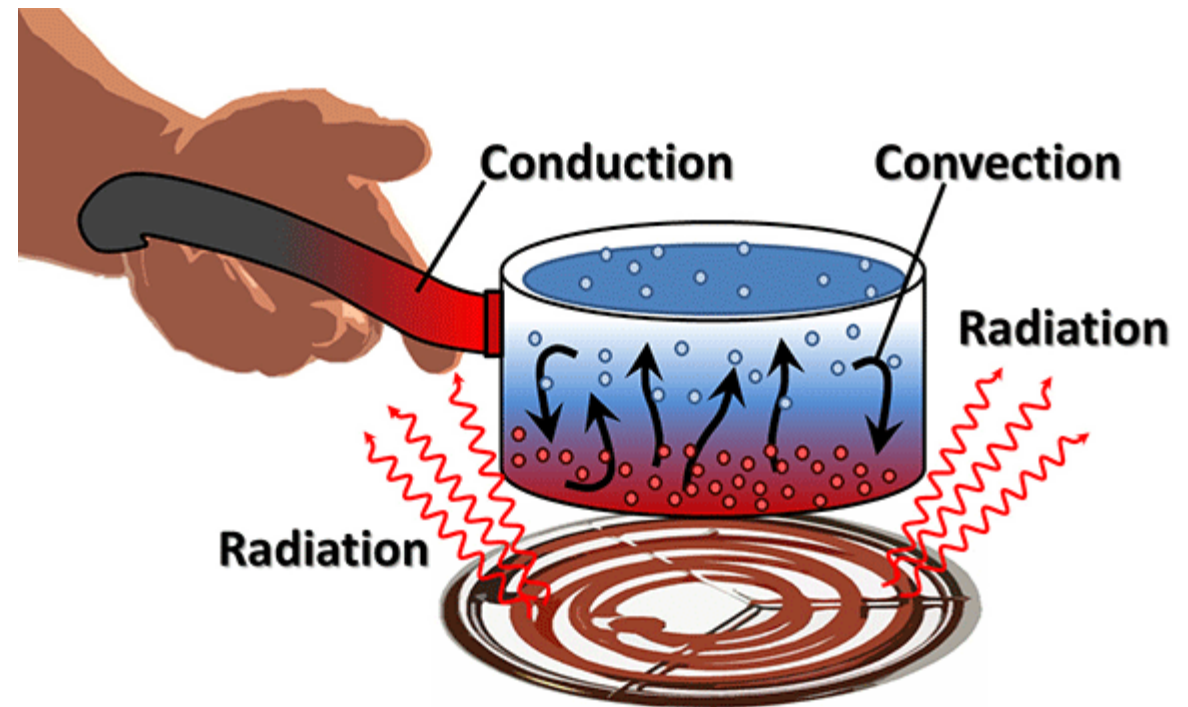
- Hotplate/Hotblock

## Radiation/Convection

- Microwave
- Fusion

## Radiation

- ColdBlock



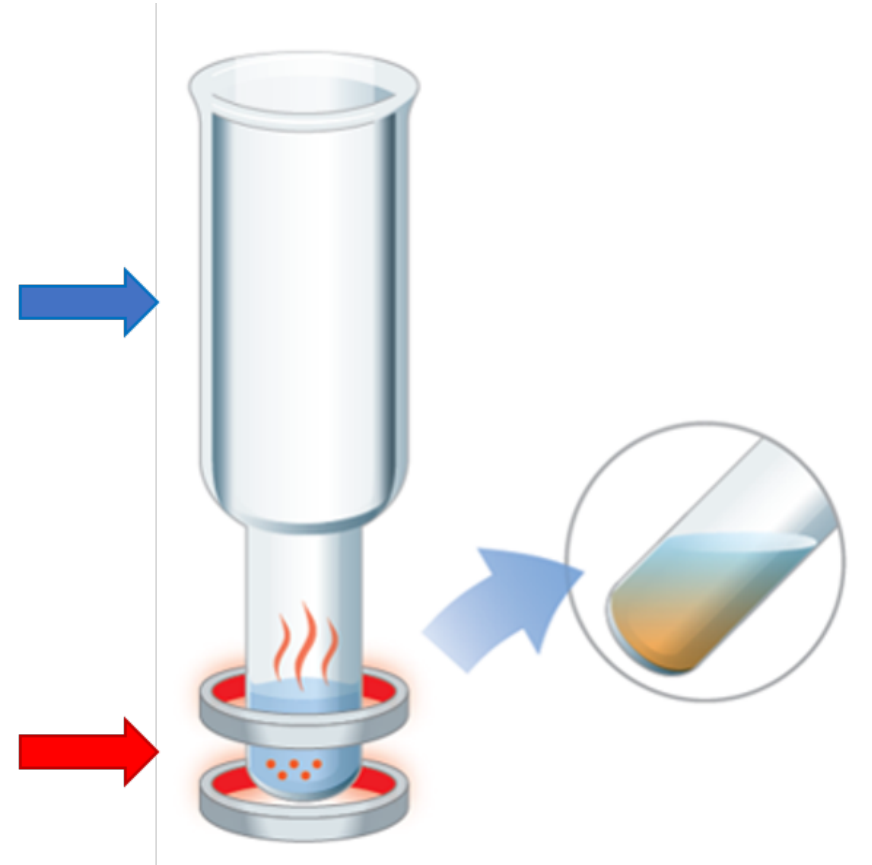
# ColdBlock Digestion Technology Overview

The First Sample Digestion  
Technology Using Focused  
Short-Wave Infrared Radiation  
(IR) and a Cooling Block

- 0.2 g – 30 g sample size
- Rapid digestions in 10 minutes or less
- No need for hydrofluoric or perchloric acid
- Excellent analytical accuracy and reproducibility

Cooling block  
promotes  
condensation  
effect

IR lamps emit  
high energy  
directly to sample  
particles



# Sample Materials Studied - Summary

## Certified Reference Materials

### Geostats:

- GU-03 – 5 ppm
- GU-08 – 312 ppm
- GU-10 – 1876 ppm
- GU-11 – 35 ppm

### CANMET

- RL-1 – 2010 ppm
- BL-5 – 70900 ppm

## Real Materials

Sample A – 1 ppm to 15 ppm

Sample B – 0.1 ppm to 5 ppm

Sample C – 0.1 ppm to 5 ppm

# Sample Materials Studied – Summary Cont'd.

## Treatment Option 1

- Inverse Aqua Regia
- 3:1 ratio of  $\text{HNO}_3$ :HCl
- 0.2 g to 1.0g of sample
- 10 minutes digestion

## Treatment Option 2

- Phosphoric acid
- 0.2 g of sample
- 10 minutes digestion

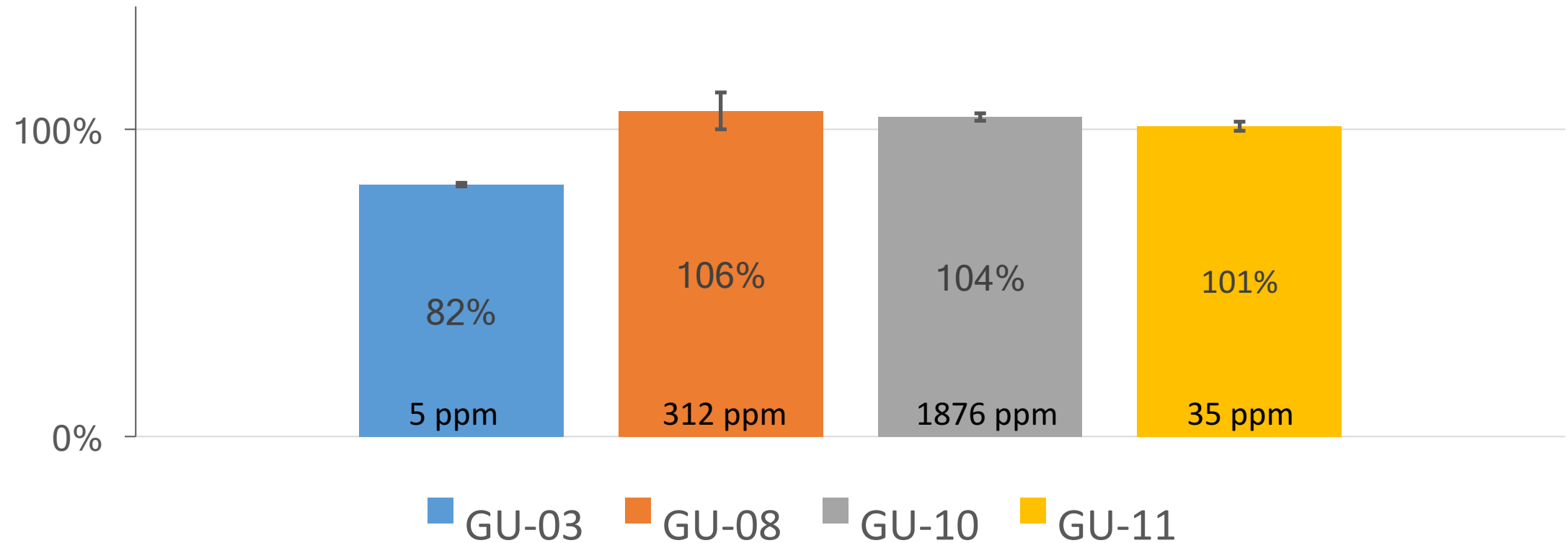
## Analytical Equipment

- Agilent 5100 ICP-OES
- Perkin Elmer DRC Elan DRC II



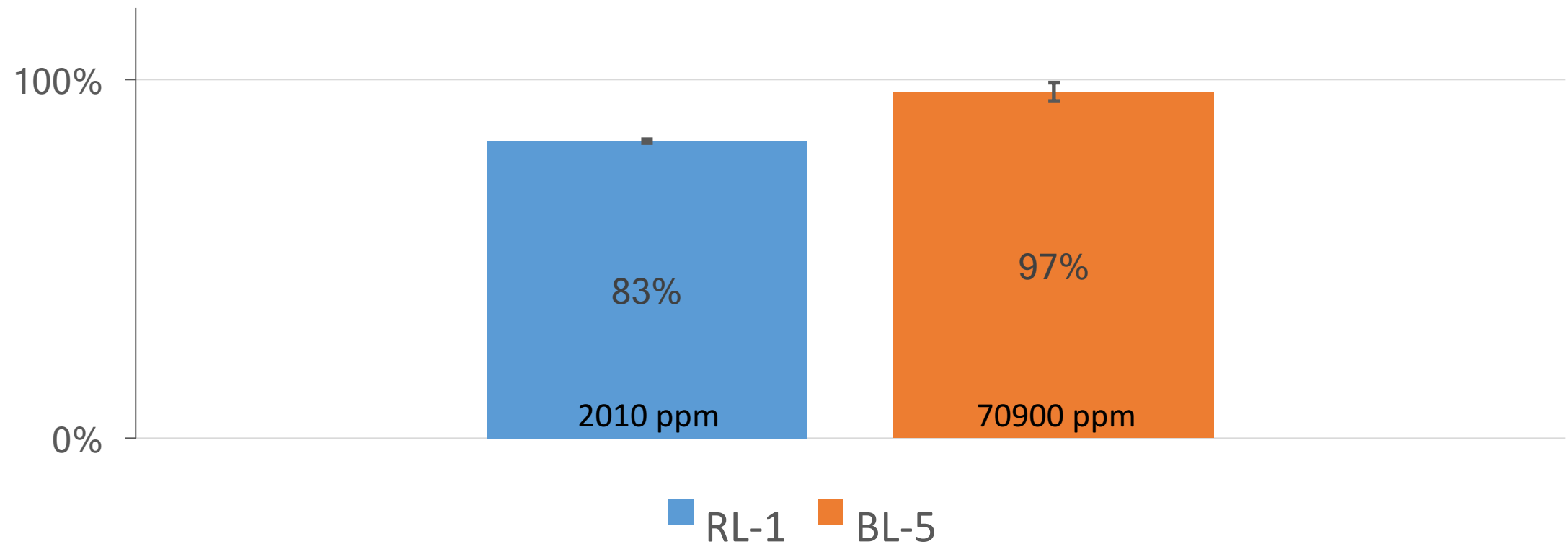
# Sample Materials Results – Geostat CRMs

Recovery of Uranium Using Inverse Aqua Regia Leach



# Sample Materials Results – CANMET CRMs

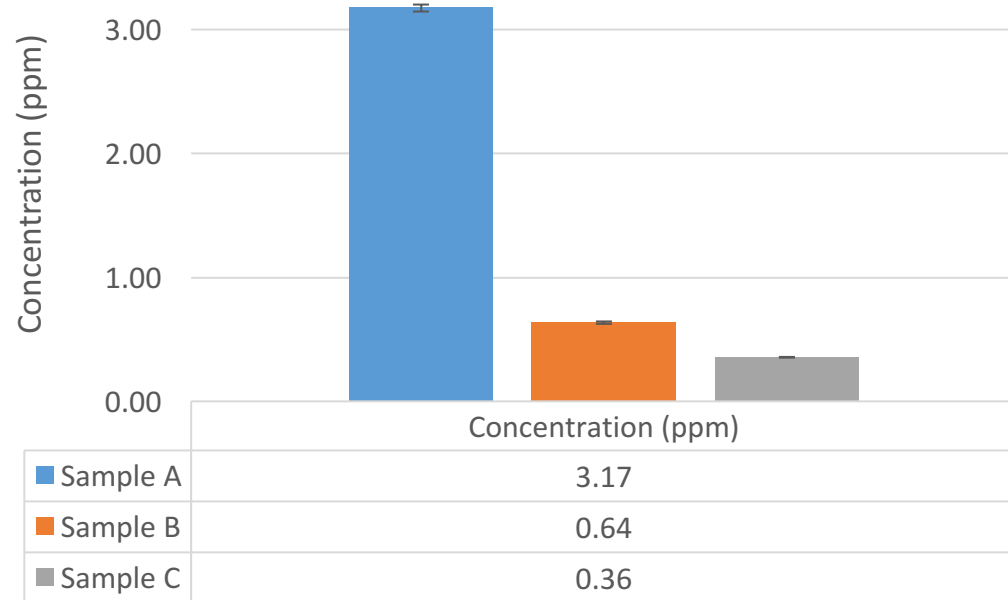
Recovery of Uranium Using Inverse Aqua Regia Leach



# Sample Materials Result – Real Materials

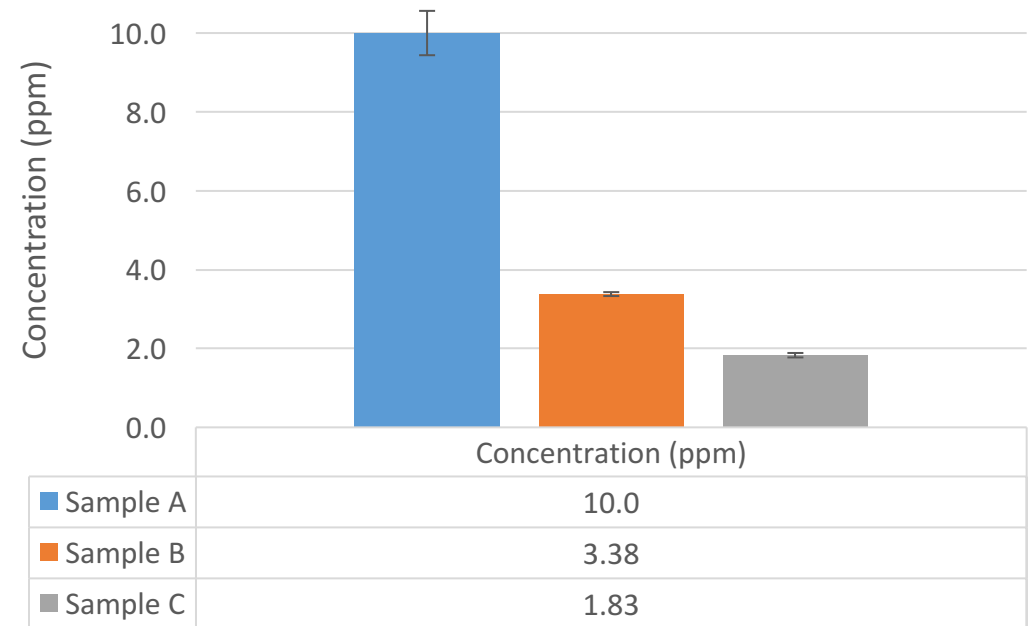
## Treatment Option 1 – Inverse AQ

Measured Concentration Of Uranium



## Treatment Option 2 – Phosphoric Acid

Measured Concentration Of Uranium



# Sample Materials Result – Real Materials Cont'd.

## Measured Concentrations

### Inverse Aqua Regia – Partial

- Sample A – 3.17 ppm
- Sample B – 0.64 ppm
- Sample C – 0.36 ppm

### Phosphoric Acid – “Total”

- Sample A – 10.0 ppm
- Sample B – 3.38 ppm
- Sample C – 1.83 ppm

## Provided Concentration Ranges

### Partial digest

- Sample A – 1 ppm to 5 ppm
- Sample B – 0.1 ppm to 1 ppm
- Sample C – 0.1 ppm to 1 ppm

### Total

- Sample A – 5 ppm to 15 ppm
- Sample B – 1 ppm to 5 ppm
- Sample C – 1 ppm to 5 ppm

# Summary

- Rapid and safe digestion was demonstrated using Inverse Aqua Regia and Phosphoric Acid treatments
- Near total recoveries for Certified Reference Materials was shown for:
  - GU-03 – 129% at 5 ppm grade Uranium
  - GU-08 – 106% at 312 ppm grade Uranium
  - GU-10 – 101% at 1876 ppm grade Uranium
  - GU-11 – 104% at 35 ppm grade Uranium
  - RL-1 – 83% at 2010 ppm grade Uranium
  - BL-5 – 97% at 70900 ppm grade Uranium
- Recoveries within Real Samples were within provided ranges:
  - Sample A – 3.17 ppm Partial and 10.0 ppm “Total” for a given range of 1 ppm to 15 ppm
  - Sample B – 0.64 ppm Partial and 3.38 ppm “Total” for a given range of 0.1 ppm to 5 ppm
  - Sample C – 0.36 ppm Partial and 1.83 ppm “Total” for a given range of 0.1 ppm to 5 ppm

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**Agilent Technologies**



**Geostats Pty Ltd**