

# UraniumSA



## METALLURGICAL DEVELOPMENT OF THE MULLAQUANA URANIUM PROJECT

### The AusIMM International Uranium Conference 2011

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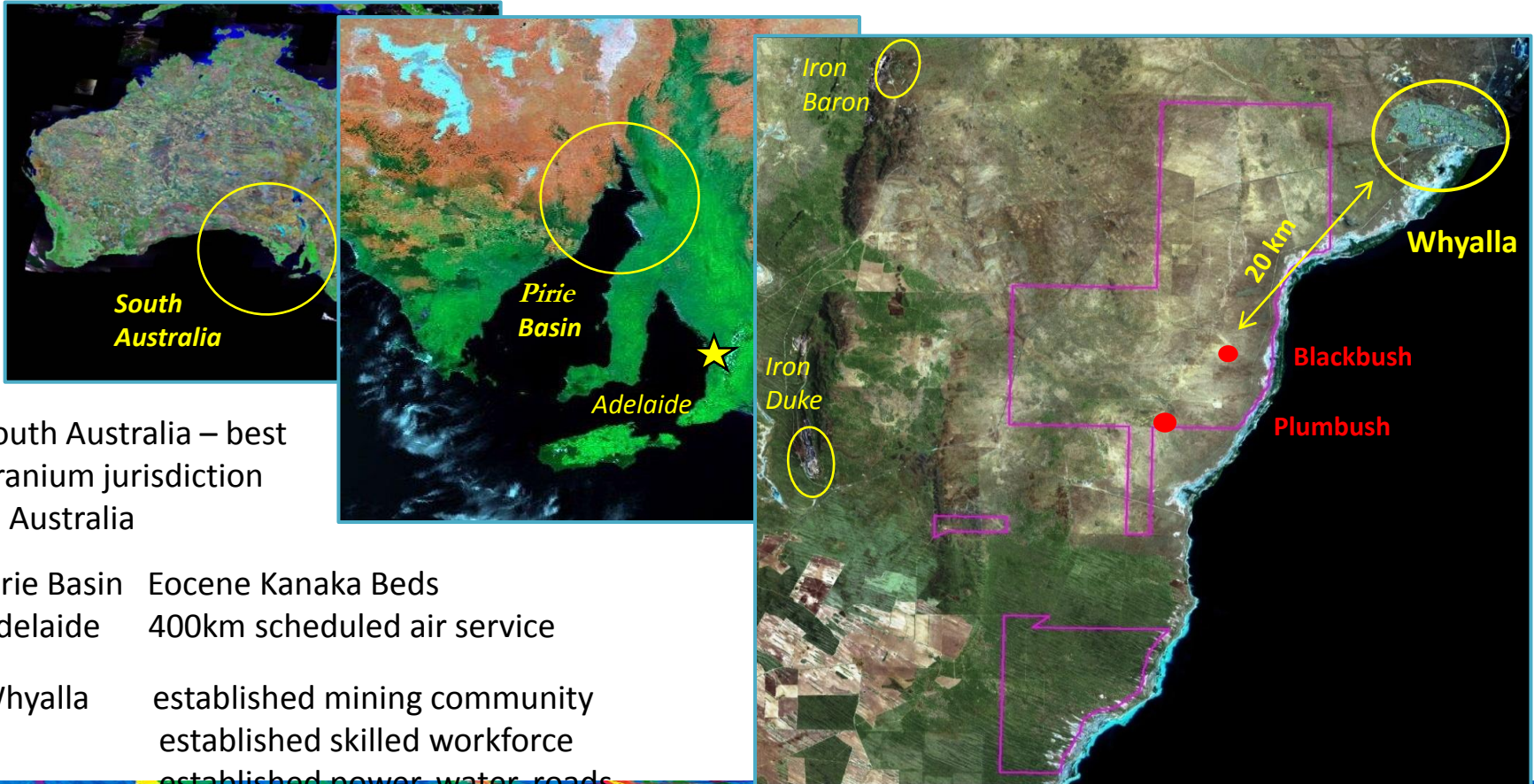
*The results reported herein, insofar as they relate to mineralisation, are based on information compiled by Simon Hall who is a Member of The Australasian Institute of Mining and Metallurgy and an employee of UraniumSA Limited with sufficient experience relevant to the style of mineralisation and type of deposits being considered and to the activity which is being reported to qualify as a Competent Person as defined by the 2004 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the JORC Code, 2004 Edition). He consents to the inclusion in the report of matters based on his information in the form and context in which it appears.*



# Presentation Outline

- Location
- Geology / Hydrogeology
- Ore Characterisation
- Leaching Testwork
- **Uranium Recovery from Hyper Saline Solutions**
- ANSTO Testwork Program
- In Situ Recovery Trial

# Exploration location – South Australia – Pirie Basin



South Australia – best uranium jurisdiction in Australia

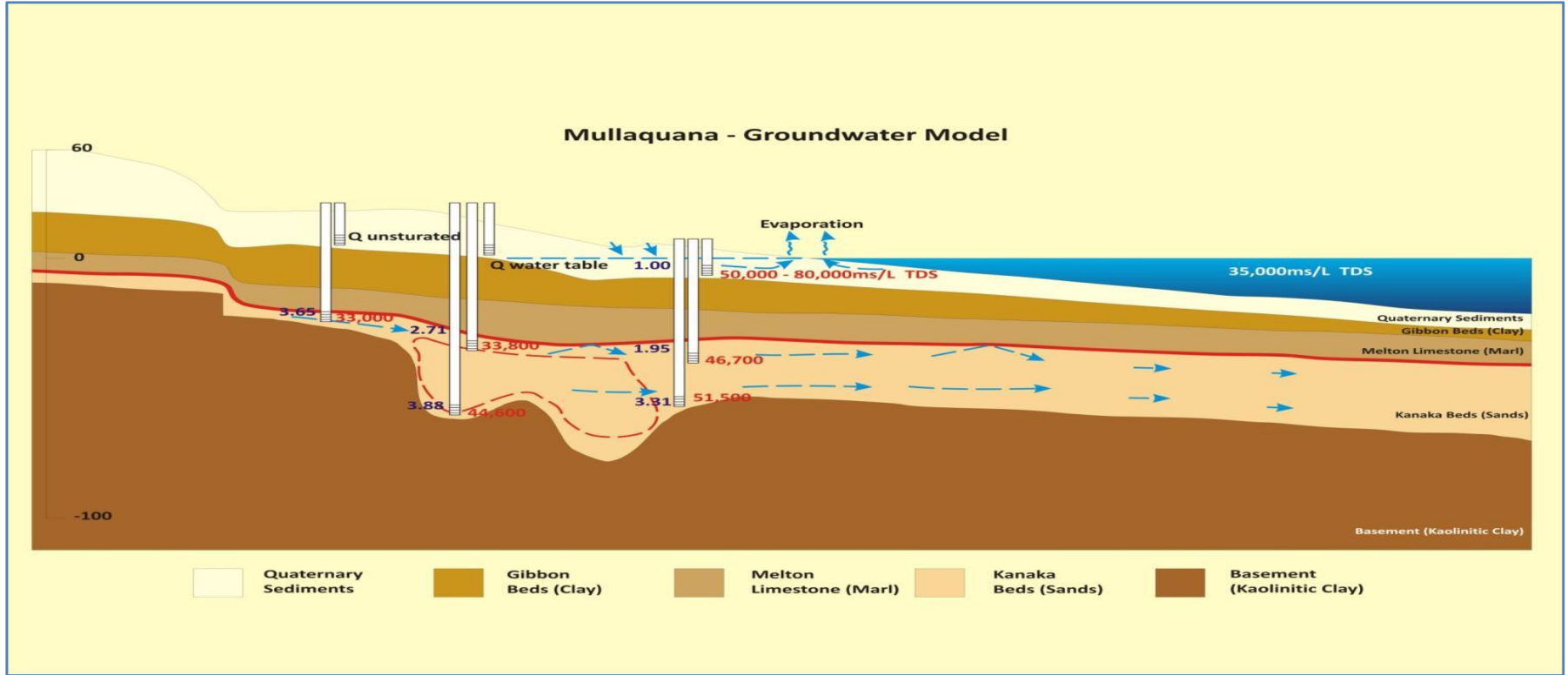
Pirie Basin Eocene Kanaka Beds

Adelaide 400km scheduled air service

Whyalla established mining community  
 established skilled workforce  
 established power, water, roads



# GROUNDWATER – SURFACE WATER - GULF



# Groundwater

| Analyte                               | Units   | MRE001 | MRE002 |
|---------------------------------------|---------|--------|--------|
| pH Value                              | pH Unit | 7.1    | 7.2    |
| Total Dissolved Solids @180°C         | mg/L    | 33000  | 36000  |
| Uranium                               | mg/L    | 0.1    | 0.2    |
| Total Alkalinity as CaCO <sub>3</sub> | mg/L    | 180    | 190    |
| Sulfate as SO <sub>4</sub> 2-         | mg/L    | 3800   | 3900   |
| Chloride                              | mg/L    | 20000  | 20000  |
| Fluoride                              | mg/L    | 1.3    | 1.4    |
| Calcium                               | mg/L    | 1800   | 1900   |
| Magnesium                             | mg/L    | 1700   | 1800   |
| Sodium                                | mg/L    | 9400   | 8200   |
| Potassium                             | mg/L    | 100    | 110    |
| Strontium                             | mg/L    | 24     | 23     |

# Ore Characterisation

4" diameter core from 3 locations sorted into low medium and high grade composites;

- Head Assays
- Mineralogy – XRD, Qemscan
- SGs / Bulk Density
- Particle Size Distribution, Assay by Size
- Moisture
- Porosity / Void Ratio
- QA / QC (duplicates)

# MRC001



High grade hole, mineralisation ~60-67m, sand / silt / lignite, gamma peak grade ~8,000 ppm eU<sub>3</sub>O<sub>8</sub>, average grade ~1,000 ppm eU<sub>3</sub>O<sub>8</sub> at ~63m

# Ore Characterisation – Core Composite Samples

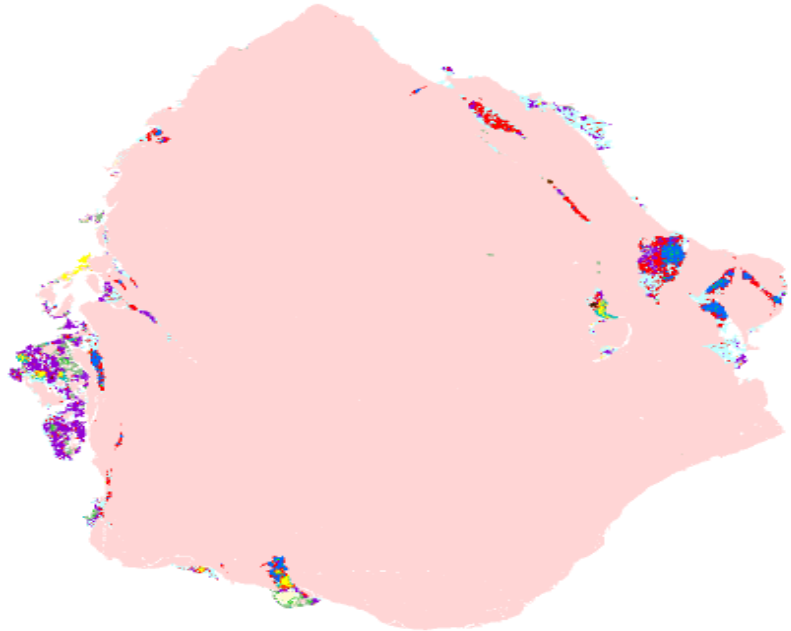
## Head Assays

|                         | U <sub>3</sub> O <sub>8</sub><br>ppm | Fe<br>% | Ca<br>% | CO <sub>3</sub> <sup>2-</sup><br>% | C (org)<br>% | Th, V<br>ppm | Mo<br>ppm |
|-------------------------|--------------------------------------|---------|---------|------------------------------------|--------------|--------------|-----------|
| 11 Composite<br>average | 950                                  | 0.63    | 0.34    | 1.49                               | 4.80         | ~20          | ~30       |
| Low                     | 132                                  | 0.2     | 0.12    | 0.1                                | 1.5          | ~ 5          | ~7        |
| High                    | 3904                                 | 2.0     | 1.00    | 7.0                                | 14.0         | ~100         | ~150      |

# Ore Characterisation – Core Composite Samples

Mineralogy – ~ 1.0 mm particle

Mineralisation is predominantly uraninite/coffinite localised on grain boundaries and fractures



| Mineral Name |                                    |
|--------------|------------------------------------|
| □            | Background                         |
| ■            | Uraninite                          |
| ■            | Coffinite                          |
| ■            | Uranium - Si intergrowths coarse   |
| ■            | Uranium - Si intergrowths fine     |
| ■            | Uranium - Pyrite intergrowths      |
| ■            | Uranium - Clay intergrowths        |
| ■            | Uranium - Ti oxide intergrowths    |
| ■            | Quartz                             |
| ■            | Pyrite                             |
| ■            | Other sulphides                    |
| ■            | Sulphide - Silicates intergrowths  |
| ■            | Ti-oxides and Ti-rich intergrowths |
| ■            | Kaolinite or similar Al Silicate   |
| ■            | Chlorite and similar               |
| ■            | Muscovite and similar              |
| ■            | Feldspar                           |
| ■            | Zircon                             |
| ■            | Carbonates                         |
| ■            | REE                                |
| ■            | Other silicates                    |
| ■            | Others                             |

# Ore Characterisation – Core Composite Samples

## ➤ Particle Size

$D_{50} \sim 0.5 \text{ mm}$

> 60% uranium in sub 0.5 mm fraction

## ➤ Bulk Density

Wet bulk density  $\sim 1.9 \text{ kg/L}$  (in situ, i.e. including water)

Dry bulk density  $\sim 1.5 \text{ kg/L}$  ( $\sim 26\%$  moisture )

## ➤ Ore SG

Average  $\sim 2.61$  with clay samples averaging  $\sim 2.29$

## ➤ Porosity

Via volume, density and PSD, ranged 27 to 50%, 30% used for preliminary calculations

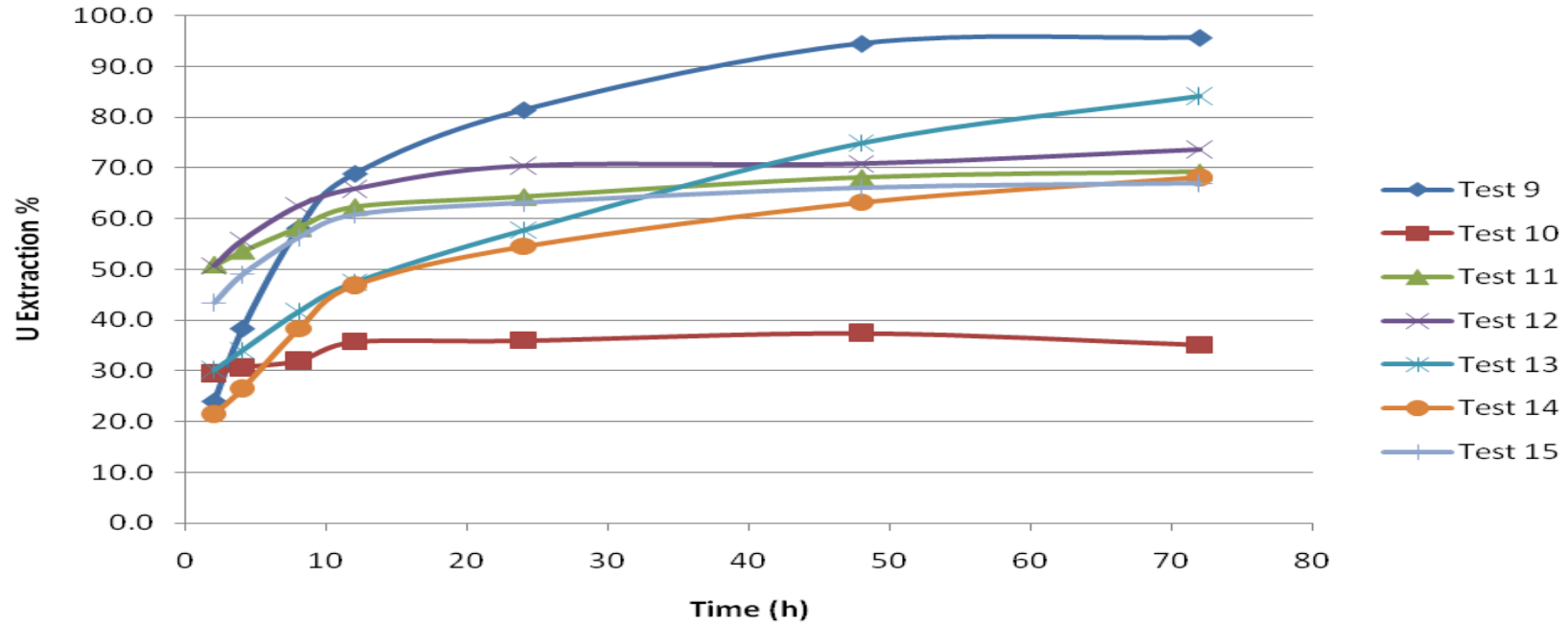
***Indicates good permeability and suitability for ISR***

# Leaching Testwork – Sea Water Bottle Rolls

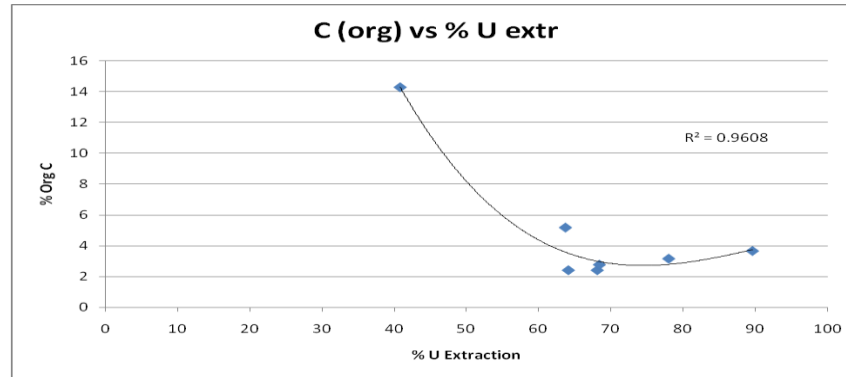
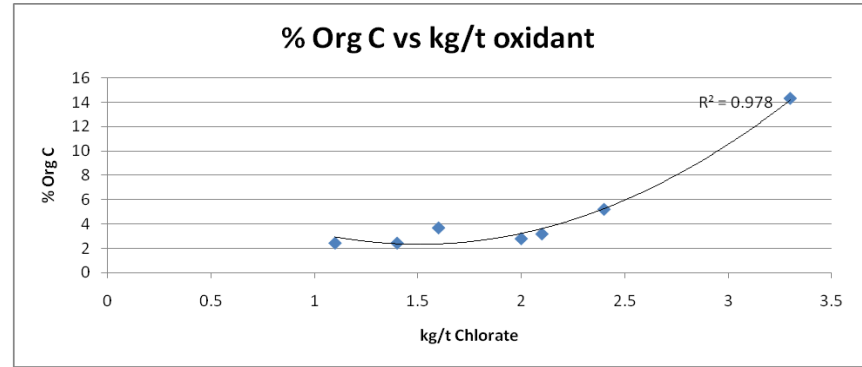
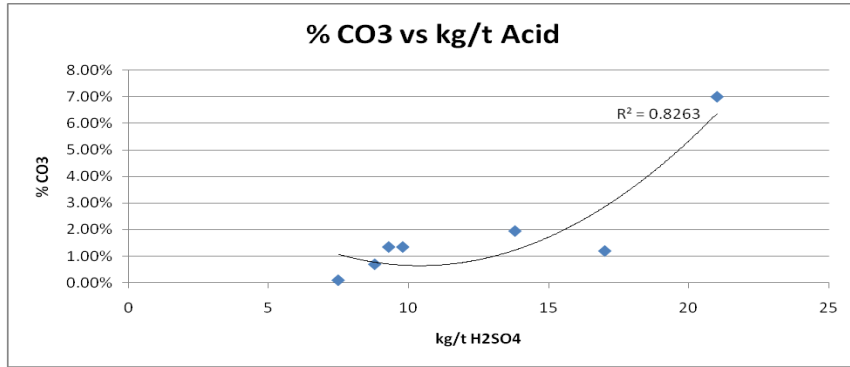
- Reagent consumption tests
- Acid and Alkaline leaching tests in sea water (~21 gpl Cl)
- ✓ Optimum;
  - ✓ pH 1.5 – 2.0 (sulphuric acid)
  - ✓ ORP ~500 mV, iron added + oxidant
  - ✓ 72 hrs
- Ore variability leach tests under optimum conditions

# Bottle Rolls – pH 1.5 – 2.0, Ore type variation

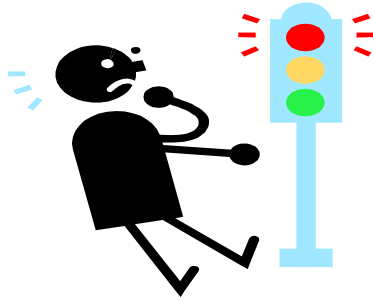
## Summary of Tests 9 - 15



# Bottle Rolls – pH 1.5 – 2.0, Ore type variation

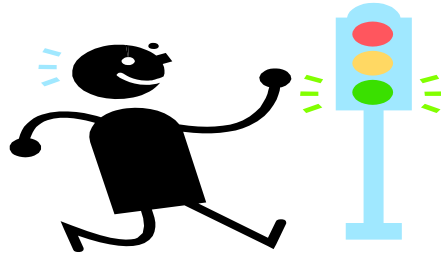


# Uranium Recovery from Hyper Saline Leach Liquors



- 2008 Consulting Chemist – chelating resin for IX?
- 2010 Desktop Study
- 2010 / 2011 Vendor and Independent Testing

# Uranium Recovery from Hyper Saline Leach Liquors



- ✓ 2011 Vendor and Independent Resin Testing
- 2011 ANSTO Testwork Program
- 2012 In Situ recovery trial

# Uranium Recovery from Hyper Saline Leach Liquors

2011 Vendor and Independent Resin Testing – acidified sea water at 100 ppm uranium

| Company / Resin     | U Loading (g/l resin) | U Elution                                 | Impurity Transfer  | ANSTO Program |
|---------------------|-----------------------|---|--------------------|---------------|
| Dow 940U            | > 30 confirmed        | Na <sub>2</sub> CO <sub>3</sub> vendor    | OK vendor          | Yes           |
| Clean Teq R603 B&C  | > 30 confirmed        | Na <sub>2</sub> CO <sub>3</sub> confirmed | ?                  | Yes           |
| IBC Superlig171     | >10 Vendor            | NaCl vendor                               | Iron Wash required | Yes           |
| Clariant            | >20                   | ?   | ?                  | Yes           |
| Iminodiacetic acid  | < 10                  | ?   | High iron loading  | Yes           |
| Purolite and Others | Testing               | ?   | ?                  | Yes           |

# Uranium Recovery from Hyper Saline Leach Liquors

## – ANSTO Testwork Program

- Bulk ore sample ~70 kg's
- Ore characterisation (PSD, Mineralogy, dilute leach)
- Resin loading tests with leach liquors generated from 10kg bottle rolls (acidic sea water leach)
- Resins with loading  $> 10 \text{ g U / l resin}$  → Elution testwork
- “Best” resins then tested with leach liquors generated from column leach tests

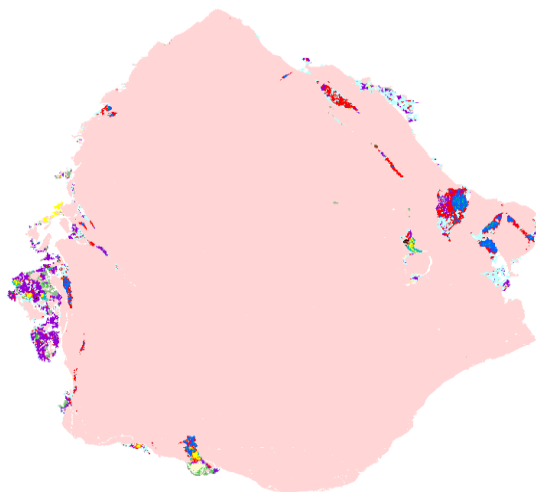
# In situ Recovery Trial

- 1<sup>st</sup> Quarter 2012 commence
- Up to five patterns tested
- Sulphuric acid leach
- Ion exchange with 2 resins on trial
- Calcium control via pore volume flush and raffinate bleed

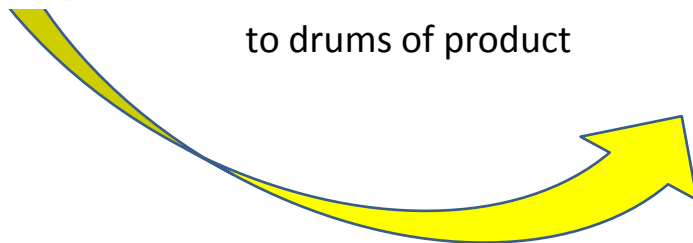
# The challenge

is to move as quickly and as cost-effectively as practicable from

positive  
laboratory  
results



to drums of product



## Acknowledgements

## Questions ?



**Uranium**SA