

Pilot Plant Campaign Toro Energy's Wiluna Project

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- Project Introduction
- Aims of Piloting Campaign
- Sample
- Pilot Plant Setup
- Performance / Information Gained
- Design Implications
- Acknowledgements

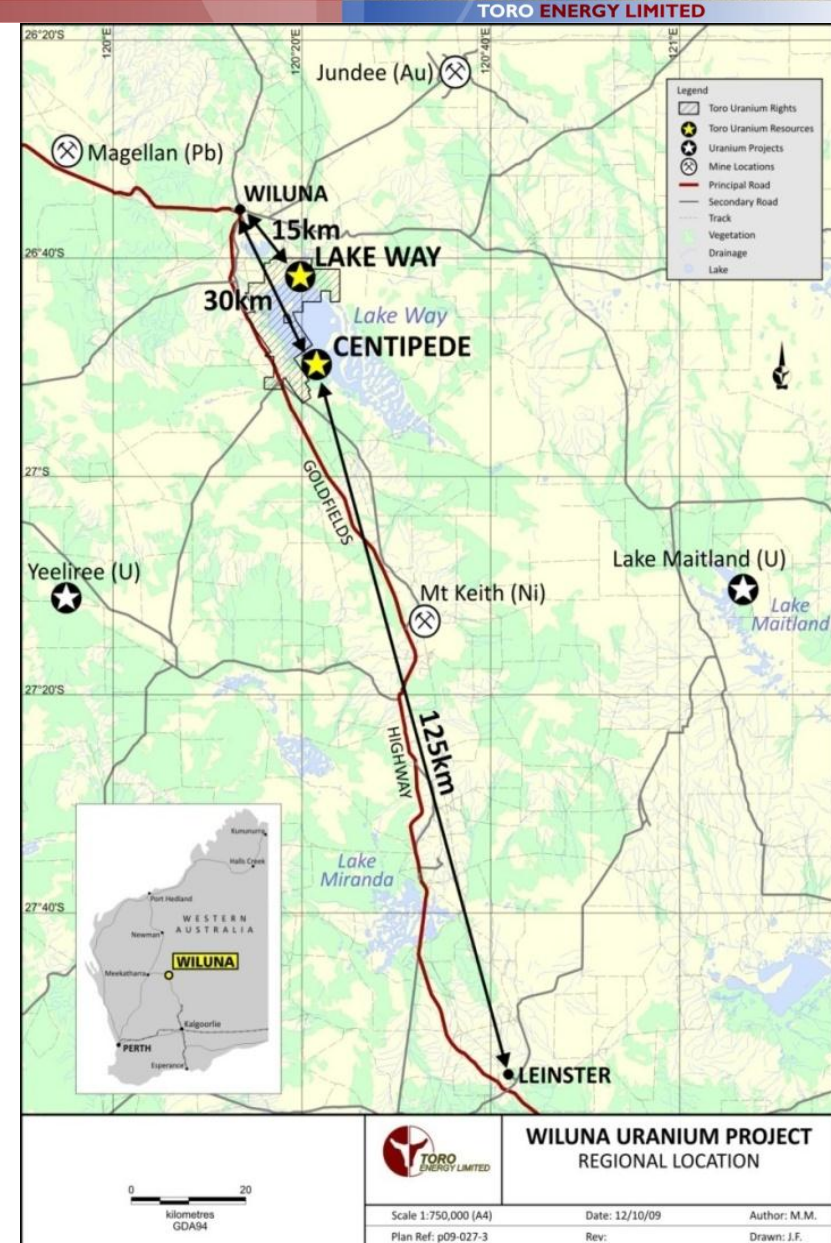
Project Introduction



Wiluna Uranium Project

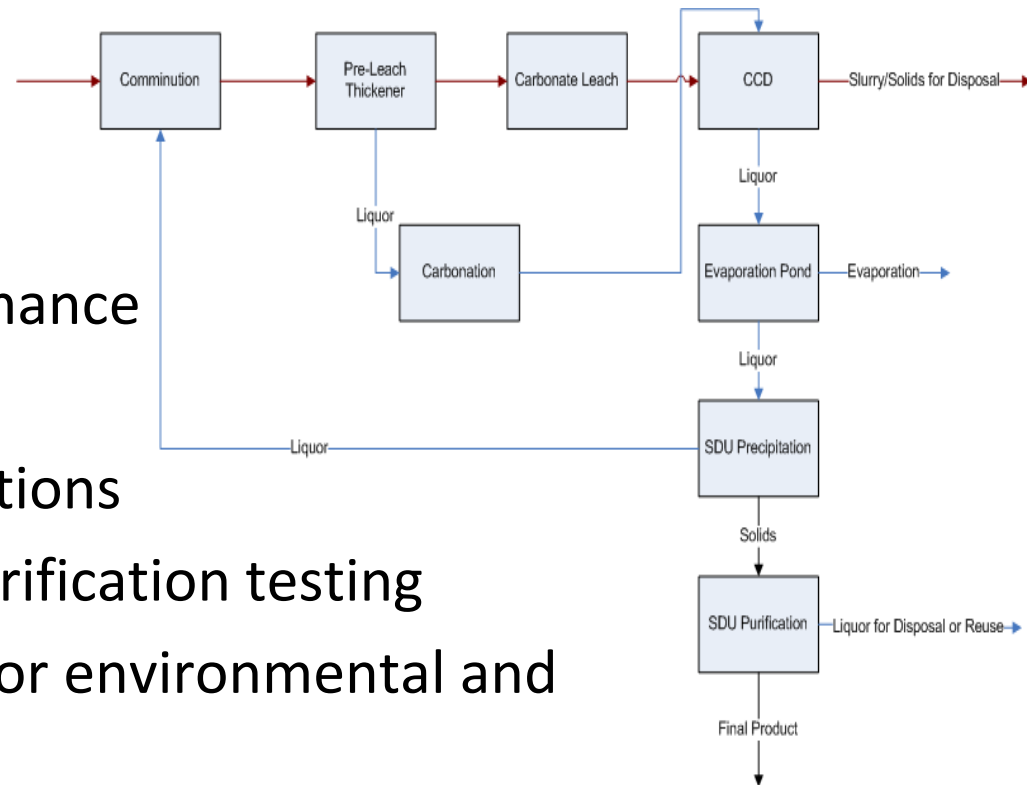
- 25Mlb¹ resource in 2 deposits
- 54Mlb¹ regional resource
- 720 ppm U₃O₈ mill head grade
- Calcrete / clay hosted carnotite mineralisation
- 1.3 mtpa Process Plant
- Agitated carbonate leaching
- Direct Precipitation

¹ Competent Persons Statement included on final page of presentation



- **Supplement Batch Testwork**

- Effect of Recycle
 - Build up of Cl, V, etc
 - Reagent consumption
- Thickener data / performance
- Saline groundwater
- Key operational observations
- Generate product for purification testing
- Generate bulk samples for environmental and other testwork



- **Improve Process Model and Plant Design**



- Resource Evaluation Pit – Centipede
- 3 Bulk Samples:
 - Low grade calcrete / clay mix
 - High grade calcrete
 - High grade clay
- Blended as per recipe to create:
 - 7.5 tonne of calcrete dominant blend
 - 7.5 tonne of clay dominant blend





Comminution Circuit

- 0.5 m \varnothing x 1.5 m EGL Rod Mill
 - 50% Nc
- 1.5 m \varnothing screen: 720 μm aperture
- 130 kg/h
- Operated for 4 hours/day
 - Mismatch in capacity between comminution and hydromet
 - Product stored in agitated tank



- Pre-leach Thickener
 - Density control prior to leach
 - Water recovery for use in process
- Leach Vessels
 - 7 x vessels
 - 35% solids
 - 90-95°C
 - 22 hours RT





- Carbonation Column
 - Convert process water from caustic to bicarbonate state
 - Commercial grade CO₂ (99%)
 - Bicarbonate state is suitable for CCD
- Counter Current Decantation (CCD)
 - 6 x thickeners (0.7m Ø x 1.6m high)
 - PLS recovery
 - CCD 6 Underflow to tailings



- Evaporation – increase U tenor
 - 2 x 1000 L duty/stand-by evaporation tanks
 - Batch evaporation of 20% by mass
 - 400 L distribution tank
- SDU Precipitation
 - PLS filtered prior to precipitation
 - 1 x 30 L Seed Contact tank - heated
 - 3 x 67 L Agitated Tanks (6 hours) for Run 1: + 1 for Run 2
 - 190 mm \emptyset Thickener - Run 1
 - 600 mm \emptyset Thickener - Run 2



- Comminution

- Feed preparation for hydrometallurgical flowsheet
- Power measured, but used as cross-check only
 - Rod mill, not SAG/Ball
- Batch operation – rarely in steady state
 - Coarse and fine product excursions
- Circulating load was building up
- Cyclone tests on Mill Product
 - 150 mm Linatex cyclone – difficulty achieving 400 μ m product
 - Screening is more effective than cyclone



- Comminution

- Effect of variable grind product - Observations

- Thickener performance
 - Sanding in Leach Vessels – decreased residence time
 - CCD performance

- Primary Classification

- Limited success with cyclone
 - Design decision: Vibrating Screen



- Pre-leach Thickener
 - Difference in performance between clay and calcrete
 - Operational variability because of grind product
 - Verification of density targets
 - 40-45% solids is achievable
 - Quantify water recoverable for internal wash solution
 - Vendor testwork
 - Dynamic thickener tests
 - Design data for Thickener



- Leach and CCD's
 - Experienced effect of variable grind – recovery implications
 - Tested operational fixes – increased agitation power
 - Vendor thickening testwork – quantity of feed
 - Equipment sizing
 - Trends on critical elements in solution
 - Uranium
 - Vanadium
 - Chloride



- SDU Precipitation
 - Generation of barren liquor for use upstream
 - Validation that recycle streams work as expected
 - Confirmed necessity of seed SDU
 - Seed concentration is critical
 - Generation of significant quantity of SDU
 - Confirm product is technically achievable
 - Sample available for development of purification
 - Vendor testwork on SDU thickening and filtration

- Confirmation of design decisions
 - Selection of primary classification - screening
 - Number of CCD's
- Criticality of Grind Product
 - Over-grinding causes losses in dewatering
 - Under-grinding causes losses in leaching
 - Modification of design approach to Comminution Circuit
 - Need to be wary of overgrinding and undergrinding

- Vendor testwork on Thickener Feed Streams
 - Key design information for Pre-leach and CCD's
- CCD's will need to be well instrumented for control
- Results defined assumptions in Process Model
 - Confirmed upstream process performance in recycled liquor
 - Establishing limits and trends for critical elements in solution
 - Improved understanding of reagent consumption
- SDU generated for purification testwork
 - Improved understanding of purification performance

- ✓ Generated bulk products for further testing
- ✓ Generated design data to supplement batch testwork
 - Thickener performance and equipment selection
 - Defined recycles
- ✓ Highlighted areas of particular focus for design and operation
 - Contend with grind product size excursions
 - Thickener performance
 - SDU seeding requirement
- ✓ All data resulted in a better Process Model / Mass Balance
 - Increased confidence in the process model and engineering design

Acknowledgements

- SGS Lakefield Oretest – Malaga
- Morne Swart
- Eugene Dombrose



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Competent Person's Statement

The information in this report that relates to Exploration Results and Mineral Resources is based on information compiled by:

- 1) Information in this report relating to Exploration is based on information compiled by Mr Mark McGeough BSc who is a Fellow of the Australasian Institute of Mining and Metallurgy. Mr McGeough is a full-time employee Toro Energy and has sufficient experience which is relevant to the styles of mineralisation and types of deposits under consideration and to the activity he is undertaking to qualify as a Competent Person as defined in the 2004 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr McGeough consents to the inclusion in this release of the matters based on his information in the form and context in which it appears.

Project Name	Category	Resource M Tonnes	Grade U ₃ O ₈	Contained U ₃ O ₈ tonnes	Contained U ₃ O ₈ , Mlb
Centipede	Measured	3.08	552	1,703	3.75
Centipede	Indicated	7.56	555	4,197	9.25
Centipede	Inferred	2.30	272	627	1.38
Lake Way	Indicated	2.57	492	1,265	2.79
Lake Way	Inferred	7.38	544	4,015	8.85
Sub Total	<i>Measured & Indicated</i>	13.21	542	7,165	15.79
Wiluna Project	<i>Inferred</i>	9.68	480	4,642	10.23
Millipede	Indicated	1.77	412	728	1.61
Millipede	Inferred	5.51	533	2,935	6.47
Dawson Hinkler Well	Inferred	13.09	312	4,077	8.99
Nowthanna *	Inferred	11.91	399	4,750	10.47
Sub Total	<i>Indicated</i>	1.77	412	728	1.61
Wiluna Regional	<i>Inferred</i>	30.51	386	11,762	25.93
Total Wiluna Resources	<i>Measured, Indicated & Inferred</i>	55.17	441	24,297	53.56

All Resources are reported using a 200 ppm U₃O₈ cutoff grade

*Note: Toro owns 100% of two tenements which comprise the major portion of the Nowthanna deposit – Toro's resource shown here.

Table 4: Toro's total uranium resource base in the Wiluna area.

- 2) The information in this report that relates to Mineral Resources is based on information compiled by Dr Katrin Karner of Toro Energy Limited, Mr Robin Simpson and Mr Daniel Guibal of SRK Consulting (Australasia) Pty Ltd. Daniel Guibal takes overall responsibility for the Resource Estimate, and Dr Karner takes responsibility for the integrity of the drilling and bulk density results. Dr Karner, Mr Simpson and Mr Guibal are Members of the Australasian Institute of Mining and Metallurgy (AusIMM), and have sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity they are undertaking to qualify as Competent Persons as defined in the 2004 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code 2004)'. The Competent Persons consent to the inclusion in this release of the matters based on the information in the form and context in which it appears