

**ASX RELEASE**

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## Vanadium Potential at Toro Energy's Wiluna Uranium Project to be evaluated

**Highlights**

- The ore mineral of Toro's Wiluna Uranium Project is a uranium vanadate (see below) therefore the project's uranium resource also contains significant quantities of vanadium.
- Recent test work (including leach tests) conducted for the Lake Maitland deposit on uranium processing improvements has shown potential to extract vanadium at the same time as uranium in the leach circuit.
- The potential to use Ion Exchange (IX) highlighted by the recent success of IX testing provides an opportunity to cost effectively recover vanadium along with uranium.
- As a consequence of the recent significant increase in the vanadium price the addition of vanadium as a product could add significant value to the Wiluna Uranium Project.
- Initial testing by Toro will focus on optimising the leach conditions for the dual extraction of both uranium and vanadium for the best overall recovery of both metals.

Toro Energy Limited (ASX: **TOE**) (**Toro** or the **Company**) is pleased to announce its plans to test the feasibility of extracting and recovering both uranium and vanadium concurrently (dual processing) at the Company's 100% owned Wiluna Uranium Project (the **Project**) in Western Australia (refer to **Figure 1**). Given the expected growth in the vanadium price (see below) and the potential future demand from Vanadium Redox Batteries (**VRBs**) Toro believes dual processing vanadium with uranium has the potential to result in a significant improvement to the feasibility and value of the Project. The initial testing will focus on the optimisation of leach conditions for the dual extraction of both metals in the same leach.

The price of vanadium is currently around US\$17.45/lb for vanadium pentoxide ( $V_2O_5$ ) flake (as of 14 March 2019 using Europe Price – as quoted from Vanadiumprice.com) with prices predicted to increase. A chart showing the price of vanadium since the year 2016 (Vanadiumprice.com 14 March 2019) is contained in **Figure 2**.

**Vanadium Uses**

The largest consumer of vanadium metal by far is the steel industry with the production of vanadium steel alloys. Vanadium is light, strong and corrosion resistant. Other important uses of vanadium include specialised aeronautical alloys, chemicals and batteries. The strong demand from steel alloys is expected to continue in the long term, especially considering the new national standards imposed on Chinese rebar manufacturers by the Chinese government in September 2018, which will require significant increases in the amount of vanadium going into vanadium alloy in China (Mining.com 2 January 2019).



Figure 1: Location of the Wiluna Uranium Project

#### Vanadium Pentoxide 98% min Europe USD/lb



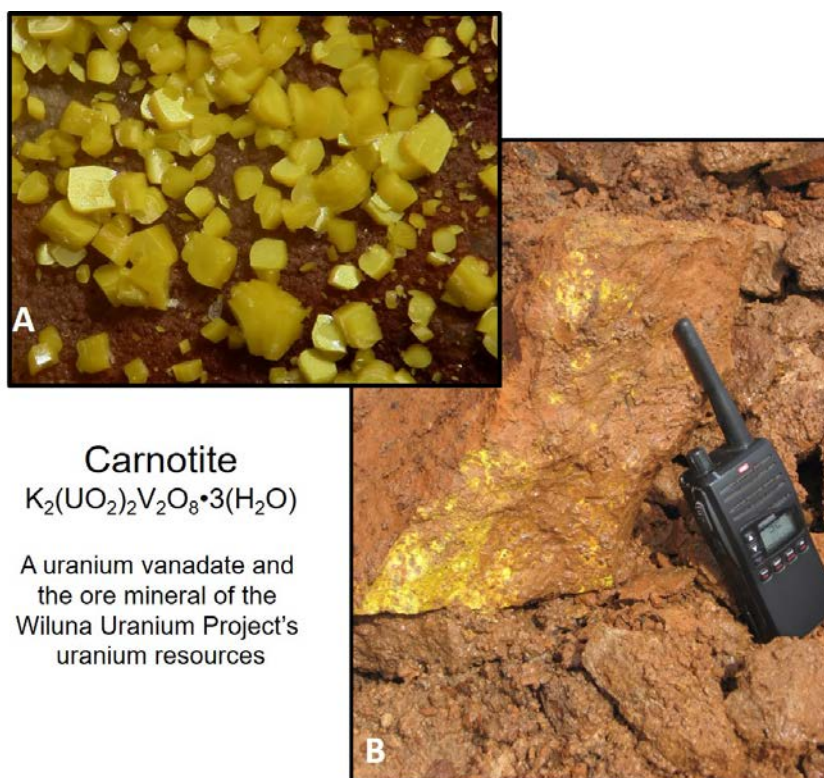
Figure 2: Price chart of Vanadium Pentoxide,  $V_2O_5$  (European) in US\$/lb since the year 2016 to current (14 March 2019) (source – Vanadiumprice.com)

However, the possibility of market disruption also exists for the future of vanadium metal due to the take-up of VRBs. The VRB is an efficient storage and re-supply solution for renewable energy, being scalable and suitable for large scale applications. China in particular is investing heavily in large scale VRBs.

Importantly for the Project, carnotite, the uranium ore mineral in the deposits that make up the Project is in fact a vanadate (chemical formula -  $K_2(UO_2)_2V_2O_8 \cdot 3(H_2O)$ ) and so contains significant amounts of vanadium along with the uranium (see **Figure 3**). On a molecular weight basis there is approximately 1 pound of vanadium for every 4.7 pounds of uranium in carnotite mineralisation (assuming ideal mineral chemistry). Converted to ore oxides this translates to approximately 1 pound of  $V_2O_5$  flake for every 3.1 pounds of  $U_3O_8$  within the carnotite only resource. Importantly, when the Project's proposed leach circuit breaks down the carnotite to access the uranium, it is also potentially accessing a source of vanadium at the same time.

In the leach testing undertaken during the Company's recent Beneficiation and Project Design studies for the Project (**BPD Studies**) it was noticed that a significant amount of vanadium had been extracted and remained present in the pregnant leach solution (**PLS**) post leach. Prior to the recent BPD Studies the vanadium in the PLS could not be recovered efficiently. However, the potential use of IX in the Project's proposed processing plant (after the success of those BPD Studies) provides an opportunity to potentially recover vanadium efficiently via IX separate to, but at the same time as, uranium.

Toro believes that the dual processing of vanadium with uranium has the potential to add significant value to the Project and to move the Project closer to a situation where it may not be as economically dependent on the uranium price. It is for this reason that Toro will embark on research into the technical viability of dual processing uranium and vanadium. The initial tests will focus on optimising the leach conditions needed to efficiently extract both uranium and vanadium at the same time. This initial testing is expected to commence within the next month.



**Carnotite**  
 $K_2(UO_2)_2V_2O_8 \cdot 3(H_2O)$

A uranium vanadate and  
the ore mineral of the  
Wiluna Uranium Project's  
uranium resources

**Figure 3: (A)** A 'text book' example of the mineral Carnotite, the uranium vanadate that is the ore mineral of the Wiluna Uranium Project – this sample from the Anderson Mine, Date Creek Basin, Yavapai Co., Arizona, USA (source – mindat.org). **(B)** Carnotite mineralisation at the Centipede-Millipede Deposit, Toro Energy's Wiluna Uranium Project, WA – see Figure 1 for location.

**ENDS**

**FURTHER INFORMATION:**

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*Toro's flagship asset is the 100% owned Wiluna Uranium Project, located 30 kilometres southwest of Wiluna in Central Western Australia. The Wiluna Uranium Project has received environmental approval from the state and federal governments providing the Project with the opportunity to become Western Australia's first uranium mine. Toro will maximise shareholder returns through responsible mine development and asset growth including evaluating the prospectivity of its asset portfolio for minerals other than uranium and increasing their value.*

**[www.toroenergy.com.au](http://www.toroenergy.com.au)**



## FORWARD LOOKING AND CAUTIONARY STATEMENTS

### Forward Looking Statements

This announcement may contain certain “forward-looking statements” which may not have been based solely on historical facts, but rather may be based on the Company’s current expectations about future events and results. Where the Company expresses or implies an expectation of belief as to future events or results, such expectation or belief is expressed in good faith and believed to have a reasonable basis. However, forward looking statements are subject to risks, uncertainties, assumptions and other factors, which could cause actual results to differ materially from future results expressed, projected or implied by such forward-looking statements. Such risks include, but are not limited to Resource risk, metals price volatility, currency fluctuations, increased production costs and variances in ore grade or recovery rates from those assumed in mining plans, as well as political and operational risks in the Countries and States in which we operate or sell product to, and governmental regulation and judicial outcomes. For a more detailed discussion of such risks and other factors, see the Company’s Annual Reports, as well as the Company’s other filings. Readers should not place undue reliance on forward looking information. The Company does not undertake any obligation to release publically any revisions to any “forward looking statement” to reflect events or circumstances after the date of this announcement, or to reflect the occurrence of unanticipated events, except as may be required under applicable securities laws.

### Cautionary Statement

The Studies are based on lower-level technical and economic assessments and are insufficient to provide certainty that the conclusions of the Studies will be realised. Further, the Company cautions that there is no certainty that the forecast financial information contained in the Studies will be realised. All material assumptions underpinning the forecast financial information are set out in this announcement. This forecasted financial information is deduced from an underlying mining production rate deemed possible due to the size of the Mineral Resources at Lake Maitland. Refer ASX announcement dated 1 February 2015 that shows Lake Maitland deposit has sufficient Mineral Resources to support a 2Mt/a mining operation. The estimated mineral resources underpinning the Studies have been prepared by competent persons in accordance with the current JORC Code 2012 Edition and the current ASX Listing Rules. Toro has concluded it has a reasonable basis for providing the forward looking statement included in this announcement. The Company confirms that it is not aware of any new information or data that materially affects the information included in the relevant market announcements and, in the case of estimates of Mineral Resources, that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed.