

ASX Announcement 28<sup>th</sup> June 2018

# Oxley Potassium Nitrate Project

## Further Roasting Test Work Completed in China



**CAPTION:** Oxley electric arc furnace trial (left), and rotary cooler trial (right).

#### **Highlights**

- Further Oxley Potassium Nitrate Project roasting trials completed in China
- Maiden 12kg scale electric arc furnace ("EAF") trial shows 83% potassium extraction from the potassium feldspar ore
- EAF being trialed as a relatively low-cost solution alternative to existing induction furnace design
- ▶ EAF yet to be optimised, with the laboratory scale furnace electrode size very large relative to charge volume, resulting in far higher than targeted roasting temperature
- ▶ 89% potassium extraction shown from additional 1kg electric induction furnace trial
- Cooling trial shows potential to utilise standard rotary cooler directly from furnace discharge, eliminating need for interim pig casters and improving heat recovery
- Roasting circuit design and cost estimates to be updated based on test work results
- Following the design and cost estimate update, Centrex plans to seek a strategic investment partner to aid in the development of this potentially significant large-scale long-life asset, whilst Centrex focuses on bringing its flagship Ardmore Phosphate Rock Project into production in North West Queensland

#### **Summary**

Centrex Metals Limited ("Centrex") has successfully completed further roasting test work in China for its Oxley Potassium Nitrate Project ("Oxley"), located 125km from the Port of Geraldton in Western Australia. The Oxley project is a globally rare 32km striking ultrapotassic lava flow, predominantly comprised of potassium feldspar. The key process for the project is the conversion of potassium feldspar to soluble potassium chloride (potash) via roasting with salt, for subsequent water leaching, and purification. The potash would then be reacted with nitric acid produced ultimately from local West Australian gas feedstock, to produce potassium nitrate, a high-value horticultural fertiliser.

A small scale electric arc furnace ("EAF") was trialed by Wuhan University of Science & Technology ("WUST") in China to show the potential to use an EAF as a relatively simple single stage roasting vessel in the circuit design. The maiden 1-hour roast resulted in an encouraging 83% extraction of potassium from the ore, confirming the potential application of an EAF in the process. In addition, cooling trials by WUST confirmed the potential to feed the roast product directly to a standard rotary cooler, meaning greater heat recovery from the roast product is now expected than in the previous multi-stage cooling circuit design for the project.

Centrex's engineering consultants will now update the Oxley roasting circuit design and project cost estimates, taking into account the new input data obtained from the test work in China. Following completion of this and given the very significant potential scale of Oxley, Centrex will build on its previous success in completing major mining joint ventures, and seek a strategic investment partner to aid in developing the project while Centrex focuses on bringing its flagship Ardmore Phosphate Rock Project in North West Queensland into production.

#### **Test Work Program**

The latest test work program for Oxley aimed to provide additional input data into design parameters and equipment selection for the project's roasting and cooling circuits. The test work was undertaken by Wuhan University of Science & Technology ("WUST"). A recent design review of the project recommended the potential to use an electric arc furnace ("EAF") instead of the currently designed electric induction furnace, to simplify the circuit and reduce the capital costs. In addition, cooling trials were recommended to determine the physical properties of the roast product as it cools, in order to determine if the furnace discharge can be fed directly into a standard rotary cooler, rather than via interim pig casters as contemplated in existing circuit design. The ability to feed the furnace discharge directly into a rotary cooler would not only eliminate the cost of the pig casters, but also increase the recoverable heat from the roast product. The recovered heat could, in turn, be used to reduce energy costs for drying and pre-heating the roasting circuit feed.

Both EAF and induction roasting trials were completed by WUST. An initial 1 hour, 12kg submerged EAF trial was completed using a 50kW DC unit, showing overall 83% potassium extraction from the Oxley ore. The target temperature of 950 degrees C was far exceeded in the trial due to the large size of the electrode (7cm, graphite negative electrode) relative to the charge volume of the feed (26cm diameter graphite crucible, positive electrode) given the constraints of the laboratory scale furnace setup. This caused higher than anticipated volatilisation of the salt, reducing the reaction potential. Further optimisation trials to improve on the already encouraging extraction rate would require an industrial scale unit with a much larger charge feed volume to electrode ratio, where the roasting temperature can be better controlled to the desired target range. The test work however showed that the EAF has potential for use in the process design.



**CAPTION:** Electric induction furnace used in Oxley trials.

A separate 1 hour, 1kg stirred electric induction furnace trial controlled at 950 degrees C was undertaken by WUST which produced a higher extraction rate of 89% potassium due to lower levels of salt volatilisation.

+61 8 8213 3100

Cooling trials were also undertaken by WUST using a custom-made laboratory scale 1.3m long, 22cm diameter rotary cooler. The roast product from the induction furnace trial was manually poured into the rotary cooler to observe how the mixture solidified and if the solidification occurred without the material sticking to the shell of the cooler. The trial showed no significant sticking and good breakup of the product with the rotary action, demonstrating the furnace discharge could be fed directly to a rotary cooler.

#### **Oxley Project Summary**

The Oxley Potassium Nitrate Project ("Oxley") is located around 125km southeast of the Port of Geraldton in Western Australia. The basis of the project is a globally rare out-cropping ultrapotassic lava flow, composed dominantly of potassium feldspar. Rock chipping along the length of the 32km striking deposit has showed consistently high potassium grades up to 14% K<sub>2</sub>O. Centrex has drilled just a small 3km section of the deposit already establishing an initial Inferred Mineral Resource of 155 million tonne at 8.3% K<sub>2</sub>O (6% cut-off) including 38 million tonne at 10% K<sub>2</sub>O.

For full details of the Inferred Mineral Resource please see announcement 8th March 2016:

#### http://www.asx.com.au/asxpdf/20160308/pdf/435nrchjm48mjx.pdf

The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.

A positive Scoping Study for a start-up high-value water-soluble potassium nitrate fertiliser ("NOP") operation was completed in August 2016. Centrex has commenced a Prefeasibility Study for the project, initially with a number of engineering design reviews of the main process plant areas to determine the go-forward option from the numerous design options flagged in the Scoping Study.

The Scoping Study was based on a vertically integrated primary producer NOP operation, with both potassium chloride and nitric acid feedstock produced on site. A simplified production process flow is shown below:

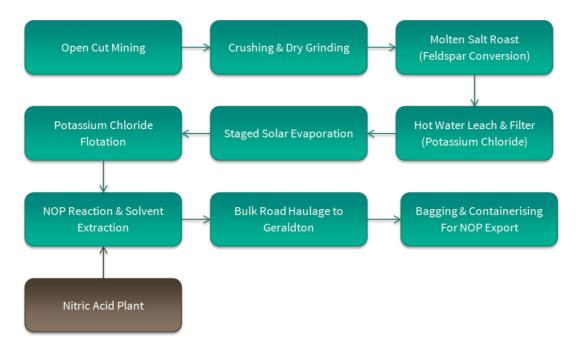


FIGURE: Simplified NOP production process flow.

Potassium feldspar ore would be mined via open cut from a series of shallow pits; selectively mining higher grade ore from the larger scale deposit using a small fleet of 90 tonne haul trucks. The ore would be crushed and then ground to  $P_{80}$  150µm via a dry circuit to reduce moisture into the furnace. The ore along with salt would be roasted to convert the potassium feldspar to soluble potassium chloride for hot water leaching and filtration.

The resulting potassium rich brine (order of magnitude higher potassium concentration than naturally occurring brines) would be staged crystallised in solar evaporation ponds to provide a potassium chloride and sodium chloride concentrate. The concentrate would be fed to a standard potash flotation plant to produce a pure potassium chloride product. The potassium chloride product would then be reacted with nitric acid produced on site to form potassium nitrate product. Both make onsite and buy ammonia options for nitric acid production were considered in the study, and both continue to be assessed for their relative merits. The final NOP product would be hauled by road in bulk to Geraldton where it would be bagged and placed into containers for export using existing third party facilities.

For further information, please contact:

#### **Ben Hammond**

Chief Executive Officer Centrex Metals Limited Ph (08) 8213 3100

#### **Gavin Bosch**

Chief Financial Officer & Company Secretary Centrex Metals Limited Ph (08) 8213 3100

+61 8 8213 3100

F +61 8 8231 4014

#### **Competent Persons Statement**

The information in this report relating to Exploration Results is based on information compiled by Mr Ben Hammond who is a Fellow of the Australasian Institute of Mining and Metallurgy. Mr Hammond is the CEO of Centrex Metals Limited. Mr Hammond has sufficient experience, which is relevant to the style of mineralization and type of deposit under consideration and to the activity, which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Hammond consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

### Oxley Potassium Nitrate Project JORC Table 1 Report

**SECTION 1:** Sampling techniques and data.

Criteria	IOPC Code explanation	Commentary
Criteria Sampling techniques  Drilling techniques	<ul> <li>Nature and quality of sampling.</li> <li>Sample representivity.</li> <li>Determination of mineralisation.</li> </ul>	A roughly 300kg bulk composite was prepared from half core PQ from diamond drill hole OXDD004 from surface to 50m depth:  • Easting 383525 (MGA 94 Zone 50) • Northing 6768749 (MGA 94 Zone 50)  See announcement 9 <sup>th</sup> December 2015 for full results of OXDD004;  http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.pdf  The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.  The 300kg composite was crushed to -3mm and homogenized at Bureau Veritas Minerals in Perth. A 15kg sub-sample was
	Drill type.  Mathed of recording and.	pulverized to P80 150 micron and mixed in equal parts with salt, then homogenized. The resulting 30kg sample was then couriered to WUST in a sealed container for test work. WUST utilised a 12kg sub-sample for the EAF and a 1kg sub-sample for the induction furnace.  The bulk composite was prepared from half core PQ from 0 to 50m depth from diamond drill hole OXDD004.
Drill sample recovery	<ul> <li>Method of recording and assessing sample recoveries.</li> <li>Measures taken to maximise sample recovery.</li> </ul>	No drilling results being reported, metallurgical test work only.

Logging	<ul> <li>Geological and geotechnical logging.</li> <li>Whether logging is qualitative or quantitative.</li> <li>Total length and percentage of the relevant intersections logged.</li> </ul>	No drilling results being reported, metallurgical test work only.
Sub- sampling techniques and sample preparation	<ul> <li>Nature, quality and appropriateness of the sample preparation technique.</li> <li>Quality control.</li> <li>Sample representivity.</li> <li>Sample sizes.</li> </ul>	The 300kg composite was crushed to -3mm and homogenized at Bureau Veritas Minerals in Perth. Head assays of the composite were analysed using XRF showing 10.93% K2O, and thought to be reasonably representative of the oxidised portion of the ore body targeted to be mined. A 15kg sub-sample was pulverized to P80 150 micron and mixed in equal parts with salt, then homogenized. The resulting 30kg sample was then couriered to WUST in a sealed container for test work. WUST utilised a 12kg sub-sample for the EAF and a 1kg sub-sample for the induction furnace.  Roast products were weighed and a sub-sample taken for assay. The roast products were then water leached for 1 hour at
		95 deg C. The leach residue and leachate were analysed.
Quality of assay data and laboratory tests	Nature of quality control procedures.	Analysis was performed by ICP. Full mass balances were recorded throughout the roast and leaching showing acceptable reconciliation. An off-gas analyser was used as well as a wet scrubber to determine the chemistry of the off-gas. Both leach residue and leachate/off-gas derived potassium extractions showed good correlation.

Verification of sampling and assaying	<ul> <li>The verification of significant intersections by either independent or alternative company personnel.</li> <li>The use of twinned holes.</li> <li>Documentation of primary data, data entry procedures, data verification, data storage protocols.</li> <li>Any adjustment to assay data.</li> </ul>	Analysis was performed by ICP. Full mass balances were recorded throughout the roast and leaching showing acceptable reconciliation. An off-gas analyser was used as well as a wet scrubber to determine the chemistry of the off-gas. Both leach residue and leachate/off-gas derived potassium extractions showed good correlation. Induction furnace results were in line with previously reported induction roasts performed at Kingston Metallurgical in Canada.
Location of data points	<ul> <li>Accuracy and quality of surveys.</li> <li>Specification of the grid system used.</li> <li>Quality and adequacy of topographic control.</li> </ul>	No drilling results being reported, metallurgical test work only.  A roughly 300kg bulk composite was prepared from half core PQ from diamond drill hole OXDD004 from surface to 50m depth:  • Easting 383525 (MGA 94 Zone 50)  • Northing 6768749 (MGA 94 Zone 50)  See announcement 9th December 2015 for full results of OXDD004; <a href="http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.pdf">http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.pdf</a> The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.
Data spacing and distributio n	<ul> <li>Data spacing for reporting of Exploration Results.</li> <li>Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the</li> </ul>	No drilling results being reported, metallurgical testwork only.  A roughly 300kg bulk composite was prepared from half core PQ from diamond drill hole OXDD004 from surface to 50m depth:  • Easting 383525 (MGA 94 Zone 50)  • Northing 6768749 (MGA 94 Zone 50)  See announcement 9th December 2015 for full results of

	Mineral Resource.  • Whether sample compositing has been applied.	OXDD004; <a href="http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.">http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.</a> <a href="pdf">pdf</a>
		The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.
Orientatio n of data in relation to geological structure	Whether the orientation of sampling achieves unbiased sampling.	OXDD004 was drilled vertically, roughly perpendicular to the shallow dipping lava flow.
Sample security	The measures taken to ensure sample security.	Samples were transported from Oxley to Bureau Veritas in sealed bags within sealed drums. Pulverised samples were transported from Bureau Veritas to WUST in sealed containers.
Audits or reviews	The results of any audits or reviews of sampling techniques and data.	Only in-house audits of testwork results have been completed outside of the laboratories own internal audits.

## Oxley Potassium Nitrate Project JORC Table 1 Report

**SECTION 2:** Reporting of Exploration Results.

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	<ul> <li>Type, reference         name/number, location         and ownership including         agreements.</li> <li>The security of the tenure         held at the time of reporting.</li> </ul>	The Oxley ultrapotassic lava flow is located on Exploration Licences E70/4318, E70/3777, E70/4004, E70/4319, E70/4378 and E70/4320. All tenements are held by Centrex's 100% subsidiary Centrex Potash Pty Ltd and all are in good standing.
Exploration done by other parties	Exploration by other parties.	All exploration reported was by Centrex.

Geology	Deposit type, geological setting and style of mineralisation.	The Oxley Potash Project comprises a series of ultrapotassic lava flows thought to have evolved from a failed intercontinental rift. The main target unit is a series of microsyenite lava flows that appear to have thickness controlled by the basement paleosurface. The microsyenite grades into an ultrapotassic trachybasalt at its base and an ultrapotassic tuff at its top.
Drill hole Information	A summary of all information material to the understanding of the exploration results.	No drilling results being reported, metallurgical testwork only.  A roughly 300kg bulk composite was prepared from half core PQ from diamond drill hole OXDD004 from surface to 50m depth:  • Easting 383525 (MGA 94 Zone 50)  • Northing 6768749 (MGA 94 Zone 50)  See announcement 9th December 2015 for full results of OXDD004; <a href="http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.pdf">http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.pdf</a> The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.
Data aggregation methods	<ul> <li>Weighting averaging techniques and grade cuts.</li> <li>Aggregation procedure.</li> <li>The assumptions used for any reporting of metal equivalent values should be clearly stated.</li> </ul>	All individual test work results are reported without aggregation.
Relationship between mineralisatio n widths and intercept lengths	Geometry of the mineralisation with respect to the drill hole angle.	OXDD004 was drilled vertically, roughly perpendicular to the shallow dipping lava flow.

Diagrams	Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.	No drilling results being reported, metallurgical testwork only.  A roughly 300kg bulk composite was prepared from half core PQ from diamond drill hole OXDD004 from surface to 50m depth:  • Easting 383525 (MGA 94 Zone 50)  • Northing 6768749 (MGA 94 Zone 50)  See announcement 9th December 2015 for full results of OXDD004; <a href="http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.pdf">http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.pdf</a> The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.
Balanced reporting	Representative reporting of both low and high grades and/or widths.	No drilling results being reported, metallurgical testwork only.  A roughly 300kg bulk composite was prepared from half core PQ from diamond drill hole OXDD004 from surface to 50m depth:  • Easting 383525 (MGA 94 Zone 50)  • Northing 6768749 (MGA 94 Zone 50)  See announcement 9th December 2015 for full results of OXDD004; <a href="http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.pdf">http://www.asx.com.au/asxpdf/20151209/pdf/433ns9c4xwrbs0.pdf</a> The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.
Other substantive exploration data	Other exploration data.	No other exploration data is reported at this time.
Further work	The nature and scale of planned further work.	Updated of the roasting circuit design and project cost estimates with the additional test work input data.