

16 August 2016



## *Zirconium Marketing and Sales Agreement Signed for DZP*

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### **DUBBO ZIRCONIA PROJECT (DZP) – zirconium, hafnium, niobium, yttrium, rare earth elements**

- **AZL has signed an exclusive worldwide marketing, sales and distribution agreement with Minchem Ltd for all zirconium materials produced by the DZP.**
- **Minchem is a technical ceramics marketing and manufacturing business that has been involved in zirconium chemicals and zirconium dioxide (ZrO<sub>2</sub> or zirconia) products for over 40 years.**
- **Minchem is based in England and has a global reach in the zirconium industry.**
- **The initial term of the agreement is for five years from commencement of DZP production, with an option to extend for a further five years by mutual agreement.**
- **The DZP plans to produce over 16,000 tpa of zirconium products (100% ZrO<sub>2</sub> basis) and includes zirconium dioxide, specialty zirconium chemicals and value added zirconium products.**
- **At full capacity, the DZP zirconium revenue is estimated to be US\$100 -120 million, which equates to about 30 – 32% of total project revenue at current spot prices for the Project's output.**
- **The agreement with Minchem provides AZL with an experienced partner to market DZP zirconium products directly to key end users in all major markets. It will also assist in the creation of higher value zirconium products which have been identified and are under active development.**
- **The zirconium chemicals market consumes about 21% of annual zircon production and is the fastest growing segment of zircon consumption.**
- **With a forecast compound annual growth rate of ~5%, the zirconium chemicals market is anticipated to reach 190,000 tpa by 2020, and 240,000 tpa by 2025, worth in excess of US\$1.5B per annum.**

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## ZIRCONIUM MARKETING AGREEMENT

Australian Zirconia Limited (AZL), a wholly owned subsidiary of Alkane Resources Ltd, has signed an exclusive worldwide marketing, sales and distribution agreement with Minchem Ltd (Minchem) for all zirconium materials produced by the DZP. This amounts to over 16,000 tpa of zirconium products (100% ZrO<sub>2</sub> basis) and includes zirconium dioxide, speciality zirconium chemicals and other value added zirconium products.

Minchem is a technical ceramics marketing and manufacturing business involved in zirconium chemicals and zirconium dioxide material. The organisation is based in England and has a global reach in the zirconium industry, representing over 40 years of experience. Minchem's knowledge and background in zirconium materials is ideally suited to promote and manage the sales and distribution of DZP zirconium and associated rare earth products.

Minchem's responsibilities will also include providing technical support to customers and assisting to identify new applications for zirconium materials. This includes value added zirconium dioxide products and stabilised zirconium dioxide products using rare earths from the DZP. Rare earths include yttrium and cerium oxides that are used to stabilise zirconia, and praseodymium oxide which is used to produce yellow pigments in ceramics.

The initial term of the agreement is for five years from commencement of DZP production, with an option to extend a further five years by mutual agreement.

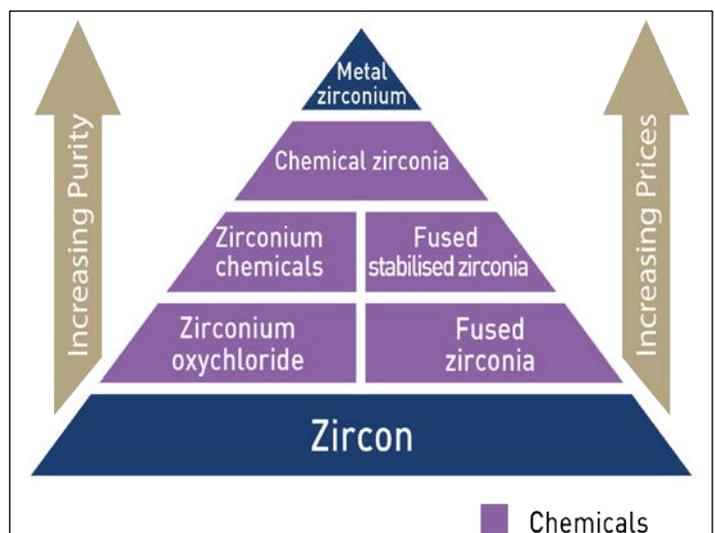
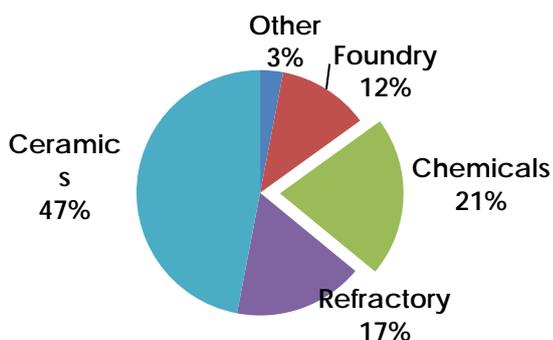
This arrangement provides AZL with an experienced partner to market DZP zirconium products directly to key end users in all major markets. It will also assist in the creation of higher value zirconium products which have been identified and are under active development.

## ZIRCONIUM MARKET

The zirconium market is dominated by the production of zircon mined in conjunction with the titanium minerals, ilmenite and rutile, from mineral sands operations. Zircon production in 2015 was approximately 1.1 million tonnes with a value of around US\$1.3 billion. About 21% of global zircon output is used for the production of downstream zirconium chemicals and zirconia, and is set to increase further as zirconium chemicals are the highest growth rate segment for zircon.

### Zircon Demand by End Use

(2015 ~ 1.1 million tonnes)





Global demand for zirconium chemicals and zirconia raw materials was approximately 160,000t in 2015, with an estimated value of US\$700 million. This includes ~50% in the form of fused zirconia, with the remaining 50% consisting of zirconium chemicals and powders based on zirconium oxychloride (ZOC). China is responsible for approximately 80% of all zirconium production, despite depending on imported zirconium silicate (zircon) as the raw material. China further dominates ZOC supply, with over 90% of global production. Remaining ZOC production is located in Russia, England, India, and Vietnam.

Zirconium materials are consumed as-is or are processed further to produce intermediates or finished products in a wide range of applications of much higher value. In many cases, zirconia is combined with rare earths such as yttrium oxide which are used to provide high temperature stability and functionality or to impart high strength and mechanical or electrical properties over a range of temperatures.

With a forecast compound annual growth rate of ~5%, the zirconium market is anticipated to reach 190,000 tpa by 2020, and 240,000 tpa by 2025. While this is an average growth rate, some applications using rare earths enjoy growth rates closer to 10%, while other markets such as refractories are lower. Output from the DZP of 16,374 tpa will represent ~8.6% of the zirconium market in 2020, with the growing zirconium market needing the equivalent increase in output of one DZP comparable facility every two years.

While zirconium materials are the highest growth segment for zircon, there are growing concerns about the availability of premium zircon with the low radioactivity needed to produce fused zirconia with less than 500ppm uranium and thorium. As the zirconium market continues to grow, there is likely to be less zircon available which is suitable for fused zirconia. ZOC production, on the other hand, produces a material with extremely low levels of radioactivity as uranium and thorium are concentrated in waste residue streams. Disposal and management of these waste streams in China is also a concern which needs to be managed. With China dominating fused zirconia and zirconium chemicals supply with over 80% of total global production, and the challenges facing fused zirconia and ZOC producers, there is a substantial need for an alternative source of supply which is independent of both zircon and China. The DZP provides a strategic alternative source of zirconium materials, without the issues faced by current producers using zircon.

## ZIRCONIUM APPLICATIONS

Zirconium products from the DZP are suitable for a wide range of applications, and will compete against all types of zirconium products available today. The success in recovering hafnium from the zirconium stream has also opened up new opportunities to produce higher value hafnium-free zirconia for the nuclear industry (production of reactor grade metal), as well as a hafnium concentrate that can be further processed into downstream hafnium oxide and metal. In addition, DZP zirconium products are also suited for high volume markets such as steel and glass making refractories, plus high performance ceramic pigments (praseodymium yellow, vanadium blue, and iron coral pink) needed for digital printing on ceramic tiles, where there is a trend towards higher purity and higher performance.

DZP zirconium materials are also applicable for a myriad of high value zirconium chemicals and chemical zirconia applications, ranging from yttria stabilised zirconia thermal barrier coatings required in jet engines to automotive catalysts that are critical for emission control systems. Zirconium compounds are also used in a wide range of electronic



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components and sensors, from piezoelectric materials to advanced sonar technologies and hydro-acoustic systems in maritime applications.



Other uses include advanced multilayer ceramic capacitors, and solid oxide fuel cells used for clean power generation. Zirconium chemicals are also used for special alloys and glasses such as fibre optical cables and potential new uses such as that recently patented by Apple for curved glass made from liquid metal alloys, including zirconium for further miniaturisation of consumer applications.



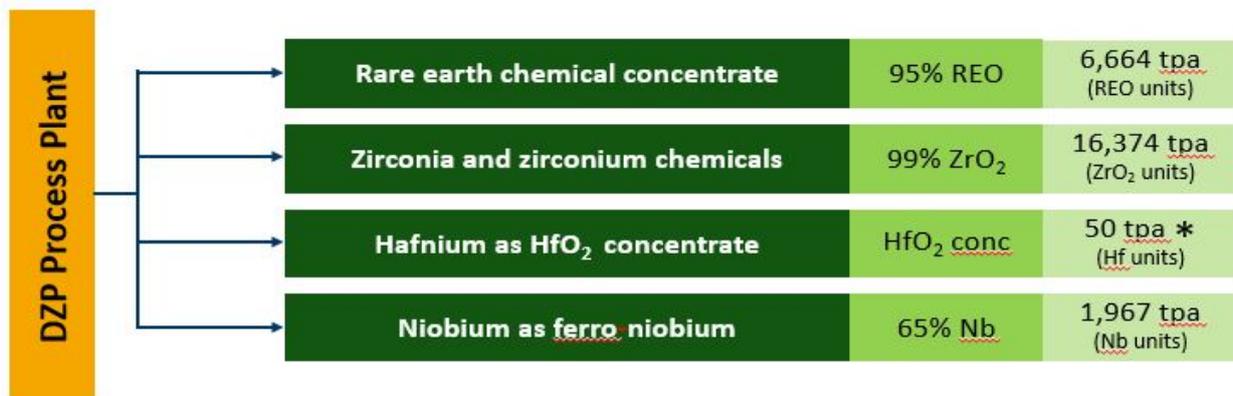
In many cases, there are no readily available alternatives, due to the unique properties of zirconium materials, when price and performance are considered. AZL also has several high value zirconia products under active development, which will generate significantly higher revenues than just selling zirconium dioxide powders and chemicals that are used as raw materials.

### DUBBO ZIRCONIA PROJECT PRODUCTION

The DZP flowsheet has been developed over many years and has been tested on the demonstration pilot plant at ANSTO since 2008 to produce a suite of saleable zirconium, niobium and rare earth products. In the last 18 months further process development work to recover hafnium from the zirconium refining circuit was established. This improvement delivered a hafnium product and a very pure (+99.9% ZrO<sub>2</sub>) and higher value zirconia product.

DZP zirconium revenue at full capacity of 1 million tonnes per annum ore throughput is estimated to be US\$100 - 120 million. This equates to about 30-32% of total project revenue at current spot prices (ASX Announcement 28 August 2015 #) for the product mix from the DZP.

### DZP Product Output



\* Start up output. 200tpa potential depending upon market demand

# the Company confirms that all material assumptions and technical parameters underpinning the production targets and forecast financial information as disclosed continue to apply and have not materially changed.

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## ABOUT MINCHEM

Minchem Ltd is a privately owned technical ceramics raw materials marketing company based in England, and represents over 40 years of experience worldwide in zirconium chemicals and zirconium dioxide products. Minchem was formed in 2000 as a result of the management buyout of the Minerals and Chemicals ('Minchem') Department of Mandoval Ltd, a wholly-owned subsidiary of Palabora Mining Company (PMC). PMC was originally owned by Rio Tinto/Anglo American and since 2012 has been a 74% Anglo American and 26% Empowerment Partners partnership.

PMC is located at Phalaborwa, Limpopo Province, in South Africa and produced up to 20,000 tonnes of natural zirconium dioxide (the mineral baddeleyite) as a by-product from the large open cut copper and phosphate mine. Baddeleyite was recovered from the 1960's to 2000, after which the baddeleyite was limited as the mine moved to underground operations. The remaining Agenting/Distributorship/Trading activity of Mandoval was purchased as the management buyout that is now Minchem Ltd.

PMC processed the baddeleyite into a range of zirconium dioxide and zirconium chemical products which were sold by PMC (under the name Zirconia Sales UK/USA/Japan Ltd, sister companies to Mandoval Ltd), with offices in the respective countries and South Africa. During this period, PMC was the market leader in zirconium products, accounting for up to 50% of the global zirconium market at its peak. PMC's zirconium products have since been replaced by zirconium chemicals and zirconium dioxide produced largely in China from zircon/zirconium oxychloride in which Minchem has also been actively involved. Minchem's knowledge and experience in zirconium markets is ideally suited to promote and manage the sales and distribution of DZP zirconium and associated rare earths.

Today Minchem Ltd is part of the larger Minchem Group comprising other processing and manufacturing divisions in ceramic/other raw materials and speciality refractory products.

Commenting on the agreement, Minchem's Managing Director, Mr Charles Skidmore said "the DZP is a new major source of zirconium and rare earth products for world markets in which we have dealt for many years. The DZP is also not dependent on zircon or China, which is a major advantage for many customers."

Further information is available on the Group's websites: <http://www.minchem.co.uk/index.html> ; <http://www.accsLtd.co.uk/MinChem-Group.html> ;

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### Competent Person

The information in this report that relates to exploration results, mineral resources and ore reserves is based on information compiled by Mr D I Chalmers, FAusIMM, FAIG, (director of the Company) who has sufficient experience which is relevant to the style of mineralisation 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 Chalmers consents to the inclusion in this report of the matters based on his information in the form and context in which it appears

### Disclaimer

This report contains certain forward looking statements and forecasts, including possible or assumed reserves and resources, production levels and rates, costs, prices, future performance or potential growth of Alkane Resources Ltd, industry growth or other trend projections. Such statements are not a guarantee of future performance and involve unknown risks and uncertainties, as well as other factors which are beyond the control of Alkane Resources Ltd. Actual results and developments may differ materially from those expressed or implied by these forward looking statements depending on a variety of factors. Nothing in this report should be construed as either an offer to sell or a solicitation of an offer to buy or sell securities.

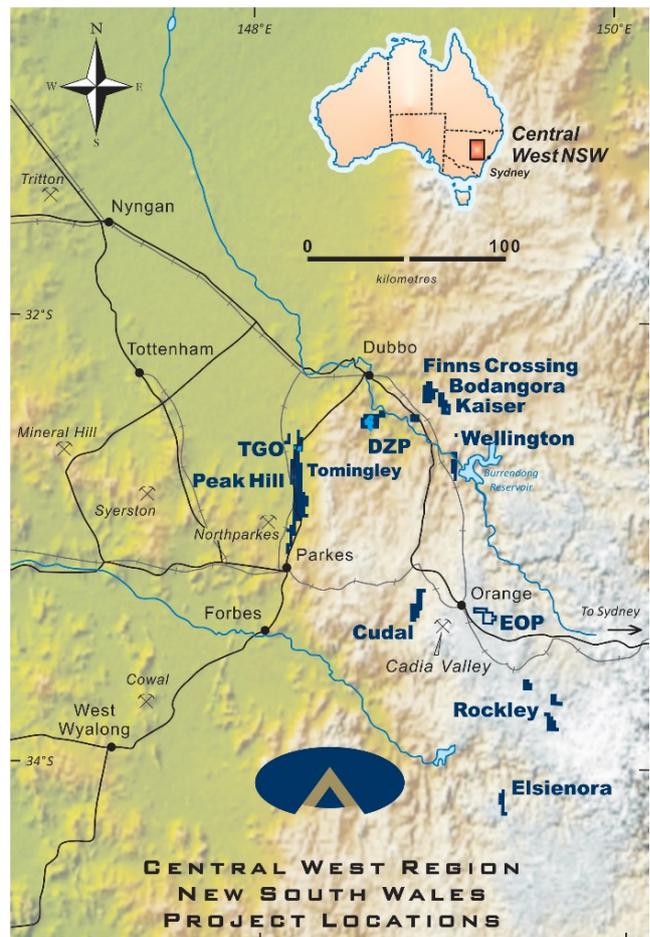
This document has been prepared in accordance with the requirements of Australian securities laws, which may differ from the requirements of United States and other country securities laws. Unless otherwise indicated, all ore reserve and mineral resource estimates included or incorporated by reference in this document have been, and will be, prepared in accordance with the JORC classification system of the Australasian Institute of Mining, and Metallurgy and Australian Institute of Geoscientists.

**ABOUT ALKANE - [www.alkane.com.au](http://www.alkane.com.au) - ASX: ALK and OTCQX: ANLKY**

Alkane is a multi-commodity company focused in the Central West region of NSW, Australia. Currently Alkane has two advanced projects - the Tomingley Gold Operations (TGO) and the nearby Dubbo Zirconia Project (DZP). Tomingley commenced production early 2014. Cash flow from the TGO has provided the funding to maintain the project development pipeline and will assist with the pre-construction development of the DZP.

The NSW Planning Assessment Commission granted development approval for the DZP on 28 May 2015 and on 24 August 2015 the Company received notification that the federal Department of the Environment gave its approval for the development. Mining Lease 1724 was granted on 18 December 2015 and the Environment Protection Licence was approved on 14 March 2016 Financing is in progress and this project will make Alkane a strategic and significant world producer of zirconium, hafnium and rare earth products when it commences production in 2018.

Alkane's most advanced gold copper exploration projects are at the 100% Alkane owned Wellington and Bodangora prospects, and Elsienera farm-in. Wellington has a small copper-gold deposit which can be expanded, while at Bodangora a large monzonite intrusive complex has been identified with porphyry style gold copper mineralisation. Encouraging gold mineralisation was recently drilled at Elsienera.



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