

ABx Group

Expanding resource base of critical rare earth elements

ABx March 2024 Quarterly Review

March Quarter summary and highlights

- The March 2024 Quarter was a period of high activity for ABx, which was rewarded with a 70% increase in rare earth resource estimate to 89 million tonnes (reported in a subsequent announcement).
- A 66-hole drilling program was undertaken during the quarter including maiden drilling at Wind Break, to the northeast of the principal exploration site. Assay testing also continued during the period.
- Research continued into the production of hydrogen fluoride from aluminium smelter waste at the pilot batch reactor. Fluorine recovery is approaching the target 90% level with considerable progress having been achieved in process optimisation.
- Negotiations continue regarding long term offtake agreements for the company's bauxite operations.
- Cash amounting to \$616K was raised during the quarter and available cash balances at the end of March 2024 were \$360K. A further \$5.2 million is held in trust for development of a pilot hydrogen fluoride / aluminium fluoride plant for Alcore.

Other

- On 14 March 2024, Arafura Rare Earths Ltd announced that it had received a conditionally approved US\$533 million debt finance package from the Commonwealth government to support the Nolans project in the Northern Territory.
- The price correction for key rare earth elements that has been underway for the past year may have bottomed out. Notwithstanding the steep falls in spot prices experienced, they remain above the 2019/2020 levels prior to the steep rise in 2020 and 2021.

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Company Data

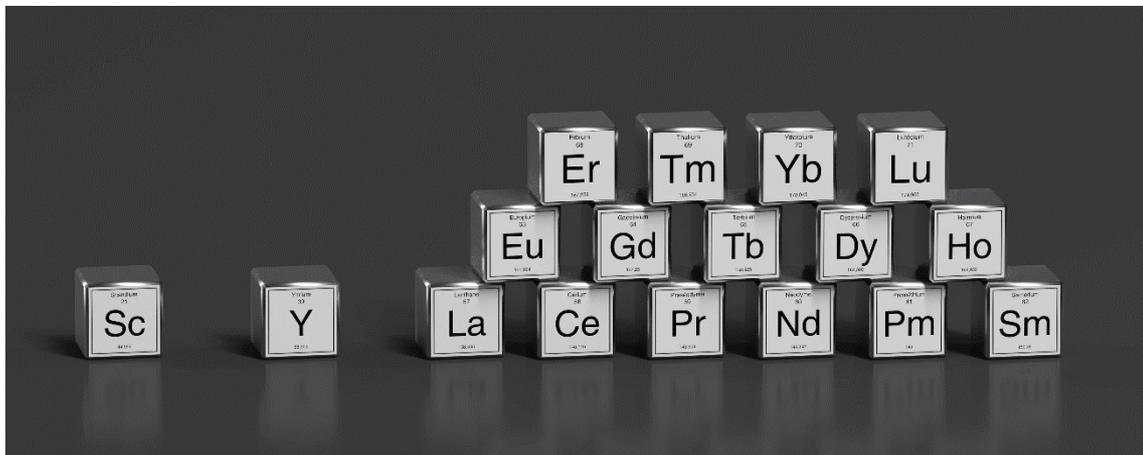
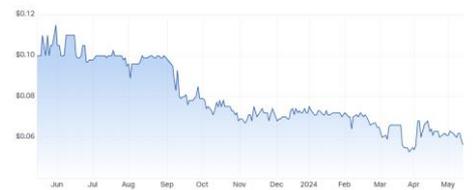
ASX code	ABX
ASX price	\$0.057
Shares on issue	250m
Market capitalisation	\$14m
Cash on hand	~\$5.5m ¹
12-month price range	\$0.053 – \$0.115
Avg Daily ASX turnover (30 days)	100K

¹ Cash = Latest 4C balance + Raisings + Tax + 4C Expected outflows

Key Personnel

Dr Mark Cooksey	MD & CEO
Paul Lennon	Non-Exec Chairman
Matthew Watkins	Company Secretary

ABX ASX Chart



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Our View

During the current quarter the company will continue to build its knowledge and understanding regarding its rare earth resource and the hydrogen fluoride project.

We have maintained our valuation at 40 cents per share but in view of the current share price of 6.2 cents per share have set our 12-month target at 10 cents per share.

Whilst the company continues to make good progress in meeting its exploration and research objectives, we do not expect a catalyst to emerge in the next few months that will change market environment for the stock. We remain highly confident that the company can and will continue to make major strides towards achieving its ultimate development goals but more capital is required to markedly advance and accelerate the program.

March Quarter Activity

Rare Earths

During the quarter under review, ABx drilled 66 holes in multiple sectors across its exploration areas. The drilling strategy comprised three elements; gain a greater understanding of the direction and extent of the resource in the primary exploration zone, identify and quantify high grade zones, and to commence exploration at Wind Break, 15km northeast of the primary exploration zone. This effort delivered a 70% increase in the resource estimate to 89 million tonnes grading 844 ppm TREO. Further, the quality of the estimate has markedly improved, with 54% of the estimate being Indicated/Measured whereas the previous estimate was mostly Inferred. The table below details the latest estimate.

Table 1: Mineral resources at Deep Leads - Rubble Mound - Wind Break (US\$30/t ~350 ppm cut-off grade)

Resources at Deep Leads-Rubble Mound & Wind Break @ US\$30/t cog								Permanent Magnet REOs				Key Ratios	
Resource Category	Million Tonnes	Avg depth (m)	Avg base (m)	Avg thickness (m)	TREO ppm	TREO-CeO ₂ ppm	Perm Mag ppm	Nd ₂ O ₃ ppm	Pr ₆ O ₁₁ ppm	Tb ₄ O ₇ ppm	Dy ₂ O ₃ ppm	PermMag TREO %	Tb+Dy TREO %
Inferred	41.4	4.2	12.3	8.0	811	629	212	141	36	5.0	30	26%	4.3%
Indicated	41.6	4.2	11.8	7.7	856	656	225	150	38	5.2	31	26%	4.2%
Measured	5.6	4.1	11.4	7.3	998	790	263	174	43	6.6	39	26%	4.6%
Totals	89	4.2	12.0	7.8	844	652	221	147	37	5.2	31	26%	4.3%

Other Rare Earth oxides													Low radioactivity	
Resource Category	CeO ₂ ppm	Er ₂ O ₃ ppm	Eu ₂ O ₃ ppm	Gd ₂ O ₃ ppm	Ho ₂ O ₃ ppm	La ₂ O ₃ ppm	Lu ₂ O ₃ ppm	Sm ₂ O ₃ ppm	Tm ₂ O ₃ ppm	Yb ₂ O ₃ ppm	Y ₂ O ₃ ppm	ThO ppm	U ₃ O ₈ ppm	
Inferred	182	17	8.3	31	6.0	124	2.2	31	2.4	15	180	6.6	1.8	
Indicated	200	18	9.0	33	6.2	131	2.3	34	2.5	15	181	6.4	1.8	
Measured	209	22	11.3	41	7.8	150	2.8	40	3.0	19	229	6.2	1.7	
Totals	192	18	8.8	33	6.2	129	2.3	33	2.5	15	183	6.5	1.8	

Parameters: Note 1 ppm = 1 gram/t. Block cut-off grade (cog) = US\$30/t (~350ppm TREO-CeO₂) Min thickness = 2 metres Density = 1.9 t/metre³
Search ellipse = 120 x 150m (Meas & Ind), 250 x 250m (Inf). TREO = total rare earth elements as oxides. TREO-CeO₂ = TREO minus cerium oxide.

The grades for praseodymium, terbium and dysprosium were comparable with the previous estimate, however the neodymium grade was 3.5% higher.

Alcore

Having established that the process for extracting fluorine from aluminium bath works and that hydrogen fluoride can be successfully produced, the research focus has been on process optimisation with a view to maximising fluorine recovery. The initial recovery rate of 70%, as reported in February was less than anticipated although understood to be due to the large particle size of the feed material. Subsequent testing, with this knowledge, resulted in recoveries approaching 90%. It is now understood that the process is likely to incorporate a second stage, to further react the material and achieve better than 90% recovery.

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Financials

Cash outflows for the period under review amounted to \$830K of which \$346K related to business operations, including R&D, and \$484K to exploration. This was funded through \$616K raised in new capital and \$310K released from non-current assets.

Nolans Project

Whilst the debt package approved by the Commonwealth government for Arafura's Nolans Project has no direct implication for ABx, it does point to the availability of funding and support for critical minerals projects, especially rare earths. Included in the package is a US\$125 million limited recourse senior debt facility under the Commonwealth Government's \$4 billion Critical Minerals Facility.

The Nolans project has a resource of 56 million tonnes grading 2.6%, of which 70% is measured and indicated. This resource has a relatively high concentration of neodymium which will underpin the project, with an expected to have a 38-year life, at initial anticipated production rates. The project contains very low terbium and dysprosium, which are the elements with the greatest supply risk and the highest value. The ABx resource has significant concentrations of both terbium and dysprosium which is major point of differentiation and competitive advantage compared with Nolans and other rock-based deposits. Arafura Rare Earths market cap is currently \$450 million.

With multiple funding programs available, we would expect that Commonwealth government support become available as ABx's project advances closer to development.

Rare Earth Prices

Early indications are that prices of the four key rare earth elements, praseodymium, neodymium, terbium and dysprosium, bottomed out in March 2024 after a steep decline from peaks in late 2021 or early 2022. The following charts, from Strategic Metals Invest (<https://strategicmetalsinvest.com/5-year-prices/>) show that prices spiked up sharply during 2020 and 2021 primarily in response to the combination of rising demand, disrupted supply chains and concerns around tightening supply. With nearly 4-fold increases in less than 2 years, a correction was inevitable which occurred during 2022 and 2023, especially as China increased supply.

China dominates the processing of rare earths and ultimately controls about 90% of the market for end product, including these four key elements. This control of the supply chain is unsustainable in view of the role these elements play not just in renewables and Electric Vehicles but also in military equipment and a wide range of other key industries. Accordingly, rare earths, amongst other metals, have been declared to be critical minerals, by the US, Japan, EU and Australia and efforts are being directed to boosting supply and expanding production outside of China. Not surprisingly, China is directing considerable efforts to protect its position which is and will continue to impact prices. Increased supply from China was a significant contributor to the fall in prices over the past year.

Notwithstanding the steep fall in prices, prices remain significantly above 2019 and early 2020 levels and are forecast by analysts to steadily rise through to at least 2030.



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Spot prices are not necessarily indicative of realised prices and ultimately revenue due to prevalence of offtake agreements and supply contracts, but they are a useful trend indicator, especially in terms of demand and supply. Whilst spot prices are not likely to be used in feasibility studies, they will certainly influence the numbers. In this regard, ABx published for the first time a table with an estimate of the gross value per tonne contained in its resource estimate. The table, below, also shows the range of value estimates for each of the elements from analysts compared with spot prices.

Rare Earth Oxide	Resource grade ppm	ABx base case prices ¹	REE Value per tonne	Prices used in announcements by other REE companies, Market Reports & Analysts			
		US\$/kg	US\$/tonne	Price (US\$/kg) ²	Price (US\$/kg) ³	Price (US\$/kg) ⁴	Price (US\$/kg) ⁵
La ₂ O ₃	128.9	\$1	\$0.13	\$1.52	\$1.35	\$2.86	\$0.56
CeO ₂	192.2	\$1	\$0.19	\$1.58	\$1.40	\$2.01	\$0.97
Pr ₆ O ₁₁	37.5	\$128	\$4.79	\$169.00	\$104.50	\$106.19	\$56.72
Nd ₂ O ₃	147.5	\$134	\$19.76	\$182.50	\$106.00	\$97.34	\$56.84
Sm ₂ O ₃	32.9	\$4	\$0.13	\$5.20	\$2.55	\$2.45	\$2.11
Eu ₂ O ₃	8.8	\$30	\$0.26	\$31.50	\$28.50	\$49.35	\$27.38
Gd ₂ O ₃	32.7	\$69	\$2.25	\$112.50	\$58.50	\$37.16	\$27.22
Tb ₄ O ₇	5.2	\$2,046	\$10.68	\$2,340.00	\$1,830.00	\$1,415.92	\$897.31
Dy ₂ O ₃	31.0	\$382	\$11.85	\$480.00	\$323.00	\$566.37	\$282.92
Ho ₂ O ₃	6.2	\$179	\$1.11	\$305.00	\$102.00	\$111.50	\$69.95
Er ₂ O ₃	17.7	\$54	\$0.96	\$69.00	\$55.00	\$34.64	\$41.66
Tm ₂ O ₃	2.5	\$100	\$0.25	\$850.00	\$850.00	--	\$113.45
Yb ₂ O ₃	15.4	\$17	\$0.26	\$16.30	\$13.50	\$17.66	\$14.08
Lu ₂ O ₃	2.3	\$810	\$1.86	\$805.00	\$805.00	\$707.96	\$781.18
Y ₂ O ₃	183.2	\$12	\$2.20	\$16.10	\$9.20	\$7.39	\$6.12
TREO gross contained value US\$/t			\$56.69				

Sources 1. 2022 Adamas Intelligence: <https://www.adamasintl.com/>. Corporate Connect report for ABx. Also used in presentation by Iluka Resources Ltd ASX ILU 3-4 May 2023. See <https://iluka.com/media/rcbbrog/macquarie-conference-presentation.pdf>
 2. Argus Metal Prices <https://www.argusmedia.com/> (from Iluka Resources Ltd (ASX IIR) APAC Vegas Conference, 23 March 2022)
 3. Argus Metal Prices <https://www.argusmedia.com/> for 29 Sep 2022 (from IIR, ASX release, 6 Oct 2022)
 4. Alcara Resources Inc (TSX ARA) RNI 43-101 Report 2022, Table 1-1 and Table 14-40
 5. Ginger International Trade & Investment Plc., Ltd. 19 April 2024. Shanghai spot prices - see <https://git.sg/products/rare-earths>

What's Next?

The past twelve months have been pivotal for ABx. Since the end of March 2023, the company has made considerable progress and its key achievements have been to prove that it has a significant rare earth deposit in northern Tasmania that is highly enriched with the two rare earths with the most critical supply risk, dysprosium (Dy) and terbium (Tb). Initial testing indicates that recovery rates are relatively high using low cost process. Further, it has proven that it can extract fluorine from aluminium bath to produce hydrogen fluoride. These have been achieved at relatively modest cost.

The expansion in the estimated resource from 14 million tonnes grading 507ppm TREO, at March 2023 to 89 million to grading 844ppm TREO, in early May 2024, was achieved at a cost of \$2.5 million or about \$33 per tonne. An additional \$1.2 million has been spent on the Alcore project. The company has been remarkably frugal.

The next steps are to scale up drilling to further define the resource and its limits within its exploration areas and to better delineate and quantify the high-grade zone that would be expected to be targeted in a mining operation. This would be a prelude to full

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feasibility study to test commercial viability, which at this stage looks very promising. Further, Alcore is approaching the limits of what can be achieved in its research lab regarding development of the hydrogen fluoride. The next step is to build a continuous pilot plant where higher volumes can be tested in a production environment that will more closely resemble a commercial operation.

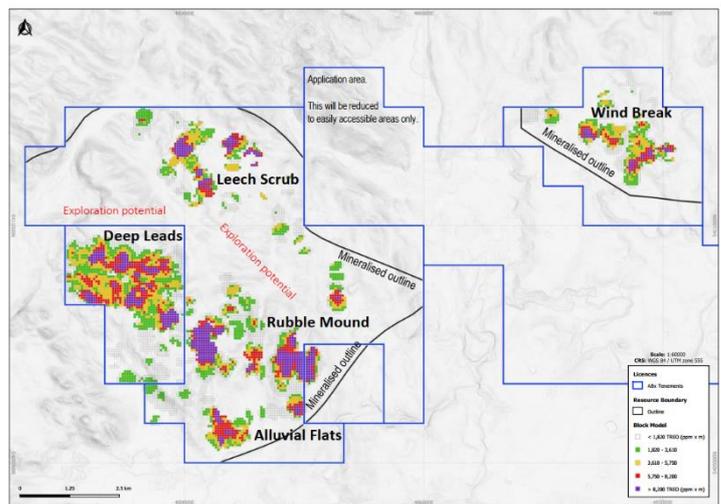
We believe active negotiations are underway with potential investors/partners who can support the scale up of both the rare earths and Alcore projects with additional capital.

Rare Earths

With drilling having been undertaken on only 29% of the mineralised outline in the primary exploration area and with new exploration licences secured to the northeast of this block (Wind Break) that expands the total exploration area by some 483 km², there is considerable potential to markedly expand the defined resource. Accordingly, the objectives for the next drilling phases will be to further define the extent of the resource and secondly to focus on known high grade areas (red and purple on the map below). This should lead to further increases in the overall resource size and in particular the size of the indicated and measured resource, which will underpin a feasibility study and ultimately a project development.

We would expect that the company will focus its attention on known high grade zones, and others that may emerge, to identify and quantify large resource concentrations that would underpin the economics of a mining operation in due course.

We understand that a small drilling program will be undertaken during late May to further identify the limits of the resource and metallurgical studies will be undertaken on samples from the most recent drilling. Previous metallurgical testing in 2023 by ANSTO (Australian Nuclear Science and Technology Organisation) on 71 samples from the Deep Leads – Rubble Mound resource achieved a 40% recovery rate using a low-cost process. If proven consistent across the resource, this would place ABx at the low end of the cost curve for dysprosium (Dy) and terbium (Tb).



Whilst resource size is the critical first step in establishing viability, the economics of a project will ultimately be driven by recovery rates. Accordingly, metallurgical testing is critical in building an understanding of the quality and economics of the resource. Initial testing indicated that recoveries at Deep Leads – Rubble Mound were superior to most other clay-hosted rare earth resources in Australia, which is a significant competitive advantage which needs to be validated with further testing.

Alcore

In November 2023, Alcore commissioned a new bath pilot batch reactor to further progress hydrogen fluoride development work. This reactor (in the adjacent photo) is 10 times the size of the one it replaced and has been used to further demonstrate the capacity to extract fluorine from bath and to optimise the process. Recent results demonstrate that a recovery in excess of 80% can be achieved with greater than 90% recovery a realisable prospect.

The next stage is to build a continuous pilot plant with a capacity of 20kg/hr bath. This plant will demonstrate quality of hydrogen fluoride produced at pilot scale and determine design and operating parameters for commercial plant. It will be the first key step in testing commercial viability of the process.



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The company has been awarded a \$7.5 million grant to proceed with the development of a pilot plant and first commercial plant, of which \$5.7 million has been received and is held in Trust. A partner, logically a local aluminium producer, is being sought to partner with the next stage of the development and we understand that ABx is in discussions with aluminium producers in Australia and overseas.

Bauxite

Negotiations continue to progress with regard to offtake agreements for the proposed Sunrise project in Queensland, but we expect that this project will make modest progress in the immediate future as the company prioritises rare earths and Alcore.

The company has been generating small amounts of revenue from ad hoc sales of bauxite to cement manufacturers. There is an opportunity to expand this into a regular supply arrangement and, in this regard, approval is anticipated during the September quarter to establish a small bauxite mining operation, more akin to an earthmoving operation, on the company's exploration area in northern Tasmania. This has the potential to deliver modest, albeit useful revenues to company at a small cost.

Financial

Spending in the March 2024 quarter amounted to \$947K, about 20% less than the average of about \$1.2 million per quarter over the previous two years. Cash reserves at the end of March \$359K will be boosted by interest income (from funds held in trust) and grants. Further the \$800K in R&D tax rebates are expected to be received in July or August which can be used to secure funding from other sources. Accordingly, sufficient cash resources are available to maintain activity. Nonetheless, further capital is required to scale up exploration and development work.

About ABx

Rare Earths

ABx holds tenements in northern Tasmania covering about 600 km² over which it is exploring for rare earths. These tenements are in two blocks. The oldest block is about 50Km west of Launceston covering about 100 km² on which two projects have been defined, Deep Leads/Rubble Mound and Wind Break. The second block, immediately to the south of Launceston includes the Portrush discovery and was extended during 2023 with the granting of additional exploration tenements totalling 483 km².

Exploration for rare earths commenced in early 2021 with resources identified at Deep Leads, Rubble Mound and Portrush from drilling undertaken during 2021 and 2022. A resource at Wind Break was identified from drilling towards the end of 2023. The subsequent drilling strategy has been focussed on step-out to find the limits of the resource, identifying the scale of the resource and to identify the high-grade zones.

Results to date have been very promising with recent results showing an extensive presence of rare earths covering a wide area and pointing to a large contiguous block over 100 km² linking Deep Leads and Rubble Mound. The most recent resource estimate was 89 million tonnes with a TREO grade of 844 ppm. A priority is to achieve a proven resource of at least 100 million tonnes, which would be the minimum level required to attract institutional interest and funding required to further advance exploration and progress towards project development.

Whilst scale is important, resource grade and recoveries will drive project economics. The average grade of the 89 million tonnes resource was last reported at 844 ppm TREO (total rare earth oxides) and 652 ppm TREO-CeO₂ (TREO minus cerium which has little value). Being a clay hosted resource, the deposit's competitive advantage lies in the presence of high value dysprosium and terbium, which are generally present at very low levels in the more common hard rock deposits. The ABx resource has the highest proportion of dysprosium and terbium (Dy+Tb is 4.3% of TREO) of any clay-hosted rare earths resource in Australia. We believe that ABx is seeking to identify a resource with a TREO-CeO₂ grade of 1200 – 1500 ppm.

Initial testing by ANSTO of 70 bulk samples from the Deep Leads deposit gave an average extraction rate of 40% at pH4. These initial extraction rates are in line with the extraction rates seen in Chinese IAC REE projects and are significantly higher than the average 28% rates used in Aclara's Penco Module project economic study – which is considered economically viable at this time.

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The two key factors driving the rare earths market are decarbonisation of the economy and geopolitics. Decarbonisation is the replacement of fossil fuel energy sources with renewables such as wind and solar. Batteries play an important role in this process as both storage platform to manage the variability in electricity supply and as the energy source of electric vehicles.

Rare earths have many applications in a wide variety of industries although permanent magnets are the most valuable application, representing over 90% of the total value of rare earths consumption. Permanent magnets are used in electric vehicles, wind turbines, smartphones and military applications amongst others. The four most important rare earths for permanent magnets are neodymium, praseodymium, dysprosium and terbium. Whereas neodymium and praseodymium are found in all rare earth deposits, and will generally underpin hard rock projects, dysprosium and terbium are only found in the far less common ionic adsorption clay deposits, which are overwhelmingly found in southern China. Further, most rare earth processing is undertaken in China.

As rare earths are essential in the manufacture of a wide range of strategic products, The US, EU, Japan, South Korea and Australia have declared them to be critical minerals. More particularly the strategic intent is to diversify the supply chain and to significantly reduce the exposure to China. This includes both resource and metal production. Countries are employing a range of tactics in pursuit of this strategy although a common theme are loans, grants and subsidies for relevant projects.

Against a background of a highly favourable market outlook and political support numerous rare earth projects are in various stages of exploration and development in North America, South America and Australia. However, most of these are hard rock resources with relatively few ionic adsorption clay deposits. Accordingly, whilst supply of light rare earth elements, including neodymium and praseodymium, is expected to markedly expand, the supply of heavy rare earth elements, including the critically important dysprosium and terbium, is expected to remain relatively constrained.

There is an enormous opportunity for ABx's northern Tasmania rare earth projects to fill an emerging supply gap against the background of relatively limited competition.

Alcore

Alcore, an 83% owned subsidiary of ABx, is developing a new process for producing hydrogen fluoride from tapped bath, an aluminium smelter waste. Hydrogen fluoride is an essential chemical for the production of fluorocarbons and aluminium fluoride, which is an essential chemical for aluminium production.

Hydrogen fluoride is mainly produced from fluorspar, which is obtained from the mineral fluorite. Fluorspar is relatively high cost and has been identified as a critical material by the USA, Europe, Japan and Canada. Australia does not mine any fluorite, or produce any fluorspar, hydrogen fluoride or aluminium fluoride, and so must import all its requirements. Although the Australian market for hydrogen fluoride is small it is a significant producer of aluminium with high demand for aluminium fluoride.

Hydrogen fluoride is currently produced from aluminium hydroxide, an intermediate form of alumina, by reaction with anhydrous hydrogen fluoride gas that is produced from fluorspar and sulfuric acid. The Alcore process produces hydrogen fluoride from low-cost raw materials, including recycled aluminium smelter wastes.

Aluminium smelting pots use molten cryolite as the electrolyte 'bath' to dissolve the alumina feedstock and allow electrolytic smelting to produce metal. Hydrogen fluoride is regularly added to maintain optimum bath chemistry and efficiency.

Over time, the process generates excess bath, which is periodically removed ('tapped') and typically sold to newly constructed smelters that have a requirement. With few new smelters being constructed, the global bath market has moved into oversupply, and smelters are increasingly finding tapped bath has become a waste product that is difficult to manage. The likelihood that China will ban bath imports will exacerbate the problem.

Against this background, the Alcore process, which recycles waste bath, has the potential to lower the cost of hydrogen fluoride for aluminium producers as well as resolving a potentially costly waste management issue.

Alcore has established a research facility at Berkeley Vale on the NSW Central Coast, north of Sydney with a view to ultimately developing a production facility at Bell Bay, in Tasmania, adjacent to the Rio Tinto aluminium smelter.

Alcore has demonstrated, with a small pilot batch reactor, that the process works and that hydrogen fluoride can be successfully produced from waste bath. Recent and ongoing work has been focussed on optimisation with a view to understanding the most efficient means of extracting maximum recovery. In February 2024, the company reported that it could consistently achieve 70% fluorine recovery. It was observed that large bath particle size was the primary reason for a lower-than-expected recovery rate. New

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equipment allowing for bath feed particle size to be controlled and optimised was subsequently commissioned and in early April, the company reported that single stage recovery of fluorine was at 80% and would reach 88% with further processing.

Optimisation of the existing equipment and process will continue, however, the next critical step to advance development will be the construction of a continuous pilot plant that will enable larger scale batch processing. This will be followed by a continuous process pilot plant ahead of a full-scale production facility.

Alcore is also developing a process to produce aluminium fluoride from lower cost sources of aluminium, including bauxite and dross, another aluminium smelter waste. Laboratory work has been conducted but further development is required.

Bauxite

ABx began life as a bauxite exploration and development company. It has a number of bauxite tenements on the east coast of Australia including the Sunrise Deposit at Binjour, SE Queensland, the Inverell deposit, NSW and various tenements in Tasmania – inclusive of those that hold the IAC rare earths prospects. In total, ABx has a total Mineral Resource Estimate (MRE) of 130 million tonnes of bauxite across the east coast of Australia and Tasmania.

Located near the town of Mundubbera, Qld, the Sunrise project has an estimated resource of 37 million tonnes of bauxite and is being developed initially as a direct shipping ore (DSO) operation. The Sunrise deposit is high quality, metallurgical grade bauxite with a proportion of gibbsite and no monohydrates with lower moisture content than is seen in bauxite mined further north on Cape York. It would also be the only Australian bauxite that would be transported at distance from the Great Barrier Reef.

In early 2022, ABx signed a Joint Venture Agreement with Alumin Pty Ltd to further advance the Sunrise Project. Alumin is a special purpose vehicle owned by Rawmin - an Indian Bauxite miner, marketer and trader who have extensive experience funding long term bauxite projects around the world.

Under the terms of the agreement, Rawmin will contribute up to A\$18 million to the development of the Sunrise Project. Each A\$3.65 million will earn Rawmin 10% equity in the project up to a maximum of 49.9%. ABx has announced that \$18 million will fund all of the operations associated with mine and port development. It is envisaged that that the mine will operate for a minimum of 20 years.

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