Nyrstar Australia Submission to

Australia's Critical Minerals List Issues Paper

17 August 2023

Dear Sir or Madam

NYRSTAR AUSTRALIA SUBMISSION TO AUSTRALIA'S CRITICAL MINERALS LIST ISSUES PAPER

Nyrstar welcomes the opportunity to make a submission to Australia's Critical Minerals List issues paper. The comments contained in this submission are focussed on providing responses to the questions outlined in the issues paper to help inform an updated Critical Minerals List.

Nyrstar is an international producer of critical minerals and metals essential for a low carbon future with operations located in Europe, the United States and Australia. Nyrstar's operating business is wholly owned by Trafigura, one of the world's leading independent commodity trading and supply chain logistics companies.

In Australia, Nyrstar owns and operates a national multi-metals processing and manufacturing business, across two interlinked sites at Port Pirie, South Australia and Hobart, Tasmania. The operations together play a critical role in producing zinc, lead, silver and many other materials that are essential for the manufacture of products used by everyone, every day.

In this submission, Nyrstar provides specific information and data that builds upon its submission to the Critical Minerals Strategy Consultation and a White Paper[1] that it released in June 2023 on the topic of Critical Metals.

Nyrstar's primary recommendation on the Critical List issues paper is that a broader and different approach to the criteria for inclusion on the Critical Minerals List needs to be applied.

Specifically, there are five focal areas that Nyrstar recommends Australia should give greater consideration to in the creation of its Critical Minerals List:

1. The strategic opportunities for Australia to work with allies and trading partners to overcome market constraints and market failure.
2. The resources need of modern industrialised economies including but not limited to the growth of low carbon technologies.
3. The contribution that specific minerals make towards the development and production of technologies and products, ***and*** their ability to unlock or increase the production of other critical minerals.
4. The global nature of risks facing each critical mineral due to rapidly changing market dynamics for demand and supply.
5. An assessment of Australia and its partners' geological resources ***and*** processing capacity.

Nyrstar continues to advocate in this submission for the strategic inclusion of zinc to Australia's Critical Minerals List. Zinc is indispensable in the development and manufacture of a number of key technology streams important to Australian and its international partners, and the supply chain for these streams are now facing considerable risk due to rapid changes in both the demand for the metal, and an increasing concentration of zinc processing within a small number of countries.

Importantly, zinc plays a less recognised but valuable role in unlocking the production of a number of other critical minerals including germanium, gallium and indium. Recognition of zinc as a critical mineral will enable greater impetus for cooperation with international partners on projects that are of mutual strategic benefit and meet the challenge of market failure.

[1] Critical Metals: Australia's opportunity in the energy transition| Nyrstar

Question 1: Is the current set of criteria still fit for purpose?

Australia can't go it alone.

The market for minerals and metals is a global one, with complicated supply chains for products and technologies spanning the globe.

Australia's Critical Minerals List should go beyond the ability for the nation to strengthen its own supply chain for a specific mineral or metal, and instead consider the opportunities or projects where Australia can strategically work together with specific trading partners and allies to mutually overcome market constraints and failure.

Similarly, the Critical Minerals List should consider the extent of concentration of supply sources for a particular mineral and the resulting extent of dependence this creates for Australia and its supply partners. As a result of rapid urbanisation and industrialisation, China increased its production of refined zinc by more than 4,000kt between 2000 and 2021 at a time when many countries closed their refineries.[2] This type of development can be utilised to create strategic advantage for a nation, and in many cases some nations are purposefully strengthening their supply of a mineral or metal to exploit dependence where possible.

Beyond batteries

Despite the current set of criteria to determine inclusion on Australia's Critical Minerals List, Nyrstar has observed that a considerable amount of focus is devoted to those materials that play a role in the production of battery materials.

While batteries are one essential technology, electric vehicles alone are not going to stop global warming. Increases in renewable power and electrification are also essential to reducing greenhouse gas emissions. Beyond energy, Australia should also consider the role minerals and metals play in other emerging technologies and essential products including defence and security, space, agriculture and the health sector. As such, it is recommended that a broader consideration be made of the technologies and products required for Australia and the world's transition to Net Zero, and of the greater landscape of technologies and products essential for the sustainable growth of modern, industrialised economies.

By expanding Australia's strategic approach to critical minerals in this way, a more balanced consideration of other industrial metals will be realised. This will ensure that key supply chains are in place to meet Australia's sovereign needs and increase the role it can play with its partners and across the region.

Economic geological resources ***and*** processing capacity

The current criteria for inclusion on the Critical Minerals List include consideration of Australia's potential economic geological resources for key minerals.

[2] Critical Metals: Australia's opportunity in the energy transition| Nyrstar

Australia's rich endowment of resources needed for important products and technologies places it in a unique position to pick and choose which minerals it strategically focuses on, and potentially how it uses the quality and abundance of certain minerals to meet its needs.

As outlined in Nyrstar's White Paper of June 2023[3], new supply projects are needed from both mining and processing. As such, greater consideration should be placed on the strategic advantage of processing minerals into metals.

Criteria for inclusion on the Critical Minerals List should also consider existing and planned processing capacity in Australia and with key allies, such as Europe and the United States of America. Together this will inform the risks or opportunities for a specific mineral that exist across this specific stage of the supply chain.

Valuing Recycling

Because of the increased demand for critical minerals, it is increasingly important to look for opportunities across the circular economy to maximise the value and opportunities of recycling in Australia.

Australia's Critical Minerals List should take into account the ability to recover and reuse minerals and in doing so increase their supply.

For example, zinc is 100 percent recyclable — it can be recovered and reused without a loss in quality. The zinc industry globally has made significant inroads towards increased recycling, with the amount of zinc produced from secondary raw materials doubling since 2010[4], reducing the requirement for mining, and improving the industry's ESG credentials. Currently, 30 percent of all zinc produced worldwide originates from recycled or secondary zinc.[5]

The zinc and steel industries are working together to increase the quantity of recycled iron and zinc. Designating zinc as a critical mineral would help support technical development and investment to encourage further recycling growth and resulting greenhouse gas reductions.

Greater consideration should also be afforded to the increased recovery of minerals from existing waste or unprocessed stockpiles. This approach can not only reduce the environmental impact of existing minerals facilities but identify opportunities to capture metals and minerals in high demand.

Industry expertise

Australia and other countries have been effective at consulting with industry on the development of its Critical Minerals Strategy. This is important to ensuring appropriate industry insight and expertise are captured.

It is recommended that this consultation be moved however from an 'as needed' or 'just in time' approach to one that provides a stream of continuous industry expertise. Nyrstar recommends that Australia consider the establishment of an Industry Advisory Panel. The panel would provide ongoing, timely and relevant industry data, market insights and expertise to the Government on its Critical Minerals Strategy, the execution of this strategy, the evolution of its Critical Minerals List and ensure consideration was given to global changes in markets and technology. Given the fast-paced geopolitical environment industries are currently operating in, it is of key importance to keep an

[3] Critical Metals: Australia's opportunity in the energy transition| Nyrstar
[4] International Zinc Association (zinc.org)
[5] Critical Metals: Australia's opportunity in the energy transition| Nyrstar

ongoing flow of information and expertise in order to regularly adapt critical mineral definitions and secure reliable supply chains. The panel would be made up of senior executives and / or technical experts from across the resources sector, capturing knowledge from different sectors and stages of the supply chain.

Question 2: For minerals that are currently on the list, or minerals that should be considered for addition to or removal from the list:

In answering this question and its sub-questions, Nyrstar has sought to specifically discuss zinc, a vital strategic metal that it recommends Australia should add to its Critical Minerals List and one that provides the ability to unlock the production of other critical minerals.

Zinc metal or 'zinc' as we will continue to refer to it in this submission is produced from the processing of raw zinc concentrate from mines in Australia and across the world, and from zinc oxides recycled from the steel industry.

a. Which technologies does the mineral feed?

Zinc is a versatile element, resulting in it achieving the status of the fourth most used metal on earth[6].

In consideration of zinc's value in being added to Australia's Critical Minerals List it is imperative that there is recognition of zinc's dual role in its contribution to modern life. The two roles that zinc plays are outlined below.

1. Zinc as a technology component

Firstly, zinc is important to the production of existing and new technologies in of itself, playing an indispensable role in the development and manufacture of thousands of products important to Australia, our trading region, and our strategic partners.

The key technology areas zinc contributes to are outlined in Table 1 below demonstrating the essential role zinc plays in thousands of products across the renewables industry, defence, healthcare, agriculture, transportation, manufacturing and industrial sectors.

Zinc plays a major role in limiting the carbon impact from carbon intensive existing industries, through prolonging the life of steel and concrete. In fact zinc has a major multiplier effect in this regard with relatively small coatings of zinc greatly prolonging the life of consumer goods, industrial products, buildings and key infrastructure.

Technology Stream	**Zinc's contribution**
Renewable energy	▪ Zinc plays a critical role in enabling renewable technologies because of its contribution to corrosion protection through galvanizing steel. Because of this zinc is a key ingredient in extending the life of solar and wind installations. ▪ Zinc is also a key component in solar cells, with some solar PV technologies requiring zinc to increase efficiency.

[6] Australia's Identified Mineral Resources 2013| Geoscience Australia

Batteries	▪ Zinc-based battery technology offers an alternative to governments and industry to de-risk lithium by diversifying its supply chain. ▪ Zinc batteries are considered safer than lithium-ion batteries and being produced today for grid storage and microgrid generation as well as for the electronics, marine, aeronautic and military sectors.
Defence	▪ Zinc is playing an important role in galvanizing defence platforms including aircraft, helicopters, amphibious ships, infantry fighter vehicles and armoured personnel carriers. ▪ Zinc is extending the life of many platforms, reducing costs of maintenance, and improving their availability to the Defence Forces that depend upon them.
Agriculture and Health	▪ Zinc fertilizer increases crop yield and nutrition quality, while improving water uptake, resulting in healthier, stronger crops. ▪ The role zinc plays in fertilizers is helping improve global food and nutrition security. ▪ Zinc is vital for the human body's processes supporting growth, enabling a healthy diet and strengthening our immune system.
Transportation	▪ Zinc is used in the production of high-strength, light-weight galvanized steel offering fuel and emissions savings for internal combustion, hybrid and electric vehicles. ▪ Today, virtually all manufacturers have adopted zinc-coated steel versus aluminium for their high-volume production electric and hybrid-electric vehicle models.
Infrastructure	▪ The growing need for roads, bridges, and other essential infrastructure across Australia and Southeast Asia will require significantly more zinc for galvanizing steel.
Green buildings	▪ Rolled or shaped zinc products in the building industry is helping increase the lifespan and lower maintenance of buildings while improving thermal and acoustic properties and being 100 percent recyclable.
Engineering materials	▪ Zinc mechanical properties make it a superior choice for inclusion in alloys in the creation of strong, durable and cost-effective engineering materials. ▪ These properties together with superior finishing capabilities see zinc alloys used in the production of products for the Defence, Health and Automotive industries and many others.

Table 1: Zinc and Technology Streams[7]

[7] International Zinc Association (zinc.org)

2. Zinc's role in unlocking other critical minerals.

Secondly, the processing of zinc can enable the unlocking of a range of other critical minerals, increasing their recovery and production, each of which are important to global, regional and domestic supply chains.

Increased production of zinc opens the door for Australia to create a greater level of sovereignty with respect to critical minerals production and support the diversification of supply chains.

The minerals able to be unlocked by zinc-lead processing includes the by-products indium, germanium, gallium, manganese, antimony and bismuth. These minerals and their application in technology are briefly outlined in Table 2.

Nyrstar supports retaining these minerals on Australia's Critical Mineral List due to their significant requirement for a range of modern technologies.

Critical Mineral Unlocked by Zinc-Lead Processing	**Technology Application**
Germanium	▪ Important for semiconductors, fibre and infrared optics, electronics and solar electric applications. ▪ Used for night vision goggles, thermal imaging and infrared scopes in military applications. ▪ Also used in satellites and fire alarm systems.
Gallium	▪ Used as a doping material for semiconductors and has been used to produce solid-state items such as transistors and light emitting diodes. ▪ Used as a semiconductor in mobile phones and sensors for touch switches. ▪ Used in high temperature thermometers. It forms alloys easily with most metals and is used to create low-melting alloys. ▪ Gallium can produce laser light directly from electricity and is used in solar panels.
Indium	▪ Used in flat-panel TVs and smartphones, semiconductors, solders, alloys and compounds. ▪ Also used over windshields of aircraft or cars, as it allows the glass to demist and reduces air conditioning requirements.
Manganese	▪ An alloy used in steel and aluminium and used in batteries and fertilizer. Commercial alloys of aluminium contain manganese to improve corrosion resistance and mechanical properties.
Antimony	▪ Used in lead acid batteries and flame-retardant plastics including PVC and PET. As alloys, it goes in lead storage batteries and into solder, sheet and pipe metals, bearings and castings.

Bismuth	▪ Predominantly used in pharmaceuticals and chemicals. Non-toxic metal with anti-bacterial properties. Bismuth is widely used in medicine and is a good replacement of lead in alloys, including shot, bullets and ammunition.

Table 2: Technology Applications of Critical Minerals Unlocked by Zinc Processing

It is the duality of zinc that significantly increases its importance, supporting its inclusion on Australia's Critical Minerals list. This duality of zinc provides opportunities to increase the supply security for Australia and its partners across a range of technologies and applications beyond what would have been otherwise considered.

b. What evidence is there of supply chain disruption relating to those minerals?

A demand-supply imbalance exists in the global market for zinc. This together with a heavy concentration of supply presents significant risk – that equates to virtual market failure – to the production of key technologies for Australia and its partners both now and into the future.

Rapid changes in zinc demand

The world is experiencing real and rapid change to the market for metals that are creating real risks to potential supply disruption for zinc and the many other critical minerals it unlocks.

Over the past 20 years, China's construction growth has been the engine of demand for zinc, however this has changed as a result of net zero targets around the world.

According to Trafigura Research and industry estimates, annual demand for zinc from all sources (including renewable energy, infrastructure and consumption, machinery and transport and consumer goods) is expected to grow by a total 2.5 million to 3 million tonnes between 2020 and 2030, equivalent to around 20 per cent of current global supply.[8]

Australia is a part of this demand equation with domestic use of zinc projected to continue to increase in coming years as more wind, solar and hydro renewable capacity is developed.

Supply chain risks[9]

Based on current supply forecasts it is expected that a supply gap in zinc of up to 1.7 million tonnes a year will emerge by the end of the decade. This shortfall is the equivalent of 150 percent of Australia's current total zinc mining output.

At the same time as the demand for zinc is changing, the supply chain is concentrated. Since 2020, China's output for zinc has far outstripped the world, both in mine and smelter production. This has enabled China to produce a wide selection of customer-ready products to the market and assume a dominant position in global metals processing.

[8] Critical Metals: Australia's opportunity in the energy transition| Nyrstar
[9] Trafigura Research, CRU, Wood Mackenzie

Conversely, Europe has transitioned to becoming a net-importer of processed zinc, increasing its dependence on other regions and minimising the opportunities available to it from unlocking other key critical minerals.

In this environment Australia's role in zinc's supply chain to the region is important, providing around 18 percent of Southeast Asia's refined zinc and alloy imports in 2022.

Rather than more supply being brought on to meet the demand for zinc, over the past 11 years zinc inventories have been drawn down to dangerously low levels. At the end of 2022, visible zinc stocks were less than a week of global consumption and this trend has broadly remained through the start of 2023.

Due to years of metal prices below incentive levels, there has been a limited number of new mines or new processing in the region brought to bear. With increasing costs and time required to bring on more supply, it is expected that the supply challenge will not be solved quickly.

Without an increase in the extraction of zinc concentrate, and the processing of zinc metal, numerous cracks in the supply chain for hundreds of products across essential technologies will emerge. Furthermore, if no production increases are brought to bear by Australia and its partners, and soon, zinc and other critical minerals processing will remain concentrated presenting risk to the nation, the region and our partners.

c. What market, financing, technical or other barriers affect these supply chains?

Responding effectively to market failure

The need for critical minerals lists globally reflects the reality that markets alone have been unable to ensure balanced supply of metals to countries for the energy transition and to meet strategic need. In many cases, increased extraction and processing of minerals and metals requires stimulus, be it from co-investment with government, streamlining of processes and other forms of support and finance.

Trade-related market changes

As demonstrated in July this year - when China announced restrictions on exports of germanium and gallium - changed market conditions as a result of government policy changes can impact the supply of critical minerals and represent a barrier for important supply chains that include some critical minerals.

Decarbonisation cost challenges

Nyrstar's Hobart Zinc refinery today accounts for between 50 and 60 percent of Australian exports of refined zinc. The site works together, with Nyrstar's Port Pirie multi-metals smelter as a circular economy. Port Pirie produces zinc fume that is exported for further processing at Hobart to create export grade zinc.

Processing at Port Pirie is described as 'hard to abate' as the processes rely on primary energy sources such as coke, coal and natural gas. There is no proven technology to replace these high emission intensity sources for heating up furnaces and as reductants.

Policy changes in Australia are resulting in increased costs for production of zinc fume in Port Pirie due to its energy portfolio today. Targeted financial support from Government will be required to

implement projects to meet aggressive decarbonisation targets and support transitionary efforts. Aligning support for decarbonisation investments with critical minerals needs make sense.

Capital intensive projects

Increasing Australia's supply of zinc is possible through a range of projects that Nyrstar can undertake at Port Pirie in South Australia and Hobart in Tasmania. Doing so will also enable the increased production of other critical minerals including Germanium and Indium.

These projects are capital intensive and not commercially viable without Government financial support. They can involve relatively low tonnages of production and as processing is concentrated can be subject to market price volatility requiring Government investment and support.

d. Are the barriers or supply chain disruption risks more acute in certain applications or levels of mineral grade or purity than others?

Zinc smelters provide a critical bridge between mineral to metal, adding value to Australia's multiple mine producers and strengthening the supply chain in the region.

The potential for supply chain disruptions for refined zinc are compounded by the limited number of smelters in Australia. Today, Nyrstar's Hobart Zinc refinery accounts for 50-60 percent of Australia's export for refined zinc underscoring the importance of its continued operations. The potential loss or disruption to Australia's zinc processing therefore represents a critical risk to the production of zinc and the industries it enables.

The United States' zinc processing capability is similarly concentrated with only one facility in operation, a factor that has led to raising the importance of zinc as part of that nation's strategic approach to critical minerals.

Metal smelters also require a long lead time for development and require a boutique set of skills to design, build and operate. The opportunity exists in Australia to expand its existing zinc processing infrastructure, build on its comparative advantage, and in doing so strengthen the supply chain infrastructure already in place for the region.

3. Should Australia differentiate between criticality or importance of minerals, and the capability to process them, through categories within the list or a separate category that sits alongside the list? This differentiation could reflect the size and maturity of markets and the different challenges or barriers faced.

It is recommended that Australia's Critical Minerals List consider the broad needs of a modern economy and in doing so create a list that identifies those minerals that it will strategically focus on.

Each mineral within that list will require separate pathways and actions to meet the challenges and barriers presented. Creation of separate lists to categorise those challenges would at this stage appear to complicate the process with little advantage.

It is imperative that Australia also consider the ability of metals to unlock the production of other critical minerals. If these 'carrier metals' like zinc are not prioritised the opportunities of developing a broader metals value chain will be lost.

4. What lessons could be learned from other countries' approaches or the ways in which they consider their criteria for listing critical minerals?

There are a number of countries that Australia can learn from when considering criteria for listing critical minerals. Some of these are outlined below.

Canada[10]

Australia would benefit from exploring the approach taken by Canada in developing its Critical Minerals List. Today Canada identifies 31 minerals and metals the country deems essential.

In particular Canada's selection of minerals and metals goes beyond solely exploring their use in low carbon energy technologies. Instead, they look at what is required in the development of a wide range of essential product or technology types as listed below. In doing so they are considering what is required for their broader economic success.

Product sectors considered by Canada in its evaluation of Critical Minerals:

- Renewable energy production and storage;
- Electric vehicle batteries and motors;
- Defence and security technologies;
- Consumer electronics; and
- Critical infrastructures.

The development of Canada's Critical Minerals List importantly not only considers what is essential for its own economic security, but places importance on providing a sustainable source of critical minerals for its trading partners. This criterion has guided Canada in its formation of plans or partnerships with international partners to align policies, advance joint research and development, and encourage new investment opportunities.

These considerations led to Canada including zinc in its Critical Minerals List in 2021, as part of its strategy to build critical mineral value chains and play a role in helping supply the world with responsibly sourced products and mitigate the risk of global supply chain disruption.

United States[11]

Australia would benefit from exploring the approach taken by the United States in development of its list of Critical Materials.

The US places an importance on the function of minerals and metals in manufacturing sovereign products beyond solely low carbon energy applications and considers more broadly the contribution of technologies and products that have a potential impact on the economy or national security.

In line with this approach the US has published a "Critical Materials List" and also has various agencies that identify lists aligned to their areas of focus.

The US list of Critical Minerals also considers more than just supply and demand in its evaluation of minerals, and instead also assigns value to the concentration of supply and the impact of what it refers

[10] The Canadian Critical Minerals Strategy – Canada.ca
[11] Critical Minerals and Materials Program| US Department of Energy

to as a 'single point of failure' – deeming when supply is concentrated in one country, the risk factor is higher.

These considerations enabled the US Government to add zinc to its Critical Minerals List in 2022. This appears to be part of a clear shift in strategic thinking to prioritise sovereignty and support supply chain diversification and independence.

South Korea[12]

Given Australia's strategic cooperation agreement with South Korea on Critical Minerals Supply Chains it would benefit from exploring the approach they have taken in development of its own list of key minerals.

The South Korean Ministry of Trade, Industry and Energy (MOTIE) recently defined 33 elements as key minerals – including zinc - and 10 of them as "strategic".

The determination of its lists reflects the significance of certain minerals to South Korea's advanced industries such as semiconductors and batteries. However, it also reflects the inherent supply chain risks of these elements.

South Korea's aim in the development of these lists is also to reduce its dependence on specific nations to better secure national economic security. Its consideration of the amount and location of imports of certain minerals is therefore an integral part of its determination of what metals are included on its list.

The lists are guiding South Korea's efforts in strengthening bilateral and multilateral cooperation on critical minerals to help secure and protect supply chains.

5. What should trigger an update to the list? For example, global strategic, technological, economic or policy changes.

The energy transition the world is facing is creating change rapidly as countries increase their demand of technologies and products, they need for both industrialising and lowering their carbon footprint. In addition, geo-political tensions are disrupting global supply chains on a continuous basis.

Because of this disruption an approach that continuously scans for issues and changes in the global strategic environment is recommended. This is preferred to setting an arbitrary time period for revisions to be made to the list, as it would result in opportunities being missed and risks being ignored.

Australia should also consider how it works cooperatively with allies to keep informed of different risks and opportunities that are materialising at a global or regional level as this may trigger updates to the list or changes to strategy.

South Korea is developing an 'early warning system' to detect risks to supply chains and inform its approach to stockpiling certain minerals and how they are released to prevent economic disruption. This approach to an early warning system could be deployed by Australia or in a multilateral approach with allies.[13]

[12] Ministry of Trade, Industry and Energy| Republic of Korea
[13] Ministry of Trade, Industry and Energy| Republic of Korea

Summary

Nyrstar appreciates the opportunity to contribute to this consultation process and would welcome the ability to provide further input into the process where required.

Nyrstar supports the Australian Government's vision of supporting diverse, resilient and sustainable supply chains for its critical minerals sector, and its objective to build a sovereign capability in critical minerals processing. This strategy will require both Government and Industry to work together to be successful.

If further information on any of the recommendations or issues raised in this submission are required, please do not hesitate to contact us through Cullen Bailey (Regional Head of Corporate Affairs) at cullen.bailey@nyrstar.com.