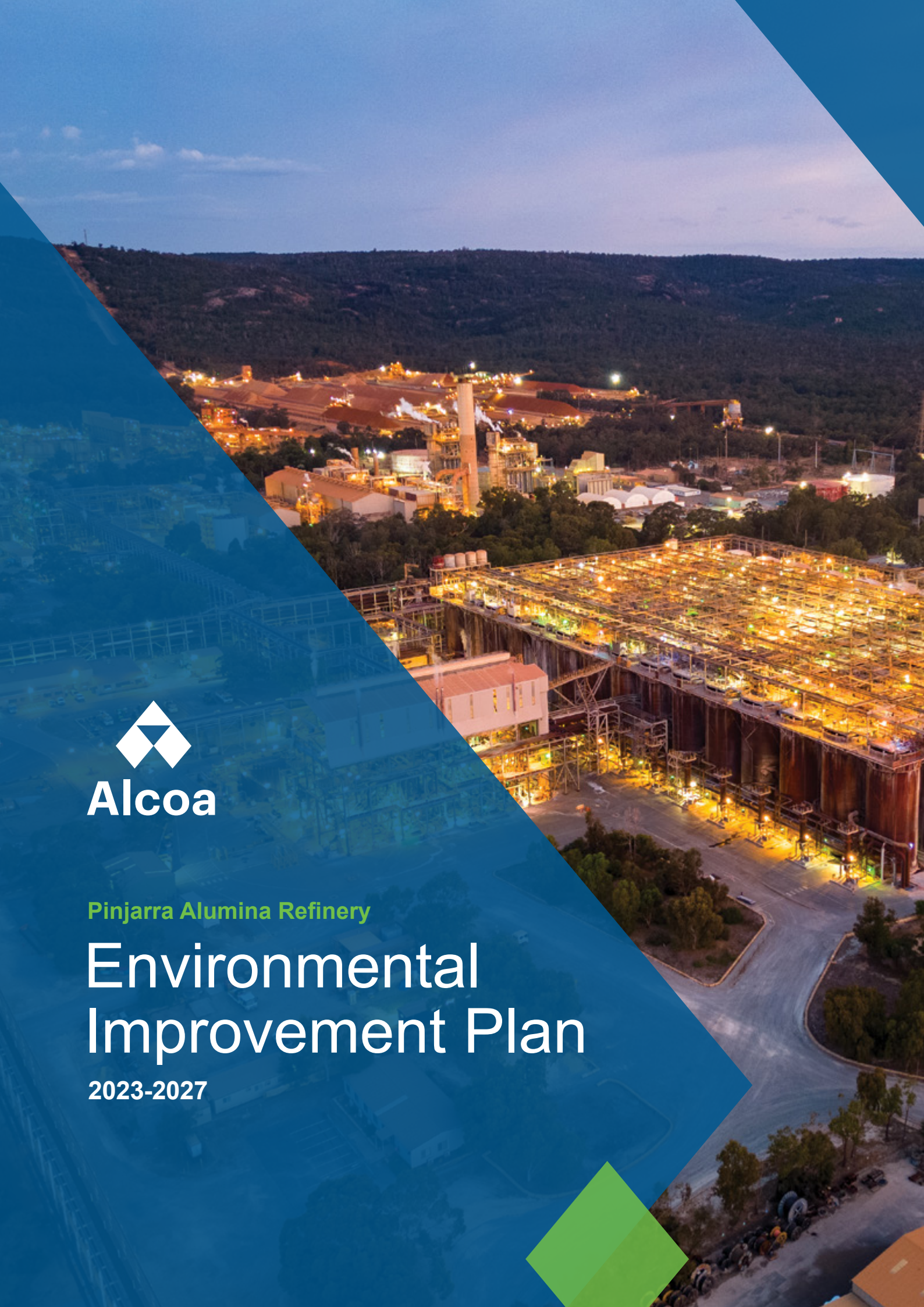


Alcoa

Pinjarra Alumina Refinery

Environmental Improvement Plan

2023-2027

Contents

For more information on Alcoa of Australia's Environmental Improvement Plans please visit **www.alcoa.com.au/sustainability/reports-publications**

Overview and acknowledgements

In April 2006, Alcoa of Australia (Alcoa) released for the first time an Environmental Improvement Plan (EIP) for each of its sites in Western Australia. EIPs are a voluntary initiative by Alcoa and were a first for industry in Western Australia. Subsequent plans have continued to be released at regular intervals by Alcoa since 2006.

This EIP outlines Alcoa's commitment to continuously improve the environmental performance, reduce environmental impacts and develop more sustainable operating practices for the Pinjarra Alumina Refinery (the refinery). This EIP also forms part of the refinery's current operational plan.

Alcoa recognises that input from stakeholders was vital to the development of this EIP. The environmental targets, aims and actions have been established thanks largely to key stakeholders which include community members, local government representatives, regulators and Alcoa employees.

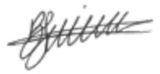
Alcoa is committed to the communities surrounding the refinery and acknowledges that initiatives based on ideas from key stakeholders help to maintain continuous improvement. It is also the intention that this EIP will give the local communities a much better understanding of Alcoa's operations.

External involvement and review is integral to the success of this EIP and the information on the following pages can be useful to measure progress in achieving set targets.

Sincere thanks are extended to everyone involved in producing this EIP, particularly members of the Pinjarra Community Consultative Network (CCN) who have given their personal time to help Alcoa progress environmentally. The EIP consultation process is a working example of community, government and industry coming together for a common purpose.

Tom Duxbury

Operations Manager
Pinjarra Alumina Refinery



Ben Miles

Environmental Manager
Pinjarra Alumina Refinery

Overview of Alcoa's Australian operations

Alcoa has been sustainably mining, refining and smelting in Australia since 1963 and is active in all major aspects of the aluminium industry. The company employs approximately 4,300 people, predominantly in regional Australia.

Principal operations in Western Australia

- Huntly Bauxite Mine
- Willowdale Bauxite Mine
- Kwinana Alumina Refinery and Port
- Pinjarra Alumina Refinery
- Wagerup Alumina Refinery
- Bunbury Port

Principal operations in Victoria

- Portland Aluminium Smelter

Australian operations

The Huntly and Willowdale bauxite mines in the Darling Range south of Perth supply bauxite to Alcoa's three alumina refineries at Kwinana, Pinjarra and Wagerup. These refineries extract alumina from the bauxite. The Huntly mine is the world's second largest bauxite mine.

Alcoa's aluminium smelter is located at Portland in Victoria. Portland Aluminium Smelter is a joint venture between Alcoa of Australia Limited (45 per cent), which manages the day-to-day operations; Eastern Aluminium Portland Pty Ltd (10 per cent) (a wholly owned subsidiary of Alcoa of Australia Limited); CITIC Nominees Pty Ltd (22.5 per cent); and Marubeni Aluminium Australia Pty Ltd (22.5 per cent).

The aluminium we produce is an important part of a modern, sustainable life, critical to a decarbonised future and 100 per cent recyclable.

Pinjarra Alumina Refinery

The refinery is located 90 kilometres south of Perth, a 30-minute drive from the coastal city of Mandurah and six kilometres, or a 10-minute drive, east of the regional town of Pinjarra. It is situated in the Peel region of Western Australia, within the Shire of Murray and is a major regional employer with approximately 1200 employees.

Bauxite mined from the Huntly mine supplies the refinery which officially opened in 1972. The refinery is one of the world's largest alumina refineries with approval to produce up to 5 million tonnes per annum of alumina. At the time of publication of this EIP Alcoa had commenced environmental and social studies, and stakeholder engagement to support an application for approval of incremental production growth up to 5.25 million tonnes per annum.

Combined with its co-generation partnership with Alinta Energy, the refinery achieves reductions in greenhouse gas emissions and improvements in the use of natural resources.

Air quality management

The management of air quality from the refinery is of upmost importance to Alcoa, the community, government and regulators.

For many years, Alcoa has conducted extensive investigations into emissions produced from alumina refining and has a thorough understanding of the range and concentration of chemical compounds present in processes and how to effectively manage them.

In 2008, Alcoa commissioned an independent Health Risk Assessment (HRA) for the refinery and residue storage area (RSA) as part of the Pinjarra Efficiency upgrade to 4.2 million tonnes per annum. In 2014, the refinery's HRA (Environ, 2014) was updated to reflect Alcoa's intent to incrementally increase the refinery's alumina production capacity to 5 million tonnes per annum. The results of the 2014 Health Risk Screening Assessment (2014 HRA) indicated that, based on a 5 million tonne per annum production scenario, the potential for emissions to cause acute or chronic non-carcinogenic health effects as well as the potential for emissions to contribute to the incidence of cancer in the exposed population remains low. The results of the 2014 HRA were subjected to peer review (Professor Philip Weinstein, 2015), with the outcomes of the 2014 HRA and the peer review submitted to the Western Australian Environmental Protection Authority. Both documents are available at **www.alcoa.com.au**. Alcoa continues to build upon previous HRAs by conducting further assessments where required to appropriately manage any major operational changes for the refinery.

The primary air emissions from the refinery include nitrogen oxide (NOx), carbon monoxide (CO), particulates in the form of alumina dust, volatile organic compounds (VOC), residue dust and trace levels of metals.

Nitrogen oxide (NOx), carbon monoxide (CO) and particulates

Emissions of NOx and CO come from the use of fossil fuels such as natural gas and are released from the refinery's powerhouse, calciners, oxalate kiln and digestion regenerative thermal oxidiser. Emissions of particulates are released from the calciners (in the form of alumina dust) and to a much lesser extent, the oxalate kiln.

Volatile organic compounds (VOC)

VOC emissions are caused by the breakdown of organic material contained in the bauxite, additives to the refining process (liquor stream) and in by-products of fuel combustion processes.

During alumina refining, the organics produce a range of substances, some of which are emitted to air. The VOC emissions cause the odour associated with alumina refineries.

Greenhouse gases

Since 2005, Alcoa Corporation has achieved a reduction of 47 per cent of its climate related emissions (absolute emissions basis). In order to support the Paris Agreement and align our efforts with the <2ºC decarbonisation path, we have refreshed our greenhouse gas reduction commitment to reducing our greenhouse gas emission intensity (scope 1 and scope 2) by 30 per cent by 2025 and 50 per cent by 2030 from a 2015 baseline.

Through productivity improvements and technological innovation, Alcoa will continue to target a reduction in greenhouse gas emission intensity of its operations, while striving to increase production. This is highlighted by a partnership between Alcoa and the Australian Renewable Energy Agency which will see an electric calcination trial project undertaken at the refinery in the near future. Planning for the implemention of the project commenced in 2023. The project will trial technology to electrify the refinery's calcining process to further understand the feasibility of substituting fossil fuel usage with renewable electricity to support decarbonisation of the alumina refining process. Energy and water savings are other potential benefits Alcoa could also achieve from successful implementation of such technology.

Dust

The main source of dust from the refinery is from the RSA. High wind speeds have the potential to pick up and transport fine dust particles from dry residue surfaces.

Dust generated from the RSA mainly consists of fine clay particles and sodium carbonate crystals. Sufficient concentrations of this material could be an irritant to the eyes and respiratory tract. Monitoring and modelling data illustrate it is extremely unlikely to reach levels sufficient to affect neighbouring communities in this way. Dust is also generated at the bauxite stockpiles area. This dust has not been treated with caustic and has similar properties to background dust from the Darling Range. Alcoa has several ambient dust monitoring stations located around the refinery. Dust emissions from the refinery and RSA are monitored daily. This data is used to assess the effectiveness of dust control measures and facilitate improvements in management practices where required.

Noise

The closest noise sensitive premises to the refinery's boundary are approximately four kilometres to the south and north-east. Alcoa undertakes regular noise monitoring programs to assess noise emissions from the refinery. Findings from these programs are utilised to inform ongoing noise amelioration projects across the refinery.

Air quality improvement targets

Dust	
Objective	**Action**
Minimise risk of dust generation from the refinery and RSA and aim to maintain dust level below internal target at the Pinjarra racecourse monitor.	Actively manage dust and investigate opportunities to further improve management practices. Investigate opportunities to further improve particulate control on calciners and implement where practicable. Continue using weather forecasting to actively manage dust. Commence implementation of Phase Two of the Pinjarra Residue Filtration Facility. Continue use of temporary dust monitors to manage construction / project dust where required. Review dust monitoring network coverage in relation to current and future proposed operations.

Air quality	
Objective	**Action**
Continue to investigate options to reduce air emissions.	Investigate options for reducing greenhouse gas emission intensity. Investigate and trial electric calcination as an option for reducing greenhouse gas emissions from calciners. Update the CCN on air emission management, trends and improvements. Identify major sources of air emissions, investigate opportunities for reductions and prioritise according to practicality and environmental benefit. Conduct refinery boundary odour study and consider additional odour studies where required.

Noise	
Objective	**Action**
Compliance with the Environmental Protection (Noise) Regulations 1997.	Continue implementing the refinery's noise management plan. Update the CCN on progress of the noise amelioration plan. Investigate opportunities to include noise reduction measures for new and existing infrastructure across the refinery where practicable.

Water conservation and management

Water use

The refinery operates a closed water circuit which is supplemented for water loss. Water loss primarily occurs through steam and moisture from the process, evaporation from water storage areas and residue surfaces, and water bound within the residue mud and sand.

To supplement this loss, water is abstracted from licensed groundwater and surface water sources. In addition, water is added to the circuit from:

- Secondary treated effluent from the Water Corporation's Pinjarra sewage treatment plant.
- Water contained in the caustic soda and bauxite.
- Rainfall runoff from the refinery and RSA.

The refinery's water supply relies heavily on abstraction from surface water and groundwater sources. In low rainfall years, extra water is drawn from the groundwater source in accordance with the conditions of water licences issued by the State Government regulator, the Department of Water and Environmental Regulation (DWER).

Alcoa continues to investigate opportunities to increase the refinery's water efficiency and to identify alternative water sources. This included finalising a refinery water security supply assessment in early 2022 which identified preferred long-term water supply options. Alcoa has commenced investigating the implementation requirements for the preferred options which include low quality externally supplied water.

Groundwater management

Alcoa regularly monitors bores located across the refinery, RSA and surrounding farmlands. The bores are of varying depths and allow for water quality and depth monitoring in each of the aquifers beneath the landholdings. Water monitoring results are reported annually to the State Government regulator (DWER).

The refinery has a two-phased approach to groundwater management, encompassing spill prevention and remediation:

- A spill prevention program that targets areas with the highest potential for spills to occur.
- The remediation strategy requires plans be developed to remediate existing contamination and engineering solutions devised to treat root causes and prevent potential future contamination.

Water use improvement targets

Water use	
Objective	**Action**
Manage the Cattamarra Aquifer within its sustainable yield.	Update the CCN on the refinery's water management and conservation programs. Continue implementing a stepwise approach to monitoring the potential impact of Cattamara abstraction on the Conjurunup Creek and South Dandalup River.
Increase efficiency of water use at the refinery.	Investigate further dust control measures for bauxite stockpiles and RSA which are not solely reliant on water. Commence implementation of Phase Two of the Pinjarra Residue Filtration Facility. Progress investigations of implementation requirements for preferred long-term water supply options including low quality externally supplied water.

Groundwater	
Objective	**Action**
Zero major incident loss of containment events.	Continue to implement the refinery's Dangerous Goods Improvement Plan and update the CCN.
Minimise offsite groundwater impacts from site activities.	Continue to review and implement the remediation strategy for the refinery and RSA.
Actively manage contaminated sites investigation and reporting requirements for refinery landholdings.	Implement requirements of the *Contaminated Sites Act 2003* in line with contaminated sites guidelines as agreed between Alcoa and DWER.

Land stewardship

The refinery and RSA are surrounded by Alcoa owned farmlands. Within the refinery and RSA, the main area of significant vegetation or habitat is located within the rail loop. However, the refinery's farmlands contain most of the native vegetation and habitat within Alcoa's Pinjarra landholdings.

There are several areas of regional significance within the refinery landholdings including declared rare and priority flora, threatened ecological communities, conservation category wetlands and heritage sites.

Alcoa aims to protect the biodiversity located on its landholdings. Focus is placed on the areas of greatest significance, such as the conservation category wetlands and priority flora and fauna.

Management of the land in and immediately surrounding the refinery and RSA is detailed in the refinery's Long Term Residue Management Strategy (LTRMS). The LTRMS is updated at regular intervals by a Stakeholder Reference Group (SRG) that includes community, government and Alcoa representatives. The LTRMS contains guiding principles developed by the SRG to provide Alcoa with guidance on how the stakeholders would like the RSA to be managed.

Heritage

Many heritage sites, both Aboriginal and European, are located across Alcoa's Pinjarra landholdings. Alcoa completed detailed heritage studies across these landholdings in multiple locations in 2022 and continues to undertake further heritage studies where required to ensure heritage sites are identified and managed appropriately. Furthermore, Alcoa has commenced the process of updating the refinery's Cultural Heritage Management Plan (CHMP). Central to the heritage studies and CHMP development is Alcoa's ongoing consultation and engagement with Traditional Owners.

Land stewardship improvement targets

Land stewardship	
Objective	**Action**
Actively manage Alcoa's Pinjarra landholdings to conserve natural ecological attributes.	Implement initiatives from the refinery's Land Management Plan and update the CCN. Continue feral animal and weed control programs. Adopt, where practicable, research findings and advice relevant to pest and weed control. Continue kangaroo management program. Continue visual amenity improvement program, which includes the use of fire-retardant vegetation within Alcoa's Pinjarra landholdings. Maintain species protection for the declared rare flora *Synaphea stenoloba* which is represented in several populations on Alcoa's Pinjarra landholdings. Undertake appropriate flora and fauna surveys, as required, for new projects and to inform future approval applications. Communicate land management activities to the community via the CCN. Consider completion of a Dieback assessment in the unmapped areas within Alcoa's Pinjarra landholdings.

Heritage	
Objective	**Action**
Actively manage Alcoa's Pinjarra landholdings to protect heritage attributes.	Develop and update, where required, a site-specific Aboriginal Cultural Heritage Management Plan. Continue ongoing consultation and engagement with Traditional Owners regarding heritage management on Alcoa's Pinjarra landholdings. Undertake appropriate heritage surveys, as required, for new projects and to inform future approval applications. Communicate heritage management activities on Alcoa's Pinjarra landholdings to the community via the CCN.

Visual amenity	
Objective	**Action**
Improve visual amenity of the refinery and RSA.	Residue rehabilitation to be self-sustaining and account for visual amenity. Progress development of a long-term visual amenity plan, considering the refinery's current and potential future footprint and future surrounding land uses.

Waste management

The refinery produces both process and non-process waste. Process waste is produced directly from the Bayer process (primarily waste alumina, hydrate, sand, mud and scale). Non-process waste is generated by activities associated with refinery operations and domestic waste.

Innovation improves bauxite residue processes

Alcoa commissioned Phase One of the Residue Filtration Facility at the refinery in 2019. With this innovative technology, bauxite residue generated from the alumina refining process is forced through very large filters that squeeze out the wastewater, which is recycled in the refining process. The filtered material allows for more efficient utilisation of the existing RSA, deferring the need to build new storage areas. The water recovered from filtration also reduces the refinery's freshwater needs. The project follows the successful commissioning of a similar plant in 2016 at Alcoa's Kwinana Alumina Refinery in Western Australia. In 2023, Alcoa applied for State Government approvals required to implement Phase Two of the Pinjarra Residue Filtration Facility.

Recycling and refinery worm farm

Alcoa is focused on minimising the amount of landfill waste generated by its operations. Several recycling initiatives are in place at the refinery including e-waste recycling and a three-bin system to collect recyclable, landfill and organic waste.

Organic waste, or worm food waste, is sent to Alcoa's worm farm based at the refinery where it is used for composting and landscaping across the site. Worm food consists of organic material such as food wastes, shredded paper and paper towels; in fact, it includes 'anything that lived'. The worm farm has been in operation since 1995 and processes almost 80 tonnes of waste from Alcoa's Western Australian operations every year.

Bauxite residue - beneficial by-product

For more than 35 years, Alcoa has been investigating opportunities to produce economically viable products from bauxite residue. By identifying and demonstrating a range of alternative uses, bauxite residue may become a resource rather than a waste in the future.

Alcoa's residue sand is currently used for RSA construction, with excess sand being stored within these storage areas. Alcoa has also developed a process to wash and carbonate the sand so that it can be considered for alternative value-adding applications. The resulting product is known as Red Sand™ and is physically similar to crushed bauxite.

Red Sand™ is a well-structured material that has good structural properties required for fill and exhibits beneficial phosphate retention properties. Red Sand™ has been successfully trialled in various applications, including turf top dressing, road base construction, fill for industrial land development and as an alternative material for golf course bunker sand.

Oxalate

Oxalate is a waste stream of the Bayer process that builds up in the caustic stream. The refinery recycles caustic through the process and as the oxalate content increases, the process becomes less efficient. To maintain efficiency, the oxalate must be removed. The waste oxalate is destroyed using two different processes; via the oxalate kiln and the oxalate bio-removal facility.

Upgraded in 2022, the oxalate bio-removal facility at the refinery uses naturally occurring bacteria to breakdown the oxalate. The bio-removal process consumes significantly less energy to operate than the oxalate kiln and produces bicarbonate and carbonate which is re-introduced into the caustic stream.

Circular economy

Alcoa initiated a collaborative project with industry experts in 2022 to undertake a review of the refinery's production process and associated waste streams. This project aims to identify and define pathways for the refinery to develop a circular economy which improves resource efficiency, minimises waste outputs and enhances waste reuse.

Waste management improvement targets

Waste management	
Objective	**Action**
Minimise waste to landfill.	Update the CCN on waste management and recycling performance. Promote recycling programs within the refinery. Investigate options for alternative use / reuse of waste streams.
Progress towards a long-term solution for oxalate management.	Implement initiatives for improving the performance of the refinery's oxalate management systems and investigate options for increasing oxalate destruction capability.

Community involvement

The refinery has the benefit of a dedicated CCN which provides community feedback and input on issues of interest to both the community and Alcoa.

For Alcoa, this engagement is a fundamental component of managing its operations and growth projects. It makes the company more responsive to community views and creates new opportunities to work in partnership with communities on local issues.

The CCN was formed in 1994 and provides input on a range of issues relating to the refinery and mining operations, local community matters and issues relevant to the Peel region.

With members of the CCN including people active in their community, the process provides a means for Alcoa to reach its stakeholders and for Alcoa to have a greater understanding of the needs of the community. The CCN enables representation from neighbours, townspeople, local business owners and local and state government. Smaller working groups are formed as needed from the CCN such as the Environmental Improvement Plan Working Group and the LTRMS SRG.

Environmental regulation and management

Alcoa's Western Australian operations are subject to environmental regulation under the *Environmental Protection Act 1986* and are licensed by DWER. Alcoa is committed to meeting the terms and conditions of its environmental licence and environmental approval conditions.

Alcoa's commitment to this EIP is voluntary. It both complements and exceeds the requirements of the refinery's environmental licence.

Environmental protection licence

The refinery's environmental licence is administered by DWER and includes emission limits and other conditions to ensure environmental impacts are managed appropriately.

Specific areas covered by the licence include:

- Reporting.
- Ambient dust monitoring and control.
- Air emission limits, targets, monitoring and reporting.
- RSA management.
- Water quality monitoring and criteria.
- Liquid chemical storage.
- Waste acceptance at landfill.
- Storage of oxalate.

The refinery's Environmental Management System (EMS) is certified to the international standard ISO14001:2015 which requires Alcoa to identify activities with the potential to significantly affect the environment, define the controls in place to manage those risks and develop action plans for improvement. The EMS enables the refinery to meet its environmental licence requirements and deliver on commitments made in this EIP.

National Pollutant Inventory

The National Environment Protection Council launched the National Pollutant Inventory (NPI) in 2000. It provides communities with environmental emissions data and aims to satisfy community demands for this information, as well as assist governments and industry with environmental planning and management. Emissions to air, land and water are reported.

The NPI is published on the Australian Government's NPI website (**www.npi.gov.au**). This database contains information about emissions from large operations and the estimates of emissions from smaller business activities such as petrol stations, dry cleaners and fast-food outlets. The refinery reports to the NPI annually.

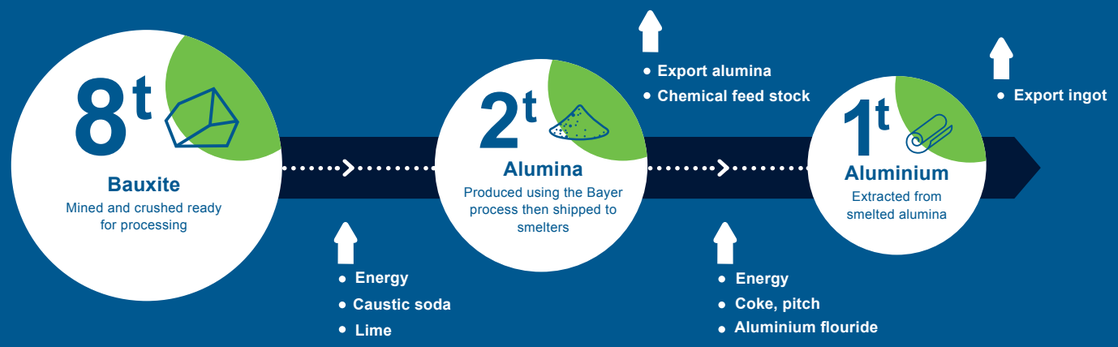
How aluminium is made

From bauxite ore to versatile metal

The aluminium making process starts with a chemically altered and weathered rock known as bauxite. Its colour and texture look similar to ordinary gravel.

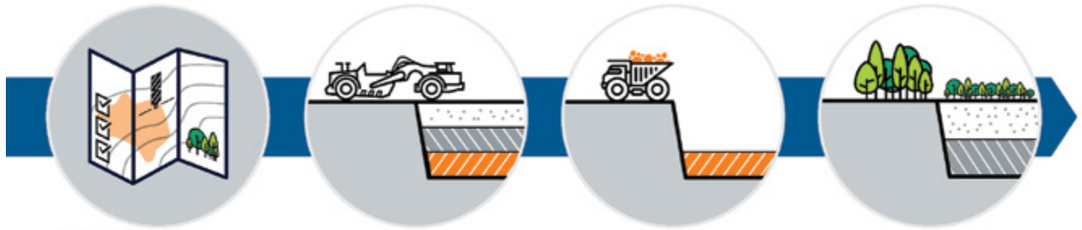
However, its careful extraction from mines in the Darling Range of Western Australia starts a process which since the beginning of the 20th century has revolutionised the transport, building and other high technology industries.

By mixing bauxite with caustic soda, and then pressure heating, Alcoa extracts alumina in a fine white powder form. Alumina is shipped to Portland Aluminium Smelter in Victoria and exported around the world. The alumina is then smelted at very high temperatures and an electric current passed through it to form aluminium – a metal essential to everyday life, critical to a decarbonised future and 100 per cent recyclable.



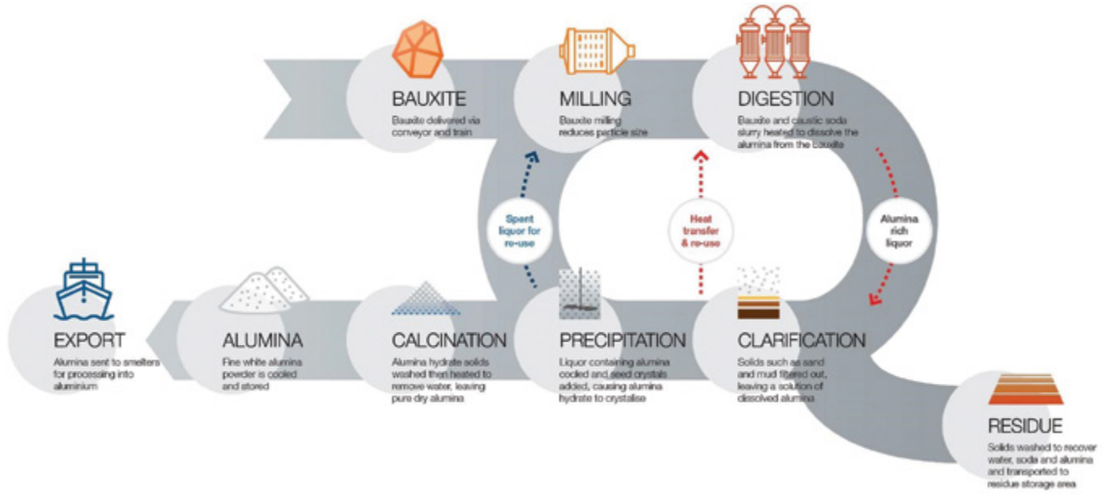
From dirt to aluminium

Bauxite mining process



PRE-MINING ASSESSMENT	PREPARATION	MINING	REHABILITATION
Environmental and social assessments	Managed timber removal and logging	Excavate bauxite ore and load trucks	Landscaping and soil return
Exploration drilling	Top soil and overburden removal and storage for use in rehabilitation	Haul bauxite to crusher	Seeding and planting for ecosystem restoration
Mine planning	Caprock ripping or blasting	Crush bauxite	Ongoing monitoring
Rehabilitation planning	Haul road construction	Transport via conveyor and train to alumina refineries for stockpiling	Completion sign off by government

Alumina refining process



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