Alcoa

Kwinana Alumina Refinery Environmental Improvement Plan

2022-2026

The Element of ***Possibility***™

Contents

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

2022-2026

Environmental Improvement Plan for Kwinana Alumina Refinery

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 this state. Subsequent Kwinana Alumina Refinery plans were released for 2008 – 2009, 2011 – 2013; 2014 – 2016 and 2017 – 2021.

This EIP outlines Alcoa's commitment to continuously improve Kwinana Alumina Refinery's environmental performance, reduce environmental impacts, and develop more sustainable operating practices. This EIP also forms part of the refinery's operational plan for 2022 – 2026.

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, community groups and local government representatives.

Alcoa is committed to supporting the communities surrounding Kwinana Alumina 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 activities.

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

Sincere thanks are extended to everyone involved in producing this EIP, particularly members of the Kwinana EIP Advisory Group who have given their personal time to help Alcoa progress environmentally. The EIP consultation process is a working example of community, government and business coming together for a common purpose.

To align with other Alcoa locations, from 2023 the Kwinana EIP Advisory Group will change its name to the Kwinana Community Consultative Network (CCN).

David Feast

Refinery Manager
Kwinana Alumina Refinery

Alcoa Australia acknowledges the Traditional Owners of the lands where we operate across Australia and pays respect to them, their culture, and to their Elders past, present and emerging.

Overview of Alcoa of Australia's operations

Alcoa of Australia (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 directly employs nearly 4,500 people, predominantly in regional Western Australia and Victoria.

At Alcoa, we strive to meet and exceed corporate and community expectations relating to environmental management, health, safety and good corporate citizenship. As we work towards a more sustainable future, we will never compromise our health, safety and environment values for profit or production.

In society's collective pursuit in a more sustainable future, we need new technologies and solutions that can help decarbonise global supply chains while enabling local communities to thrive.

The aluminium industry has an essential role to play. Aluminium is lightweight, strong, and infinitely recyclable. It can replace plastic and heavier metals in applications ranging from product packaging to electric vehicles, all while advancing sustainably.

With leading bauxite mining practices, the lowest-carbon alumina refining system globally, game-changing innovations in aluminium smelting, and the industry's most comprehensive portfolio of low-carbon products, Alcoa is working to reinvent the aluminium industry for a sustainable future.

We're proud of our commitment to responsible environmental, social, and governance practices, and our ambition toward Net Zero is an extension of our ongoing efforts toward decarbonisation. Our smelting portfolio includes renewable energy and we have pursued sustainability-related innovations in bauxite, alumina, and aluminium and are developing next-generation technologies that have the potential to fundamentally transform our industry.

Principal operations in Western Australia

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

Principal operations in Victoria

- Portland Aluminium Smelter

Australian operations overview

At our Australian locations, Alcoa operates integrated bauxite mining, alumina refining and aluminium smelting systems.

We extract bauxite at our Huntly and Willowdale mines and rehabilitate the land. The ore is then transported to our Kwinana, Pinjarra and Wagerup refineries and turned into alumina. The white powder is shipped to smelters to become aluminium — a strong, lightweight, recyclable metal you'll find in your car, kitchen, TV, mobile phone, life saving medical equipment and countless other technologies.

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%) (a wholly owned subsidiary of Alcoa of Australia); 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.

Aluminium lifecycle

Mine Bauxite
High quality bauxite is extracted from mining operations

Rehabilitate Land
Mined land is rehabilitated and self-sustaining ecosystems re-established

Refine Alumina
Using the Bayer process, bauxite is refined to produce alumina

Smelt Aluminium
Aluminium is extracted from the alumina via the smelting process

Manufacture Products
Strong, lightweight and flexible, aluminium is used in everyday products

Recycle
Aluminium is endlessly recyclable, minimising energy consumption and environmental impact

Kwinana Alumina Refinery overview

Kwinana Alumina Refinery is located 40 kilometres south of Perth in the Kwinana Industrial Area (KIA), Western Australia's premier heavy industrial estate. It was the first of three alumina refineries Alcoa has built in Western Australia.

The refinery was officially opened in July 1963 with production commencing three months later. The first alumina shipment left aboard the Lake Sorrel in February 1964, bound for Alcoa's then Point Henry Aluminium Smelter in Victoria. The first export shipment left for Japan one month later.

Kwinana Alumina Refinery's capacity is approximately 2.2 million tonnes per year. As well as producing alumina for smelting into aluminium, the refinery also produces a variety of specialty aluminas for various industrial and manufacturing applications, including water purification, refractory materials, pharmaceuticals, artificial marble, paper sizing, ceramics, abrasives, petroleum processing, plastic and fire retardant in carpets.

In 1992 Kwinana became the first alumina refinery in the world to achieve an ISO-9002 Quality Accreditation and led the way in 1997 in achieving ISO-14001 Environmental Management Certification. In 2020 Alcoa's Western Australian mining and refining operations attained Aluminium Stewardship Initiative Certification.

Kwinana's residue storage areas are managed in accordance with Alcoa's Global Impoundment Policy which provides direction for the management and governance of our residue storage areas in accordance with regulatory requirements and industry guidelines such as the International Council on Mining and Metals (ICMM) supported Global Industry Standard on Tailings Management.

2022 - 2026 targets and actions

Alcoa is focused on developing better ways to ensure a sustainable future. Through this Environmental Improvement Plan (EIP) and other mechanisms we are committed to:

- Using fewer resources
- Protecting resources for which we are responsible
- Reducing our emissions and waste
- Reusing and recycling materials

This plan focuses on the key areas of:

- Air quality management
- Water conservation and management
- Land management
- Waste management and energy efficiency

Air quality management

The management of air quality from Kwinana Alumina Refinery receives close scrutiny from the community, government and regulators as an individual facility and refinery operating near other industries in the KIA.

The refinery is part of the KIA and Western Trade Coast and is an active participant in the Kwinana Industries Council's Environmental and Planning Committee Group.

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

The primary air emissions from the refinery include:

- Nitrogen oxide (NOx)
- Carbon monoxide (CO)
- Particulates (residue and alumina dust)
- Volatile organic compounds (VOCs)
- Trace levels of metals

Air emissions, both particulates and gaseous emissions, are actively managed and monitored in accordance with the Department of Water and Environmental Regulation licence requirements for the refinery.

Noise and odour management is a complex issue because of the number of heavy industries operating in close proximity in the KIA. Alcoa periodically undertakes field monitoring for noise and has also undertaken odour surveys.

Past community perception surveys have not highlighted noise as an issue for the Kwinana operations. Therefore, it has been agreed there need not be any specific actions for noise in the refinery's EIP, and the focus will be on particulates (dust) and gaseous emissions.

Air quality improvement targets

Particulates	
Objective	**Action**
Minimise risk of dust generation from operations.	Maintain the current dust control standards and investigate opportunities to further improve dust management and implement where practical. Provide status reports on dust control to the Kwinana Community Consultative Network.

Gaseous emissions	
Objective	**Action**
Identify options to reduce air emissions.	Provide an annual update to the Kwinana Community Consultative Network on air emission management, trends and improvements.

Water conservation and management

Water is a valuable community resource and Alcoa has a strong commitment to water conservation and using fit for purpose water. This means, where possible, Alcoa deliberately sources and uses lower quality water which has less value to other water users.

Kwinana Alumina Refinery's water is obtained through a variety of sources:

- Water recycling
- Rainfall harvesting
- Ground water extraction
- Scheme water

The refinery operates a closed water circuit. Rainwater runoff from the refinery's operational areas, including the residue area, is captured and reused in the alumina production process.

Refining does not discharge process water, either as cooling water or effluent. Process water losses occur through steam, evaporation and leaching. In line with the Australian Council of Large Dams (ANCOLD) guidelines an emergency spillway is installed on the cooling water pond to prevent overtopping and cater for safe discharge of excess rainfall in a low likelihood extreme weather event.

Ground water is drawn from both recovery and production bores, with potable water purchased from the Water Corporation. Recovery bore systems form part of the groundwater monitoring and management plan for the refinery and residue areas, the objective of which is to monitor, contain, control and reduce known groundwater plumes. The effectiveness of recovery is assessed by monitoring and the results are reported to the Department of Water and Environmental Regulation annually, in accordance with licence conditions.

Water management improvement targets

Usage	
Objective	**Action**
Target reduced water consumption in refining operations.	Proactively manage water consumption.
Reduce the use of high quality water sources at the refinery.	Seek out economically viable opportunities to substitute higher quality water sources with lower quality water sources that are fit for purpose.

Containment	
Objective	**Action**
Contain, control and where possible contract existing plumes in retired and operating residue areas.	Review as appropriate the success of plume containment efforts for Areas ABC and Area F and determine whether further action is required.
Reduce existing contamination under the refinery and adjacent property.	Sustain and where appropriate optimise the existing recovery bore system within the refinery.
Reduce the risk of ground water contamination from existing containment facilities including residue pipeline facilities.	Prioritise actions for progressing improvements to refinery containment. Complete inspection of pipeline corridor and prioritise remediation actions.
Progress contaminated sites investigation and reporting requirements as required by the Contaminated Sites Act 2003.	Provide an annual update as appropriate to the Kwinana Community Consultative Network on relevant milestones in the reporting program.

Land management

This EIP overlaps with other important planning processes to address the visual amenity impact of our operations, the Long Term Residue Management Strategy (LTRMS).

Through this consultative process, sustainable rehabilitation practices associated with our residue areas and wetlands are undertaken. Additionally, through the LTRMS community members continue to work with Alcoa to develop guiding principles for the long term residue planning process.

Alcoa also has several landholdings of local cultural and conservation significance, including the Spectacles wetlands in Mandogalup, Wellard wetlands in Baldivis and a section of Mount Brown, part of the Beeliar Regional Park in Naval Base. Alcoa works collaboratively and strategically with relevant interest groups and local and state government to ensure the ongoing health and sustainability of these important natural resources.

Land management improvement targets

Rehabilitation	
Objective	**Action**
Residue rehabilitation programs enhance the visual amenity in and around Alcoa landholdings.	Provide annual updates as appropriate to the Kwinana Community Consultative Network on the progressive rehabilitation of external/final-form embankments.

Flora and fauna	
Objective	**Action**
Actively manage Alcoa landholdings to enhance and conserve natural ecological attributes.	Undertake vertebrate pest control on Alcoa landholdings. Undertake relevant weed control around Area F to complement adjoining Bush Forever program. Continue to seek and support community partnerships which align and support conservation goals. Maintain commitment to ongoing fauna and flora surveys. The focus of the surveys will be reviewed and adapted where appropriate.

Wetlands	
Objective	**Action**
Maintain the health of the Spectacles as an important regional wetland.	Develop and implement ongoing land management programs for wetlands located on Alcoa's land. Work with local government and community interest groups to promote appropriate wetland use. Evaluate opportunities for participation in conservation activities and pursue where practical.
Recognise the value to the community of the Wellard Wetlands, consistent with Alcoa's clay extraction requirements.	Develop and implement ongoing land management programs for wetlands located on Alcoa's land. Include Wellard wetlands on a periodic basis in the triennial fauna assessment. Evaluate opportunities for participation in conservation activities. Maintain relationships with interested stakeholders to provide eucalyptus leaves for Koala fodder.

Fire hazard reduction	
Objective	**Action**
Actively manage Alcoa landholdings to minimise bush fires.	Evaluate fire management options for landholdings and implement applicable strategies.

Waste management and energy efficiency

Innovation improves bauxite residue processes

Alcoa commissioned an innovative technology known as residue filtration at Kwinana Alumina Refinery in 2016. With this technology, bauxite residue generated from the alumina refining process is forced through very large filters that squeeze out the water, which is recycled in the refining process. The filtered material allows for more efficient utilisation of existing residue areas. The water recovered from filtration also significantly reduces the refinery's freshwater needs. Alcoa continues to evaluate the use of this technology at other refineries around the world. A second plant was installed at Pinjarra refinery in Western Australia in 2019 and work has commenced on a third plant at Pocos de Caldas refinery in Brazil, with construction expected to be completed by the end of 2022.

Bauxite residue reuse strategies

For more than 30 years Alcoa has been investigating opportunities to produce economically viable products from bauxite residue. By identifying and demonstrating a range of technically and economically feasible alternative uses, bauxite residue may be considered a stored resource.

Alcoa's residue sand is currently used for the construction of residue storage areas, with excess being stored within these storage areas. Alcoa has also developed a process to wash and carbonate the sand so it can be considered for alternative value-adding applications. The resulting product is known as Red Sand™, which has a nominal particle size of +100 micron and is physically similar to crushed bauxite.

Red Sand™ is a well-structured material and exhibits beneficial phosphate retention properties. The technology to produce Red Sand™ has been demonstrated through a pilot plant operated at Alcoa's Wagerup Alumina Refinery with the sand produced from this plant used by the Department of Main Roads in a road construction trial on Greenlands Road (Pinjarra, Western Australia), and by Fairbridge Village (Pinjarra, Western Australia) to top dress its main oval. The pilot plant has also been operated at Kwinana Alumina Refinery with the sand produced being used to top-dress the Alcoa Social Club oval and in a series of trials with various golf clubs, and an industrial land development trial in conjunction with the Western Australian land authority.

Carbon and energy efficiency

Energy is a key input of the alumina refining process. Alcoa's refinery systems are fully integrated from an energy efficiency perspective with process heat recovery optimised where feasible. The refinery steam and energy systems use natural gas and energy.

Globally Alcoa is committed to reducing carbon emissions in the refining process and to this end is testing Mechanical Vapor Recompression (MVR) technology in Western Australia.

MVR has the potential to replace fossil-fuel energy consumed in the boilers producing steam. If viable, electricity sources from renewable energy would power compressors to turn waste vapor into steam, which would then be used to provide refinery process heat.The technology has the potential to reduce an alumina refinery's carbon footprint by 70 percent and eliminate up to 35 percent of freshwater usage.

Work is underway to pilot MVR at our refinery in Wagerup, Western Australia, with construction due to start early in 2023.

No specific commitments are made to improvements in energy usage at Kwinana for this plan.

Waste management improvement targets

Residue reuse	
Objective	**Action**
Support projects which identify and research residue reuse strategies.	Provide regular updates on the status of residue re-use projects.

Oxalate	
Objective	**Action**
Implement long term oxalate management strategy.	Evaluate feasibility of options for management of stored oxalate and implement where practical.

Waste synergy	
Objective	**Action**
Identify synergies to reduce waste within the Kwinana Industrial Area and implement where practical.	Contribute to the Kwinana Industries Council's synergy programs with other industries and evaluate projects with potential to reduce waste.

Sustainability, environmental regulation, and management

Sustainability

Alcoa extracts, processes, and refines the most recyclable mineral on earth. And the aluminium we produce plays a key role in meeting the needs of a sustainable society.

Alcoa's Western Australian refineries have attained certifications from the Aluminium Stewardship Initiative (ASI), the industry's most comprehensive system to verify responsible production.

Globally, Alcoa's SustanaTM family of low-carbon products, are supporting customers lowering the carbon footprint of their supply chains.

- SustanaTM Ecolum is a lower carbon aluminium
- SustanaTM Source is a lower carbon alumina
- SustanaTM Ecodura is aluminium with recycled content

Environmental regulation

Alcoa's Western Australian operations are subject to environmental regulation under the Environmental Protection Act 1986 and its regulations. As such the refineries are licensed by the Department of Environment Regulation. 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 company's environmental protection licence.

Environmental management system

Kwinana Alumina Refinery's Environmental Management System (EMS) is certified to the ISO14001:2015 standard. The EMS was recertified in May 2021 for a three-year period.

ISO14001 requires the location 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.

To ensure the EMS continues to be an effective environmental management tool, both internal and external audits of the system are conducted regularly. Auditing is a systematic method to review the effectiveness of operational controls to ensure unacceptable risks to the environment are effectively managed and to identify corrective actions and opportunities for improvement. An audit involves analysis, testing and confirmation of procedures and practices.

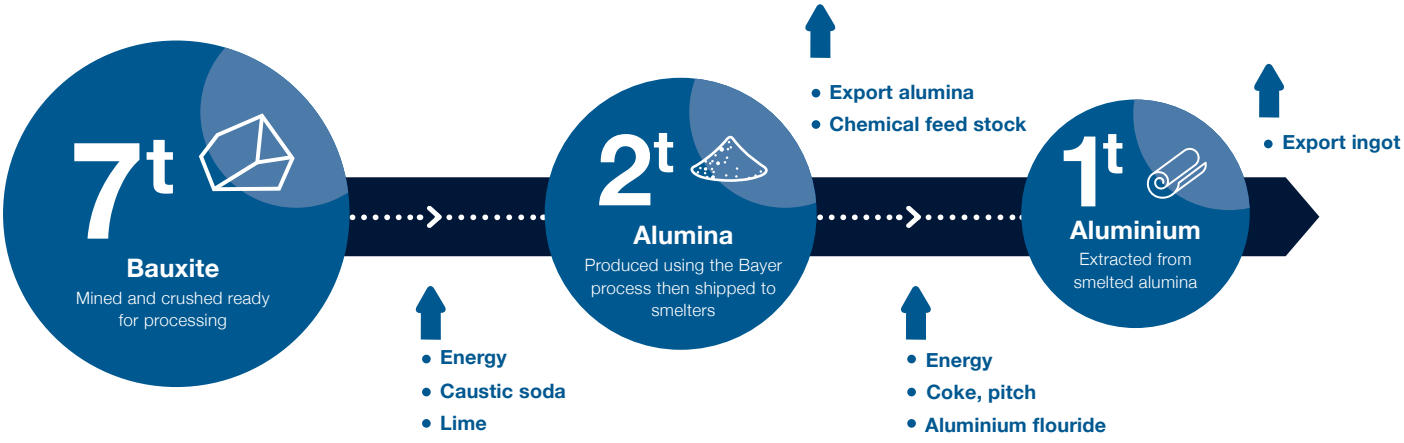
How aluminium is made

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 little more than ordinary gravel.

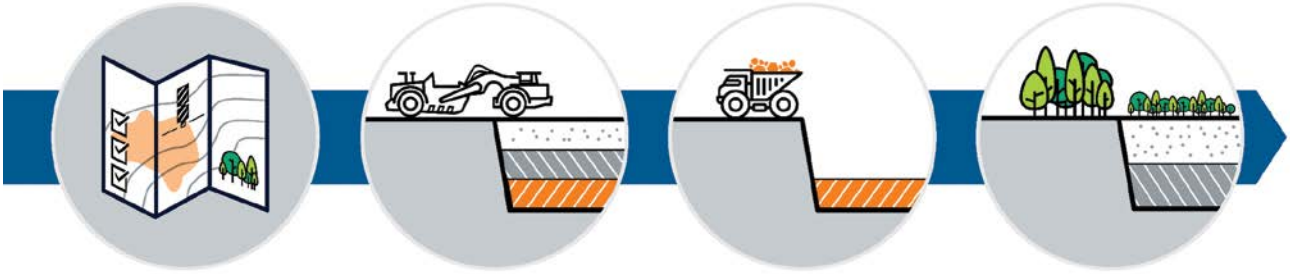
However, its careful extraction from mines in the Darling Range of Western Australia starts a process which since the beginning of the 20th century has revolutionised the transport, building and other high technology industries.

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 – one of the world's most versatile metals.



Our mining and refining processes

Bauxite mining process



PRE-MINING ASSESSMENT

- Environmental and social assessments
- Exploration drilling
- Mine planning
- Rehabilitation planning

PREPARATION

- Managed timber removal and logging
- Top soil and overburden removal and storage for use in rehabilitation
- Caprock ripping or blasting
- Haul road construction

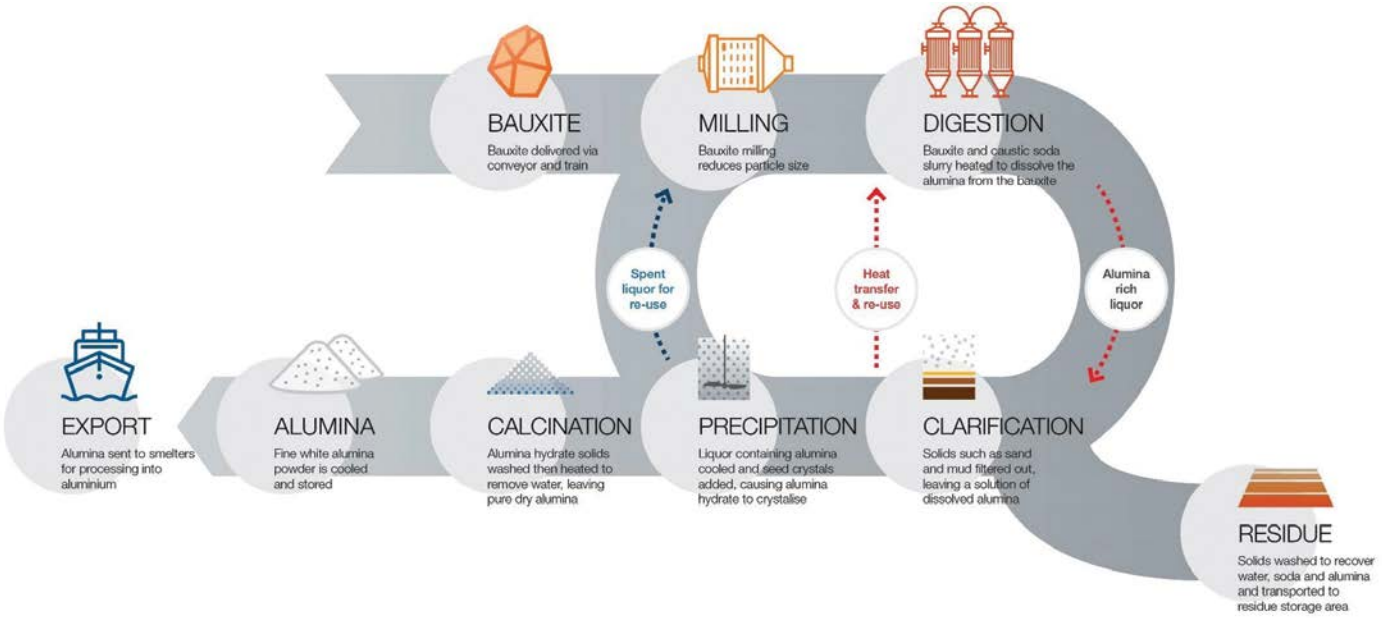
MINING

- Excavate bauxite ore and load trucks
- Haul bauxite to crusher
- Crush bauxite
- Transport via conveyor and train to alumina refineries for stockpiling

REHABILITATION

- Landscaping and soil return
- Seeding and planting for ecosystem restoration
- Ongoing monitoring
- Completion sign off by government

Alumina refining process



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