UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 10-K

(Mark One)

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2022

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from _____ to _____

Commission File Number 1-37816

ALCOA CORPORATION

(Exact name of registrant as specified in its charter)

Delaware	**81-1789115**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
201 Isabella Street, Suite 500, Pittsburgh, Pennsylvania	**15212-5858**
(Address of principal executive offices)	**(Zip Code)**

(Registrant's telephone number, including area code): 412-315-2900

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, par value $0.01 per share	AA	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act: **None**

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☑ No ☐

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ☐ No ☑

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☑ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☑ No ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	☒	Accelerated filer	☐
Non-accelerated filer	☐	Smaller reporting company	☐
Emerging growth company	☐		

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. ☑

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements. ☐

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b). ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes ☐ No ☑

The aggregate market value of the registrant's voting stock held by non-affiliates at June 30, 2022 was approximately $8.2 billion, based on the closing price per share of Common Stock on June 30, 2022 of $45.58 as reported on the New York Stock Exchange.

As of February 17, 2023, there were 178,349,345 shares of the registrant's common stock, par value $0.01 per share, outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Part III of this Form 10-K incorporates by reference certain information from the registrant's Definitive Proxy Statement for its 2023 Annual Meeting of Stockholders to be filed pursuant to Regulation 14A.

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Note on Incorporation by Reference

In this Form 10-K, selected items of information and data are incorporated by reference to portions of Alcoa Corporation's Definitive Proxy Statement for its 2023 Annual Meeting of Stockholders (Proxy Statement), which will be filed with the Securities and Exchange Commission within 120 days after the end of Alcoa Corporation's fiscal year ended December 31, 2022. Unless otherwise provided herein, any reference in this Form 10-K to disclosures in the Proxy Statement shall constitute incorporation by reference of only that specific disclosure into this Form 10-K.

PART I

Item 1. Business.

(dollars in millions, except per-share amounts, average realized prices, and average cost amounts)

The Company

Alcoa Corporation, a Delaware corporation (the Company), is active in all aspects of the upstream aluminum industry with bauxite mining, alumina refining, and aluminum smelting and casting. The Company has direct and indirect ownership of 27 locations across nine countries on six continents.

The Company's operations in 2022 comprised three reportable business segments: Bauxite, Alumina, and Aluminum. The Bauxite and Alumina segments primarily consist of a series of affiliated operating entities held in Alcoa World Alumina and Chemicals, a global, unincorporated joint venture between Alcoa and Alumina Limited (described below). The Aluminum segment consists of the Company's aluminum smelting and casting operations along with most of the Company's energy production assets. Beginning in January 2023, the Company changed its operating segments, by combining the Bauxite and Alumina segments, and will report its financial results in the following two segments: (i) Alumina and (ii) Aluminum.

Aluminum, as an element, is abundant in the earth's crust, but a multi-step process is required to make finished metal. Aluminum metal is produced by refining alumina oxide from bauxite into alumina, which is then smelted into aluminum and can be cast into many shapes and forms.

Alcoa smelts and casts aluminum in various shapes and sizes for global customers, including developing and creating various alloy combinations for specific applications.

Aluminum metal is a commodity traded on the London Metal Exchange (LME) and priced daily. Additionally, alumina is subject to market pricing through the Alumina Price Index (API), which is calculated by the Company based on the weighted average of a prior month's daily spot prices published by the following three indices: CRU Metallurgical Grade Alumina Price, Platts Metals Daily Alumina PAX Price, and FastMarkets Metal Bulletin Non-Ferrous Metals Alumina Index. As a result, the prices of both aluminum and alumina are subject to significant volatility and, therefore, influence the operating results of Alcoa.

Alcoa Corporation became an independent, publicly traded company on November 1, 2016, following its separation (the Separation Transaction) from its former parent company, Alcoa Inc. References herein to "ParentCo" refer to Alcoa Inc. and its consolidated subsidiaries through October 31, 2016, at which time it was renamed Arconic Inc. (Arconic) and since has been subsequently renamed Howmet Aerospace Inc.

Business Strategy

Alcoa has three strategic priorities: reduce complexity, drive returns and advance sustainably. The Company strives to operate with lean overhead and manage its portfolio of assets with the goal of profitability through all market cycles. Alcoa aims to drive margin-focused growth and innovate and create low-carbon solutions. Alcoa works to be a responsible and reliable producer, which includes engagement with communities in which it operates to bring shared value.

Today, Alcoa has a comprehensive suite of Sustana™ brand products, which includes EcoDura™ aluminum, EcoLum™ aluminum, and EcoSource™ alumina.

Further, Alcoa has active research and development projects that have the potential to drive value by reducing costs, improving efficiency, and reducing greenhouse gas emissions in both alumina refining and aluminum smelting. The roadmap of technologies include:

- The ELYSIS™ joint venture uses an aluminum smelting technology that eliminates all direct greenhouse gas emissions from the traditional smelting process, instead emitting pure oxygen as a byproduct. The research and development program is being ramped up to commercial scale and commercial-grade research and development scale quantities of the metal have been used by top-tier brands including Apple Inc. and Audi AG.
- The Refinery of the Future initiative aims to achieve alumina refining with no direct greenhouse gas emissions through adapting various processes and new technologies under development for alumina refining, such as mechanical vapor recompression (MVR) and electric calcination.
- The ASTRAEA™ process is a proprietary technology under development that can purify post-consumer aluminum scrap, regardless of alloy combination, and beneficiate it up to high purity levels that exceed what is produced at most primary aluminum smelters operating today, permitting use in high tolerance applications, such as aerospace.

Alcoa has received annual recognition from S&P Dow Jones Sustainability Indices and has also earned certifications from the Aluminium Stewardship Initiative (ASI), a comprehensive third-party program to verify responsible production in the aluminum industry. Alcoa has certified 17 operating sites and can market globally ASI-certified bauxite, alumina, and aluminum.

In 2019, the Company announced a five year strategic portfolio review of smelting and refining capacity to improve cost positioning, including curtailment, closure or divestiture. Through 2021, Alcoa reached approximately 75 and 58 percent of its target to improve, curtail, close, or divest 1.5 and 4 million metric tons of smelting and refining capacity, respectively. While no actions were taken in 2022 related to these targets, the Company took actions in response to market conditions, and the strategic portfolio review is continuing.

The Company has the goal of being the lowest emitter of carbon dioxide among all global aluminum companies, per ton of emissions in both smelting and refining, and aims to move its aluminum asset portfolio to a first quartile cost position relative to other aluminum producers upon completion of our portfolio review. In 2022, Alcoa exceeded its target of 85 percent of its smelting portfolio being powered by renewable energy, attaining 86 percent. Renewable energy is derived from natural processes that are replenished constantly, such as sunlight, wind, and hydropower.

See Part II Item 7 of this Form 10-K in Management's Discussion and Analysis of Financial Condition and Results of Operations under caption Business Update.

Joint Ventures

Alcoa World Alumina and Chemicals (AWAC)

AWAC is an unincorporated global joint venture between Alcoa Corporation and Alumina Limited, a company incorporated under the laws of the Commonwealth of Australia and listed on the Australian Securities Exchange. AWAC consists of a number of affiliated entities that own, operate, or have an interest in bauxite mines and alumina refineries, as well as an aluminum smelter, in seven countries. Alcoa Corporation owns 60% and Alumina Limited owns 40% of these entities, directly or indirectly, with such entities being consolidated by Alcoa Corporation for financial reporting purposes. The scope of AWAC generally includes the mining of bauxite and other aluminous ores; the refining, production, and sale of smelter grade and non-metallurgical alumina; and the production of certain primary aluminum products.

Alcoa provides the operating management for AWAC, which is subject to direction provided by the Strategic Council of AWAC. The Strategic Council consists of five members, three of whom are appointed by Alcoa (of which one is the Chair) and two of whom are appointed by Alumina Limited (of which one is the Deputy Chair). Matters are decided by a majority vote with certain matters requiring approval by at least 80% of the members, including: changes to the scope of AWAC; changes in the dividend policy; equity calls in aggregate greater than $1,000 in any year; sales of all or a majority of the AWAC assets; loans from AWAC companies to Alcoa or Alumina Limited; certain acquisitions, divestitures, expansions, curtailments or closures; certain related-party transactions; financial derivatives, hedges or swap transactions; a decision by AWAC entities to file for insolvency; and changes to pricing formula in certain offtake agreements which may be entered into between AWAC entities and Alcoa or Alumina Limited.

AWAC Operations

AWAC entities' assets include the following interests:

- 100% of the bauxite mining, alumina refining, and aluminum smelting operations of Alcoa's affiliate, Alcoa of Australia Limited (AofA);
- 100% of the Juruti bauxite deposit and mine in Brazil;
- 45% interest in Halco (Mining) Inc., a bauxite consortium that owns a 51% interest in Compagnie des Bauxites de Guinée (CBG), a bauxite mine in Guinea;
- 9.62% interest in the bauxite mining operations in Brazil of Mineração Rio Do Norte (MRN), a Brazilian company, until the sale of its interest in April 2022;
- 39.96% interest in the São Luís refinery in Brazil;
- 55% interest in the Portland, Australia smelter that AWAC manages on behalf of the joint venture partners;
- 25.1% interest in the mine and refinery in Ras Al Khair, Saudi Arabia;
- 100% of the refinery and alumina-based chemicals assets at San Ciprián, Spain;
- 100% of Alcoa Steamship Company LLC, a company that procures ocean freight and commercial shipping services for Alcoa in the ordinary course of business;
- 100% of the refinery assets at the closed facility in Point Comfort, Texas, United States; and,
- 100% interest in various assets formerly used for mining and refining in the Republic of Suriname (Suriname).

Exclusivity

Under the terms of their joint venture agreements, Alcoa and Alumina Limited have agreed that, subject to certain exceptions, AWAC is their exclusive vehicle for their investments, operations or participation in the bauxite and alumina business, and they will not compete with AWAC in those businesses. In the event of a change of control of either Alcoa or Alumina Limited, this exclusivity and non-compete restriction will terminate, and the partners will then have opportunities to unilaterally pursue bauxite or alumina projects outside of or within AWAC, subject to certain conditions provided in the Amended and Restated Charter of the Strategic Council.

Equity Calls

The cash flow of AWAC and borrowings are the preferred sources of funding for the needs of AWAC. An equity call can be made on 30 days' notice, subject to certain limitations, in the event the aggregate annual capital budget of AWAC requires an equity contribution from Alcoa and Alumina Limited.

Dividend Policy

AWAC will generally be required to distribute at least 50% of the prior calendar quarter's net income of each AWAC entity, and certain AWAC entities will also be required to pay a distribution every three months equal to the amount of available cash above specified thresholds and subject to the forecast cash needs of the AWAC entity.

Leveraging Policy

Debt of AWAC is subject to a limit of 30% of total capital (defined as the sum of debt (net of cash) plus any minority interest plus shareholder equity). The AWAC joint venture has raised a limited amount of debt to fund growth projects as permitted under Alcoa's revolving credit line and in accordance with the joint venture partnership agreements.

Saudi Arabia Joint Venture

In December 2009, Alcoa entered into a joint venture with the Saudi Arabian Mining Company (Ma'aden), which was formed by the government of Saudi Arabia to develop its mineral resources and create a fully integrated aluminum complex in Saudi Arabia. Ma'aden is listed on the Saudi Stock Exchange (Tadawul). The joint venture complex includes a bauxite mine with estimated capacity of 5 million dry metric tons per year; an alumina refinery with a capacity of 1.8 million metric tons per year (mtpy); and an aluminum smelter with a capacity of 780,000 mtpy.

The joint venture is currently comprised of two entities: the Ma'aden Bauxite and Alumina Company (MBAC) and the Ma'aden Aluminium Company (MAC). Ma'aden owns a 74.9% interest in the MBAC and MAC joint venture. Alcoa owns a 25.1% interest in MAC, which holds the smelter; AWAC holds a 25.1% interest in MBAC, which holds the mine and refinery. The refinery and smelter are located within the Ras Al Khair industrial zone on the east coast of Saudi Arabia.

In accordance with the June 2019 amended joint venture agreement, Ma'aden's put option and Alcoa Corporation's call option, relating to additional interests in the joint venture, were exercisable for a period of six months after October 1, 2021. On March 31, 2022, Ma'aden's and Alcoa's put and call options, respectively, expired with neither party exercising their options.

The amended joint venture agreement defined October 1, 2021 as the date after which Alcoa is permitted to sell all of its shares in both MBAC and MAC collectively, for which Ma'aden has a right of first refusal. Prior to this date, Ma'aden and Alcoa Corporation could not sell, transfer, or otherwise dispose of, pledge, or encumber any interests in the joint venture. Under the amended joint venture agreement, upon the occurrence of an unremedied event of default by Alcoa, Ma'aden may purchase, or, upon the occurrence of an unremedied event of default by Ma'aden, Alcoa may sell, its interest in the joint venture for consideration that varies depending on the time of the default.

ELYSIS

ELYSIS Limited Partnership is a joint venture between wholly-owned subsidiaries of Alcoa (48.235%) and Rio Tinto Alcan Inc. (Rio Tinto) (48.235%), respectively, and Investissement Québec (3.53%), a company wholly-owned by the Government of Québec, Canada. The purpose of the ELYSIS joint venture is to advance larger scale development and commercialization of its patent-protected technology that produces oxygen and eliminates all direct greenhouse gas emissions from the traditional aluminum smelting process. Alcoa invented the inert anode technology for the aluminum smelting process that serves as the basis for the ELYSIS joint venture. Batches of aluminum produced by ELYSIS have been sold for use by such companies as Apple Inc. and Audi AG, as the joint venture continues working toward an industrial scale with a technology package planned for sale beginning in 2024.

Others

The Company is party to several other joint ventures and consortia. See additional details within each business segment discussion below.

The Aluminerie de Bécancour Inc. (ABI) smelter is a joint venture between Alcoa and Rio Tinto located in Bécancour, Québec. Alcoa owns 74.95% of the joint venture through the equity investment in Pechiney Reynolds Quebec, Inc., which owns a 50.1% share of the smelter, and two wholly-owned Canadian subsidiaries, which own 49.9% of the smelter. Rio Tinto owns the remaining 25.05% interest in the joint venture.

CBG is a joint venture between Boké Investment Company (51%) and the Government of Guinea (49%) for the operation of a bauxite mine in the Boké region of Guinea. Boké Investment Company is owned 100% by Halco (Mining) Inc.; AWA LLC holds a 45% interest in Halco. AWA LLC is part of the AWAC group of companies and is ultimately owned 60% by Alcoa and 40% by Alumina Limited.

Until the sale of Alcoa's interest in April 2022, MRN was a joint venture between Alcoa Alumínio (8.58%), AWA Brasil (AWAB) (4.62%), and AWA LLC (5%), each a subsidiary of Alcoa, and affiliates of Rio Tinto (12%), Companhia Brasileira de Alumínio (10%), Vale S.A. (Vale) (40%), South32 Limited (South32) (14.8%), and Norsk Hydro ASA (5%) for the operation of a bauxite mine in Porto Trombetas in the state of Pará in Brazil. AWAB and AWA LLC are part of the AWAC group of companies and are ultimately owned 60% by Alcoa and 40% by Alumina Limited.

On April 30, 2022, Alcoa completed the sale of its investment in MRN for proceeds of $10. An additional $30 in cash could be paid to the Company in the future if certain post-closing conditions related to future MRN mine development are satisfied. Related to this transaction, the Company recorded an asset impairment of $58 in the first quarter of 2022 in Restructuring and other charges, net on the Statement of Consolidated Operations. In addition, the Company entered into several bauxite offtake agreements with South32 Minerals S.A. to provide bauxite supply for existing long-term supply contracts.

Alumar is an unincorporated joint venture for the operation of a refinery, smelter, and casthouse in Brazil. The refinery is owned by AWAB (39.96%), Rio Tinto (10%), Alcoa Alumínio (14.04%), and South32 (36%). AWAB is part of the AWAC group of companies and is ultimately owned 60% by Alcoa and 40% by Alumina Limited. With respect to Rio Tinto and South32, the named company or an affiliate thereof holds the interest. The smelter and casthouse are owned by Alcoa Alumínio (60%) and South32 (40%).

Strathcona calciner is a joint venture between affiliates of Alcoa and Rio Tinto. Calcined coke is used as a raw material in aluminum smelting. The calciner is owned by Alcoa (39%) and Rio Tinto (61%); Alcoa's capacity is currently idled in connection with the curtailment of the Intalco aluminum smelter.

Hydropower

Machadinho Hydro Power Plant (HPP) is a consortium located on the Pelotas River in southern Brazil in which the Company has a 25.7% ownership interest through Alcoa Alumínio. The remaining ownership interests are held by unrelated third parties.

Barra Grande HPP is a joint venture located on the Pelotas River in southern Brazil in which the Company has a 42.2% ownership interest through Alcoa Alumínio. The remaining ownership interests are held by unrelated third parties.

Estreito HPP is a consortium between Alcoa Alumínio, through Estreito Energia S.A. (25.5%) and unrelated third parties located on the Tocantins River, northern Brazil.

Serra do Facão HPP is a joint venture between Alcoa Alumínio (35%) and unrelated third parties located on the Sao Marcos River, central Brazil.

Manicouagan Power Limited Partnership (Manicouagan) is a joint venture between affiliates of Alcoa and Hydro-Québec. Manicouagan owns and operates the 335 megawatt McCormick hydroelectric project, which is located on the Manicouagan River in the Province of Québec, Canada. Alcoa owns 40% of the joint venture.

Bauxite

This segment consists of the Company's global bauxite mining operations. Bauxite is the principal raw material used to produce alumina and contains various aluminum hydroxide minerals, the most important of which are gibbsite and boehmite. Bauxite is refined using the Bayer process, the principal industrial chemical process for refining bauxite to produce alumina, a compound of aluminum and oxygen that is the raw material used by smelters to produce aluminum metal. The Company obtains bauxite from its own resources, including those belonging to AWAC, as well as through long-term and short-term contracts and mining leases. Tons of bauxite are reported on a zero-moisture basis in millions of dry metric tons (mdmt) unless otherwise stated.

In 2022, Alcoa-operated mines supplied 92 percent of their volume to Alcoa refineries and sold the remaining 8 percent to third-party customers. Alcoa-operated mines produced 36.7 mdmt of bauxite and mines operated by partnerships in which Alcoa, including AWAC, has equity interests produced 5.4 mdmt of bauxite on a proportional equity basis, for a total Company bauxite production of 42.1 mdmt.

On April 30, 2022, Alcoa completed the sale of its investment in MRN. The Company entered into several bauxite offtake agreements with South32 to provide bauxite supply for existing long-term supply contracts.

Based on the terms of its bauxite supply contracts, the amount of bauxite AWAC purchases from its minority-owned joint ventures, MRN (until its sale in April 2022) and CBG, differ from its proportional equity in those mines. Therefore, in 2022, Alcoa had access to 43.0 mdmt of production from its portfolio of bauxite interests and bauxite offtake and supply agreements and sold 3.5 mdmt of bauxite to third parties; 39.5 mdmt of bauxite was delivered to Alcoa refineries.

Beginning in January 2023, financial information for the activities of the bauxite mines and the alumina refineries will be combined and the Company will report its financial results in the following two segments: (i) Alumina, and (ii) Aluminum. Accordingly, segment information for all prior periods presented will be updated to reflect the new segment structure in future Quarterly Report on Form 10-Q and Annual Report on Form 10-K filings.

Information regarding the Company's bauxite mining properties and bauxite mineral resources and reserves is included in Part 1 Item 2 of this Form 10-K.

Alumina

This segment consists of the Company's worldwide refining system, which processes bauxite into alumina. Alcoa's alumina sales are made to customers globally and are typically priced by reference to published spot market prices. The Company produces smelter grade alumina and non-metallurgical grade alumina. The Company's largest customer for smelter grade alumina is its own aluminum smelters, which in 2022 accounted for approximately 30% of its total alumina shipments. A small portion of the alumina (non-metallurgical grade) is sold to third-party customers who process it into industrial chemical products. This segment also includes AWAC's 25.1% share of MBAC.

The Company primarily sells alumina through fixed price spot sales and contracts containing two pricing components: (1) the API price basis and (2) a negotiated adjustment basis that takes into account various factors, including freight, quality, customer location, and market conditions. In 2022, approximately 96% of the Company's smelter grade alumina shipments to third parties were sold on a fixed price spot basis or adjusted API price basis.

Alcoa's alumina refining facilities and its worldwide alumina capacity stated in metric tons per year (mtpy) are shown in the following table:

Country	Facility	Nameplate Capacity[1] (000 mtpy)	Alcoa Corporation Consolidated Capacity[1] (000 mtpy)
Australia (AofA)	Kwinana	2,190	2,190
	Pinjarra	4,700	4,700
	Wagerup	2,879	2,879
Brazil	Poços de Caldas	390	390
	São Luís (Alumar)	3,860	2,084
Spain	San Ciprián	1,600	1,600
TOTAL		15,619	13,843

Equity Interests:

Country	Facility	Nameplate Capacity[1] (000 mtpy)	Alcoa Corporation Consolidated Capacity[1] (000 mtpy)
Saudi Arabia	Ras Al Khair (MBAC)	1,800	452

(1) Nameplate Capacity is an estimate based on design capacity and normal operating efficiencies and does not necessarily represent maximum possible production. Alcoa Corporation Consolidated Capacity represents our share of production from these facilities. For facilities wholly-owned by AWAC, Alcoa takes 100% of the production.

As of December 31, 2022, Alcoa had approximately 1,014,000 mtpy of idle capacity relative to total Alcoa consolidated capacity of 13,843,000 mtpy. Idle capacity of 800,000 mtpy at the San Ciprián refinery is due to the partial curtailment of the refinery in 2022 and 214,000 mtpy of idle capacity at the Poços de Caldas facility is a result of the previous full curtailment of the Poços de Caldas smelter.

In October 2019, the Company announced a five-year review of our production assets that includes a range of potential outcomes for these facilities to improve cost positioning, including curtailment, closure, or divestiture. The review includes 4 million metric tons of global refining capacity, of which 2,305,000 mtpy of capacity has been permanently closed since the announced review.

In 2022, production at the San Ciprián refinery was reduced to approximately 50 percent of the 1.6 million metric tons of annual capacity to mitigate the financial impact of high natural gas costs. The Company is actively reviewing the location's operating levels given the ongoing volatility in European energy markets.

In January 2023, the Company reduced production at the Kwinana (Australia) refinery by approximately 30 percent in response to a domestic natural gas shortage in Western Australia due to production challenges experienced by key gas suppliers.

Aluminum

This segment currently consists of (i) the Company's worldwide smelting and casthouse system and (ii) a portfolio of energy assets in Brazil, Canada, and the United States. The smelting operations produce molten primary aluminum, which is then formed by the casting operations into either common alloy ingot (e.g., t-bar, sow, standard ingot) or into value add ingot products (e.g., foundry, billet, rod, and slab). The energy assets supply power to external customers in Brazil and the United States, as well as internal customers in the Aluminum segment (Baie-Comeau (Canada) smelter and Warrick (Indiana) smelter) and, to a lesser extent, the Alumina segment (Brazilian refineries). This segment also includes Alcoa's 25.1% share of MAC, the smelting joint venture company in Saudi Arabia.

Smelting and Casting Operations

Contracts for primary aluminum vary widely in duration, from multi-year supply contracts to spot purchases. Pricing for primary aluminum products is typically comprised of three components: (i) the published LME aluminum price for commodity grade P1020 aluminum, (ii) the published regional premium applicable to the delivery locale, and (iii) a negotiated product premium that accounts for factors such as shape and alloy.

Alcoa's primary aluminum facilities and its global smelting capacity stated in metric tons per year (mtpy) are shown in the following table:

Country	Facility	Nameplate Capacity[1] (000 mtpy)	Alcoa Corporation Consolidated Capacity[1] (000 mtpy)
Australia	Portland	358	197
Brazil	Poços de Caldas[2]	N/A	N/A
	São Luís (Alumar)	447	268
Canada	Baie Comeau, Québec	314	314
	Bécancour, Québec	413	350
	Deschambault, Québec	287	287
Iceland	Fjarðaál	351	351
Norway	Lista	95	95
	Mosjøen	200	200
Spain	San Ciprián	228	228
United States	Massena West, NY	130	130
	Ferndale, WA (Intalco)	279	279
	Evansville, IN (Warrick)	269	269
TOTAL		3,371	2,968

Equity Interests:

Country	Facility	Nameplate Capacity[1] (000 mtpy)	Alcoa Corporation Consolidated Capacity[1] (000 mtpy)
Saudi Arabia	Ras Al Khair (MAC)	804	202

(1) Nameplate Capacity is an estimate based on design capacity and normal operating efficiencies and does not necessarily represent maximum possible production. Alcoa Corporation's consolidated capacity is its share of Nameplate Capacity based on its ownership interest in the respective smelter.

(2) The Poços de Caldas facility is a casthouse and does not include a smelter.

The Company's five-year review of our production assets first announced in October 2019 includes 1.5 million metric tons of smelting capacity. The portfolio review includes evaluations to improve cost positioning, including curtailments, closures, or divestitures. As of December 31, 2022, the Company had approximately 868,000 mtpy of idle smelting capacity relative to total Alcoa consolidated capacity of 2,968,000 mtpy. The idle capacity includes the capacity at the fully curtailed Intalco smelter, 228,000 mtpy of idle capacity at the San Ciprián smelter, 162,000 mtpy of idle capacity at the Warrick smelter, 157,000 mtpy of idle capacity at the Alumar smelter, 31,000 mtpy of idle capacity at the Lista smelter, and 11,000 mtpy of idle capacity at the Portland smelter.

On August 30, 2022, the Company announced the curtailment of one-third of its production capacity (31 kmt) at the Lista (Norway) smelter. The site's exposure to spot energy pricing during the third quarter of 2022 caused significant cost increases. In July 2022, the Company entered into a fixed price power agreement effective for the fourth quarter of 2022 through December 31, 2023. In February 2023, the agreement was amended with improved fixed pricing and lower volume commitments.

On July 1, 2022, the Company announced curtailment of approximately 54,000 mtpy at the Warrick smelter in the state of Indiana.

In January 2022, Alcoa completed the curtailment of the San Ciprián aluminum smelter's 228,000 mtpy of annual capacity while the casthouse continues to operate. The curtailment is a result of an agreement that was reached with the workers' representatives in December 2021 to suspend production due to exorbitant energy prices in Spain and to begin the restart process in January 2024. On February 3, 2023, the Company reached an updated agreement with the workers' representatives to commence the restart process in phases beginning in January 2024. Alcoa plans that all pots will be restarted by October 1, 2025, and from October 1, 2025 until the end of 2026, the minimum production will be 75 percent of the nominal capacity of 228,000 mtpy.

On September 20, 2021, the Company announced its plan to restart its 268,000 mtpy per year share of capacity at the Alumar smelter in São Luís, Brazil, which had been fully curtailed since 2015. The first metal sales occurred in the second quarter of 2022 and the Company continues to progress the restart of the smelter.

In October 2022, the Company completed the restart of 35,000 mtpy (19,000 mtpy Alcoa share) of previously curtailed annual capacity at the Portland aluminum smelter in Australia that was previously announced in November 2021. With the restart complete, the plant is operating at approximately 95 percent of its total capacity and Alcoa has approximately 186,000 mtpy of consolidated annual capacity operating at Portland.

Energy Facilities and Sources

In 2022, energy comprises approximately 30% of the Company's total alumina refining production costs and electric power comprises approximately 25% of the Company's primary aluminum production costs.

Electricity markets are regional and are limited by physical and regulatory constraints, including the physical inability to transport electricity efficiently over long distances, the design of the electric grid, including interconnections, and the regulatory structure imposed by various federal and state entities.

Electricity contracts may be short-term (real-time or day ahead) or years in duration, and contracts can be executed for immediate delivery or years in advance. Pricing may be fixed, indexed to an underlying fuel source or other index such as LME, cost-based or based on regional market pricing. In 2022, Alcoa generated approximately 11% of the power used at its smelters worldwide and generally purchased the remainder under long-term arrangements.

The following table sets forth the electricity generation capacity and 2022 generation of facilities in which Alcoa Corporation has an ownership interest. See also the Joint Ventures section above.

Country	Facility	Alcoa Corporation Consolidated Capacity (MW)	2022 Generation (MWh)
Brazil	Barra Grande	150	1,108,364
	Estreito	155	1,075,678
	Machadinho	119	1,343,885
	Serra do Facão	60	176,617
Canada	Manicouagan	133	1,160,170
United States	Warrick	657	4,072,355
TOTAL		**1,274**	**8,937,069**

The figures in this table are presented in megawatts (MW) and megawatt hours (MWh), respectively.

Each facility listed above generates hydroelectric power except the Warrick facility, which generates substantially all of the power used by the Warrick smelting facility from the co-located Warrick power plant using coal purchased from third parties at nearby coal reserves. During 2022, approximately 37% of the generation from the Warrick power plant was sold into the market under its current operating permits. Alcoa Power Generating Inc., a subsidiary of the Company, also owns certain Federal Energy Regulatory Commission (FERC)-regulated transmission assets in Indiana, Tennessee, New York, and Washington.

The consolidated capacity of the Brazilian energy facilities shown above in megawatts (MW) is the assured energy, representing approximately 52% of hydropower plant nominal capacity. Since May 2015 (after curtailment of the Poços de Caldas and São Luís smelters in Brazil), the excess generation capacity from the Brazilian hydroelectric facilities has been sold into the market.

Below is an overview of our external energy for our smelters and refineries.

	External Energy Source	
Region	**Electricity**	**Natural Gas**
North America	*Québec, Canada* Alcoa's smelter located in Baie-Comeau, Quebec, purchases approximately one-quarter of its electricity needs from Manicouagan Power Limited Partnership. Otherwise, all electricity consumed by the three smelters in Québec is purchased under contracts with Hydro-Québec that expire on December 31, 2029. *Massena, New York (Massena West)* The Massena West smelter in New York receives power from the New York Power Authority (NYPA) pursuant to a contract between Alcoa and NYPA that expires in March 2026.	Alcoa generally procures natural gas on a competitive bid basis from a variety of sources, including producers in the gas production areas and independent gas marketers. Contract pricing for gas is typically based on a published industry index such as the New York Mercantile Exchange (NYMEX).
Australia	*Portland* This smelter purchases power from the National Electricity Market (NEM) variable spot market in the state of Victoria. During 2021, the smelter entered into fixed-for-floating swap contracts with AGL Hydro Partnership, Origin Energy Electricity Limited and Alinta Energy CEA Trading Pty Ltd, at a combined level of 515 MW. In addition, in November 2021 the Portland Aluminium joint venture announced the planned restart of 35,000 mtpy of idle capacity (19,000 mtpy Alcoa share) which was underpinned by an additional fixed-for-floating swap contract with AGL Hydro Partnership for 72 MW. These swap contracts manage exposure to the variable energy rates from the NEM spot market. The swap contracts will expire on June 30, 2026.	*Western Australia* AofA uses gas to co-generate steam and electricity for its alumina refining processes at the Kwinana, Pinjarra and Wagerup refineries. In 2015, AofA secured a significant portion of gas supplies to 2032, covering more than 95 percent of the refineries' gas requirements through 2023 and decreasing percentages thereafter. In 2020 and 2022, AofA contracted for additional gas supplies starting in 2024. On a combined basis, these gas supply arrangements are expected to cover approximately 80% of the refineries' gas requirements through 2027. In January 2023, the Company reduced production at the Kwinana (Australia) refinery by approximately 30 percent in response to a domestic natural gas shortage in Western Australia due to production challenges experienced by key gas suppliers.

	External Energy Source	
Region	**Electricity**	**Natural Gas**
Europe	*San Ciprián, Spain* The Company completed the temporary curtailment of its 228,000 mtpy smelting capacity at the San Ciprián smelter in January 2022 pursuant to the agreement reached with the workers' representatives on December 29, 2021. The smelter purchases its reduced electricity requirements under a bilateral spot power contract that expired on June 30, 2022. In anticipation of a phased restart beginning in 2024 as agreed with workers' representatives (see above), up to approximately 75 percent of the smelter's future power needs have been secured under long-term agreements with renewable energy providers to date. The Company continues to negotiate with other generators to secure the remaining power supply needs for the smelter. The supply of energy will depend on the permitting and development of the windfarms. *Lista and Mosjøen, Norway* Beginning in 2017, Alcoa entered into several long-term power purchase agreements, which secured approximately 50 percent of the necessary power for the Norwegian smelters for the period of 2020 to 2035. The remaining 50 percent was purchased under short-term contracts. In 2022, approximately 25 percent of the necessary power at the Mosjøen (Norway) smelter was purchased at spot rates. Financial compensation of the indirect carbon emissions costs passed through in the electricity bill is received in accordance with EU Commission Guidelines and the Norwegian compensation regime. During 2022, the Company acted to mitigate spot energy pricing at the Lista (Norway) smelter. In July 2022, the Company entered into a fixed price power agreement effective for the fourth quarter of 2022 through December 31, 2023. In February 2023, the agreement was amended with improved fixed pricing and lower volume commitments. The Company is continuing to review operating levels with changes in market conditions. *Iceland* Landsvirkjun, the Icelandic national power company, supplies competitively priced electricity from a hydroelectric facility to Alcoa's Fjarðaál smelter under a 40-year power contract, which will expire in 2047 with a price renegotiation effective from 2027.	*Spain* In January 2022, Naturgy terminated its contract supplying 50 percent of the refinery's natural gas demand until June 2022 and 25 percent from July to December 2022. Subsequent to February 2022, the Company has access to adequate supply at spot gas rates.
South America	*Alumar* On September 20, 2021, the Company announced its plan to restart its 268 kmt per year share of capacity at the Alumar smelter in São Luís, Brazil, which had been fully curtailed since 2015. The first metal sales occurred in the second quarter of 2022 and the Company continues to progress the restart of the smelter. Alcoa entered into several short-term power purchase agreements which secured substantially all of the necessary power for its share of the Alumar smelter for the restart period in 2022 through the end of 2023. Alcoa also entered into multiple long-term power purchase agreements which collectively secured all of the necessary power for its share of the Alumar smelter for the period of 2024 through 2038. All power secured for short and long term is from renewable sources.	

Sources and Availability of Raw Materials

The Company believes that the raw materials necessary to its business are and will continue to be available and that the sources and availability of such raw materials are currently adequate. Generally, materials are purchased from third-party suppliers under competitively priced supply contracts or bidding arrangements. Substantially all of the raw materials required to manufacture our products are available from more than one supplier. Some sources of these raw materials are located in countries that may be subject to unstable political and economic conditions, which could disrupt supply or affect the price of these materials.

Certain raw materials, such as caustic soda and calcined petroleum coke, may be subject to significant price volatility which could impact our financial results.

Alcoa sources bauxite from its own resources, including AWAC entities, and believes its present sources of bauxite on a global basis are sufficient to meet the forecasted requirements of its alumina refining operations for the foreseeable future.

For each metric ton (mt) of alumina produced, Alcoa consumes the following amounts of the identified raw material inputs (approximate range across relevant facilities):

Raw Material	Units	Consumption per mt of Alumina
Bauxite	mt	2.2 – 4.1
Caustic soda	kg	60 – 100
Electricity	kWh	170 to 260 total consumed (0 to 230 imported)
Fuel oil and natural gas	GJ	6 – 13.5
Lime (CaO)	kg	6 – 60

For each metric ton of aluminum produced, Alcoa consumes the following amounts of the identified raw material inputs (approximate range across relevant facilities):

Raw Material	Units	Consumption per mt of Primary Aluminum
Alumina	mt	1.92 ± 0.02
Aluminum fluoride	kg	17.0 ± 2.6
Calcined petroleum coke	mt	0.38 ± 0.03
Cathode blocks	mt	0.005 ± 0.001
Electricity	kWh	13.27 – 16.69
Liquid pitch	mt	0.09 ± 0.02
Natural gas	mcf	3.0 ± 1.0

Certain aluminum we produce includes alloying materials. Because of the number of different types of elements that can be used to produce various alloys, providing a range of such elements would not be meaningful. With the exception of a very small number of internally used products, Alcoa produces its aluminum alloys in adherence to an Aluminum Association (of which Alcoa is an active member) standard, which uses a specific designation system to identify alloy types. In general, each alloy type has a major alloying element other than aluminum but will also include lesser amounts of other constituents.

Competition

Alcoa is subject to highly competitive conditions in all aspects of the aluminum supply chain in which it competes. With our business segments operating in close proximity to our broad, worldwide customer base, we endeavor to meet customer demand in key markets in North America, South America, Europe, the Middle East, Australia, and China.

We compete with a variety of both U.S. and non-U.S. companies in all major markets across the aluminum supply chain. Competitors include bauxite miners who supply to the third-party bauxite market, alumina suppliers, refiners and producers, commodity traders, aluminum producers, and producers of alternative materials such as steel, titanium, copper, carbon fiber, composites, plastic, and glass.

By having an integrated aluminum value chain, we are able to offer our Sustana line of products manufactured through low-carbon emitting processes, which includes: EcoSource alumina, Ecolum aluminum, and EcoDura aluminum.

Bauxite

We are among the world's largest bauxite miners. The majority of bauxite mined globally is converted to alumina for the production of aluminum. In 2022, approximately 8% of Alcoa's bauxite shipments were sold to third-party customers and Alcoa-operated mines supply approximately 92% of their volume to Alcoa refineries.

Alcoa's share of mines operated by partnerships in which Alcoa, including AWAC, has equity interests, supply approximately 55% of their volume to Alcoa refineries. Our principal competitors in the third-party bauxite market include Rio Tinto and multiple suppliers from Guinea, Australia, Indonesia, and Brazil, among other countries. We compete largely based on bauxite quality, price, and proximity to customers, as well as strategically located long-term bauxite resources in Australia, Brazil, and Guinea, which is home to the world's largest reserves of high-quality metallurgical grade bauxite.

Alumina

We are the world's largest alumina producer outside of China. The alumina market is global and highly competitive, with many active suppliers, producers, and commodity traders. Our main competitors in the third-party alumina market are Aluminum Corporation of China, South32, Hangzhou Jinjiang Group, Rio Tinto, and Norsk Hydro ASA. In recent years, there has been significant growth in alumina refining in China and India. The majority of our product is sold in the form of smelter grade alumina.

Key factors influencing competition in the alumina market include cost position, price, reliability of bauxite supply, quality, and proximity to customers and end markets. We had an average cost position in the first quartile of global alumina production in 2022. Our refineries are strategically located near low-cost bauxite mines, which provide a long-term supply of bauxite to our refining portfolio. Our alumina refineries include sophisticated refining technology to maximize efficiency with the bauxite grades from these internal mines.

The Company anticipates continuing growth in its EcoSource low carbon smelter-grade alumina from smelting customers. Alumina-associated emissions are generally the third largest component of aluminum's carbon footprint.

Aluminum

In our Aluminum segment, competition is dependent upon the type of product we are selling.

The market for primary aluminum is global, and demand for aluminum varies widely from region to region. We compete with commodity traders, such as Glencore, Trafigura, J. Aron and Gerald Group, and aluminum producers such as Emirates Global Aluminum, Norsk Hydro ASA, Rio Tinto, Century Aluminum, Vedanta Aluminum Ltd., and United Company RUSAL Plc.

Several of the most critical competitive factors in our industry are product quality, production costs (including source, reliability of supply, and cost of energy), price, access and proximity to raw materials, customers and end markets, timeliness of delivery, customer service (including technical support), product innovation, and breadth of offerings. Where aluminum products compete with other materials, the characteristics of aluminum are also a significant factor, particularly its light weight, strength, and recyclability.

Increasingly, Alcoa is seeing higher demand for its Sustana line of products by customers focused on low carbon inputs throughout their supply chain.

The strength of our position in the primary aluminum market is largely attributable to: our integrated supply chain; long-term energy arrangements; the ability of our casthouses to provide customers with a diverse product portfolio in terms of shapes and alloys; and our decreasing demand for fossil fuels, as approximately 86% of the aluminum smelting portfolio operated by the Company was powered by renewable (primarily hydropower) energy sources in 2022. The Company intends to continue to focus on optimizing capacity utilization.

Patents, Trade Secrets and Trademarks

The Company believes that its domestic and international patent, trade secret and trademark assets provide it with a competitive advantage. The Company's rights under its intellectual property, as well as the technology and products made and sold under them, are important to the Company as a whole and, to varying degrees, important to each business segment. Alcoa's business as a whole is not, however, materially dependent on any single patent, trade secret or trademark. As a result of product development and technological advancement, the Company continues to pursue patent protection in jurisdictions throughout the world. As of December 31, 2022, Alcoa's worldwide patent portfolio consisted of approximately 400 granted patents and 180 pending patent applications. The Company also has a number of domestic and international registered trademarks that have significant recognition within the markets that are served, including the name "Alcoa" and the Alcoa symbol.

In connection with the Separation Transaction, Alcoa Corporation and ParentCo entered into certain intellectual property license agreements that provide for a license of certain patents, trademarks, and know-how from ParentCo or Alcoa Corporation, as applicable, to the other, on a perpetual, royalty-free, and non-exclusive basis, subject to certain exceptions.

Government Regulations and Environmental Matters

Alcoa's global operations subject it to compliance with various types of government laws, regulations, permits, and other requirements which often provide discretion to government authorities and could be interpreted, applied, or modified in ways to make the Company's operations or compliance activities more costly. These laws and regulations include those relating to safety and health, environmental protection and compliance, tailings management, data privacy and security, anti-corruption, human rights, competition, and trade, such as tariffs or other import or export restrictions that may increase the cost of raw material or cross-border shipments and impact our ability to do business with certain countries or individuals. Though we cannot predict the collective potential adverse impact of the expanding body of laws, regulations, and interpretations, we believe that we are in compliance with such laws and regulations in all material respects and do not expect that continued compliance with such regulations will have a material effect upon capital expenditures, earnings, or our competitive position. For a discussion of the risks associated with certain applicable laws and regulations, see Part I Item 1A of this Form 10-K.

Environmental

Alcoa is subject to extensive federal, state/provincial, and local environmental laws and regulations and other requirements, in the U.S. and abroad, including those relating to the release or discharge of materials into the air, water and soil, waste management, pollution prevention measures, the generation, storage, handling, use, transportation and disposal of hazardous materials, and the exposure of persons to hazardous materials. Alcoa is working towards the implementation of the Global Industry Standard on Tailings Management (GISTM), an integrated approach to the management and operations of our tailings storage facilities to enhance the safety of these facilities. Additionally, we are and may become subject to various laws and regulations related to climate change, particularly related to the reduction of greenhouse gas emissions.

We maintain remediation and reclamation plans for various sites, and we manage environmental assessments and cleanups at approximately 60 locations, which include currently owned or operated facilities and adjoining properties, previously owned or operated facilities and adjoining properties, and waste sites, such as U.S. Superfund (Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)) sites. In 2022, capital expenditures for new or expanded facilities for environmental control were approximately $136 and approximately $162 is expected in 2023. See Part II Item 8 of this Form 10-K in Note S to the Consolidated Financial Statements under caption Contingencies for additional information.

Safety and Health

We are subject to a broad range of foreign, federal, state, and local laws and regulations relating to occupational health and safety, and our safety program includes measures required for compliance. We have incurred, and will continue to incur, capital expenditures to meet our health and safety compliance requirements, as well as to continually improve our safety systems.

For a discussion of the risks associated with certain applicable laws and regulations, see Part I Item 1A of this Form 10-K.

Human Capital Resources

Our core values – Act with Integrity, Operate with Excellence, Care for People, and Lead with Courage – guide us as a company, including our approach to human capital management. We believe that our people are our greatest asset. The success and growth of our business depend in large part on our ability to attract, develop, and retain a diverse population of talented, qualified, and highly skilled employees at all levels of our organization, including the individuals who comprise our global workforce, our executive officers and other key personnel.

Our Company policies, including the Code of Conduct and Ethics, Harassment and Bullying Free Workplace Policy, and EHS Vision, Values, Mission, and Policy, support our mission to advance our Company culture and core values. Alcoa maintains a Human Rights Policy that applies globally to the Company, its partnerships, and other business associates, which incorporates international human rights principles encompassed in the Universal Declaration of Human Rights, the International Labor Organization's Declaration on Fundamental Principles and Rights at Work, the United Nations Global Compact, and the United Nations Guiding Principles on Business and Human Rights.

Employees

As of December 31, 2022, Alcoa had approximately 13,100 employees in 17 countries. Approximately 9,600 of our global employees are covered by collective bargaining agreements with certain unions and varying expiration dates, including approximately 1,000 employees in the U.S., 1,900 employees in Europe, 1,400 employees in Canada, 2,500 employees in South America, and 2,800 employees in Australia. Approximately 900 U.S. employees are covered by a collective bargaining agreement in place with the United Steelworkers (USW). There are also U.S. collective bargaining agreements in place, with varying expiration dates, with the International Association of Machinists and Aerospace Workers (IAM) and the International Brotherhood of Electric Workers (IBEW).

In 2022, the Company continued the process of hiring employees for the restart of the Alumar smelter in Brazil and approximately 420 additional employees were hired.

Safety and Health

The safety and health of our employees, contractors, temporary workers, and visitors are top priorities and key to our ability to attract and retain talent. We aspire to work safely, all the time, everywhere. We strive to foster a culture of hazard and risk awareness, the effective understanding and use of our safe systems of work, proactive incident reporting, and knowledge sharing.

Our safety programs and systems are designed to prevent loss of life and serious injury at our locations and include rigorous safety standards and controls, periodic risk-based audits, a formal and standardized process for investigating fatal and serious injury incidents (including potential incidents), management of critical risks and safety hazards, and efforts to eliminate hazards or implement controls to prevent and mitigate risks. We have operating standards based on human performance, which teach employees how to anticipate and recognize situations where errors are likely to occur, which help enable us to predict, reduce, manage, and prevent fatalities and injuries.

We strive to maintain a culture of speaking up, where incidents are reported and ideas are shared. We integrate our temporary workers, contractors, and visitors into our safety programs and data.

We have included a safety metric focused on reducing fatalities and serious injuries in our annual incentive program for the past several years.

Inclusion, Diversity, and Equity

Alcoa's vision is to provide trusting workplaces that are safe, respectful, and inclusive of all individuals and that reflect the diversity of the communities in which we operate. Our mission is to build a stronger Everyone Culture – a more inclusive culture where inclusion, diversity, and equity (IDE) is embedded in our actions and employees feel valued, empowered, and respected.

As of December 31, 2022, women comprised approximately 18 percent of our global workforce. To support our efforts to increase employee diversity, for the past several years, we have included a metric in our annual incentive plan focused on increasing the gender diversity of our global workforce as well as other underrepresented groups. We also recognize the benefits and importance of diversity among our senior management. Of the eight executive team members, 50 percent are women and 12 percent are racially/ethnically diverse.

In 2022, we continued our IDE strategic efforts with leadership from our Global Inclusion & Diversity Council and three inclusion groups: AWARE – Alcoans working actively for racial-ethnic equality; EAGLE, our LGBT+ Equality inclusion group; and AWN – Alcoa Women's Network. At the end of 2022, we announced the expansion of our inclusion groups for 2023, by adding ABLE – Alcoans moving beyond limited expectations, for those with disabilities.

Available Information

The Company's internet website address is www.alcoa.com. Alcoa makes available free of charge on or through its website its Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, and amendments to those reports as soon as reasonably practicable after the Company electronically files such material with, or furnishes it to, the Securities and Exchange Commission (the SEC). These documents can be accessed on the investor relations portion of our website www.alcoa.com/investors. This information can also be found on the SEC's internet website, www.sec.gov. The information on the Company's website is included as an inactive textual reference only and is not a part of, or incorporated by reference in, this Annual Report on Form 10-K.

Dissemination of Company Information

Alcoa Corporation intends to make future announcements regarding Company developments and financial performance through its website, www.alcoa.com, as well as through press releases, filings with the SEC, conference calls, and webcasts.

Information about our Executive Officers

The names, ages, positions, and areas of responsibility of the executive officers of the Company as of the filing date of this Form 10-K are listed below.

Roy C. Harvey, 49, is President and Chief Executive Officer of Alcoa Corporation. He became Chief Executive Officer in November 2016 and assumed the role of President in May 2017. Mr. Harvey served as Executive Vice President of ParentCo and President of ParentCo's Global Primary Products (GPP) division from October 2015 to November 2016. From June 2014 to October 2015, he was Executive Vice President, Human Resources and Environment, Health, Safety and Sustainability at ParentCo. Prior to that time, Mr. Harvey served as Chief Operating Officer, and was also Chief Financial Officer, for GPP at ParentCo. In addition to these roles, Mr. Harvey served in the roles of Director of Investor Relations and Director of Corporate Treasury at ParentCo. Mr. Harvey joined ParentCo in 2002.

Molly S. Beerman, 59, has served as Executive Vice President and Chief Financial Officer of Alcoa Corporation since February 1, 2023. Prior to this, Ms. Beerman was Senior Vice President and Controller of the Company from November 2019 to January 2023 and Vice President and Controller from December 2016 through October 2019. Ms. Beerman was Director, Global Shared Services Strategy and Solutions from November to December 2016. In 2016, Ms. Beerman held a consulting role with the Finance Department of ParentCo. From 2012 to 2015, Ms. Beerman served as Vice President, Finance and Administration for a non-profit organization focused on community issues. Prior to that, Ms. Beerman was employed by ParentCo from 2001 to 2012, having held several roles in the finance function and eventually becoming the director of global procurement center of excellence from 2008 to 2012. Ms. Beerman is a certified public accountant.

Renato Bacchi, 46, has served as Executive Vice President and Chief Strategy and Innovation Officer of Alcoa Corporation since February 1, 2023. Mr. Bacchi is responsible for strategy, corporate and business development, energy, non-operated joint ventures, and curtailed and closed sites, and he oversees the Company's innovations and technologies, including the Company's Technical Center for research and development (R&D) activities. Previously, he was Executive Vice President and Chief Strategy Officer from February 2022 through January 2023, Senior Vice President and Treasurer from November 2019 through January 2022, and Vice President and Treasurer from November 2016 through October 2019. Prior to the Separation Transaction, Mr. Bacchi served as the Assistant Treasurer of ParentCo from October 2014 through October 2016 and the Director, Corporate Treasury from 2012 to 2014. Prior to this time, Mr. Bacchi held various roles of increasing responsibility in areas including finance, strategy, procurement, energy and sales. Mr. Bacchi joined ParentCo in Brazil in 1997.

Sonya Elam Harden, 58, has served as Executive Vice President and Chief External Affairs Officer of Alcoa Corporation since August 2020. In this role, Ms. Elam Harden is responsible for global government affairs, community relations, and sustainability, and she oversees the Alcoa Foundation. Ms. Elam Harden was the Interim Head of External Affairs of Alcoa Corporation from March 2020 through July 2020 and served as the Vice President, Government Affairs for the Western Hemisphere from November 2016 through July 2020. Prior to the Separation Transaction, Ms. Elam Harden held various roles of increasing responsibility in communications, marketing, and government affairs at ParentCo, including as Director of Communications for the GPP division from November 2010 through October 2016 and as Director of Marketing from October 2009 to November 2010. Ms. Elam Harden initially joined ParentCo in 1989, and rejoined in 2001, after having left ParentCo in 1998.

Jeffrey D. Heeter, 57, has served as Executive Vice President and General Counsel of Alcoa Corporation since November 2016. In this role, Mr. Heeter has overall responsibility for the Company's global legal, compliance, governance, and security matters. He previously also served as the Secretary of Alcoa Corporation from November 2016 to December 2019. Mr. Heeter served as Assistant General Counsel and an Assistant Officer of ParentCo from 2014 to November 2016. Mr. Heeter was Group Counsel for the GPP division of ParentCo from 2010 to 2014. From 2008 to 2010, Mr. Heeter was General Counsel of Alcoa of Australia in Perth, Australia. Mr. Heeter joined ParentCo in 1998.

Tammi A. Jones, 43, has served as Executive Vice President and Chief Human Resources Officer of Alcoa Corporation since April 2020. Ms. Jones oversees all aspects of human resources management, including talent and recruitment, compensation and benefits, inclusion and diversity, training and development, and labor relations. Ms. Jones served as Vice President, Compensation and Benefits from January 2019 through March 2020 and was the Director, Organizational Effectiveness from April 2017 to December 2018. From April 2015 through March 2017, Ms. Jones served as Human Resources Director, Aluminum (including of GPP at ParentCo until the Separation Transaction), and she served as Human Resources Director for ParentCo Wheels and Transportation Products from April 2013 to April 2015. Ms. Jones joined ParentCo in 2006 and held a variety of human resource positions at ParentCo, including Human Resources Director, Europe Building & Construction and Human Resources Director, UK and Ireland in ParentCo's Building and Construction Systems division.

William F. Oplinger, 56, has served as Executive Vice President and Chief Operations Officer of Alcoa Corporation since February 1, 2023. In this role, Mr. Oplinger is responsible for the daily operations of the Company's bauxite, alumina, and aluminum assets. From November 2016 to January 2023, Mr. Oplinger was Executive Vice President and Chief Financial Officer of the Company. Prior to this, Mr. Oplinger served as Executive Vice President and Chief Financial Officer of ParentCo from April 1, 2013 to November 2016. Mr. Oplinger joined ParentCo in 2000, and through 2013 held key corporate positions in financial analysis and planning and also served as Director of Investor Relations. Mr. Oplinger also held principal positions in the ParentCo's GPP division, including as Controller, Operational Excellence Director, Chief Financial Officer, and Chief Operating Officer.

Kelly R. Thomas, 53, has served as Executive Vice President and Chief Commercial Officer of Alcoa Corporation since February 14, 2022. In this role, Ms. Thomas is responsible for leading the Company' commercial function, including sales and trading, marketing, supply chain, commercial operations, and procurement. Prior to joining Alcoa, Ms. Thomas was the Vice President, Finance at Vista Metals Corporation, an aluminum products company, from October 2015 to February 2022 and the Chief Operating Officer at Electronic Recyclers International, an electronics recycler, from June 2014 through September 2015. Prior to this time, from 2010 to 2014, Ms. Thomas held various positions of increasing responsibility at Aleris Corporation, including Senior Vice President and General Manager of North American Rolled Products. Ms. Thomas joined Reynolds Metals in 1999, later acquired by ParentCo, and held various roles in sales, risk management, and marketing at ParentCo from 2001 to 2009.

Item 1A. Risk Factors.

There are inherent risks associated with Alcoa's business and industry. In addition to the factors discussed elsewhere in this report, the following risks and uncertainties could have a material adverse effect on our business, financial condition, or results of operations, including causing Alcoa's actual results to differ materially from those projected in any forward-looking statements. Although the risks are organized by heading, and each risk is described separately, many of the risks are interrelated. You should not interpret the disclosure of any risk factor to imply that the risk has not already materialized. While we believe we have identified and discussed below the key risk factors affecting our business, there may be additional risks and uncertainties that are not presently known to Alcoa or that Alcoa currently deems immaterial that also may materially adversely affect us in future periods. See Part II Item 7 of this Form 10-K in Management's Discussion and Analysis of Financial Condition and Results of Operations under caption Forward-Looking Statements.

Industry and Global Market Risks

The aluminum industry and aluminum end-use markets are highly cyclical and are influenced by several factors, including global economic conditions, the Chinese market, and overall consumer confidence.

The nature of the industries in which our customers operate causes demand for our products to be cyclical, creating potential uncertainty regarding future profitability. The demand for aluminum is sensitive to, and impacted by, demand for the finished goods manufactured by our customers in industries, such as the commercial construction, transportation, and automotive industries, which may change as a result of changes in the global economy, foreign currency exchange rates, energy prices, or other factors beyond our control. The demand for aluminum is also highly correlated to economic growth, and we could be adversely affected by large or sudden shifts in the global inventory of aluminum and the resulting market price impacts.

We believe the long-term prospects for aluminum and aluminum products are positive; however, we are unable to predict the future course of industry variables or the strength of the global economy and the effects of government intervention. Our business, financial condition, and results of operations may be materially affected by the conditions in the global economy generally, including inflationary and recessionary conditions, and in global capital markets, including in the end markets and geographic regions in which we and our customers operate. Many of the markets in which our customers participate are also cyclical in nature and experience significant fluctuations in demand for their products based on economic conditions, consumer demand, raw material and energy costs, and government actions. Many of these factors are beyond our control.

The Chinese market is a significant source of global demand for, and supply of, commodities, including aluminum. Chinese production rates of aluminum, both from new construction and installed smelting capacity, can fluctuate based on Chinese government policy, such as the level of enforcement of capacity limits and/or licenses and environmental policies. In addition, industry overcapacity, a sustained slowdown in Chinese aluminum demand, or a significant slowdown in other markets, that is not offset by decreases in supply of aluminum or increased aluminum demand in emerging economies, such as India, Brazil, and several Southeast Asian countries, could have an adverse effect on the global supply and demand for aluminum and aluminum prices. Also, changes in the aluminum market can cause changes in the alumina and bauxite markets, which could also materially affect our business, financial condition, or results of operations. As a result of these factors, our profitability is subject to significant fluctuation.

A decline in consumer and business confidence and spending, severe reductions in the availability and cost of credit, and volatility in the capital and credit markets could adversely affect the business and economic environment in which we operate and the profitability of our business. We are also exposed to risks associated with the creditworthiness of our suppliers and customers. If the availability of credit to fund or support the continuation and expansion of our customers' business operations is curtailed or if the cost of that credit is increased, the resulting inability of our customers or of their customers to either access credit or absorb the increased cost of that credit could adversely affect our business by reducing our sales or by increasing our exposure to losses from uncollectible customer accounts. These conditions and a disruption of the credit markets could also result in financial instability of some of our suppliers and customers. The consequences of such adverse effects could include the interruption of production at the facilities of our customers, the reduction, delay or cancellation of customer orders, delays or interruptions of the supply of raw materials we purchase, and bankruptcy of customers, suppliers, or other creditors. Any of these events could adversely affect our business, financial condition, and results of operations.

Market-driven balancing of global aluminum supply and demand may be disrupted by non-market forces.

In response to market-driven factors relating to the global supply and demand of aluminum and alumina, including energy prices and environmental policies, other industry producers have independently undertaken to reduce or increase production. Changes in production may be delayed or impaired by the ability to secure, or the terms of long-term contracts, to buy energy or raw materials.

The impact of non-market forces on global aluminum industry capacity, such as political instability or pressures or governmental policies in certain countries relating to employment, the environment, or maintaining or further developing industry self-sufficiency, may affect overall supply and demand in the aluminum industry. For example, the ongoing active conflict between Russia and Ukraine could adversely impact macroeconomic conditions and result in heightened economic sanctions from the U.S. and the international community in a manner that adversely affects our industry. The disruption of the market-driven balancing of the global supply and demand of aluminum, a resulting weak pricing environment and margin compression may adversely affect our business, financial condition, and results of operations.

We could be materially adversely affected by volatility and declines in aluminum and alumina, including global, regional, and product-specific prices, or by significant changes in production costs which are linked to LME or other commodities.

The overall price of primary aluminum consists of several components: (i) the underlying base metal component, which is typically based on quoted prices from the LME; (ii) the regional premium, which comprises the incremental price over the base LME component that is associated with the physical delivery of metal to a particular region (e.g., the Midwest premium for metal sold in the United States); and (iii) the product premium, which represents the incremental price for receiving physical metal in a particular shape (e.g., foundry, billet, slab, rod, etc.) and/or alloy. Each of the above three components has its own drivers of variability.

The LME price volatility is typically driven by macroeconomic factors (including political instability), global supply and demand of aluminum (including expectations for growth, contraction, and the level of global inventories), and trading activity of financial investors. LME cash prices reached the highest level in over a decade in March 2022 at $3,985 per metric ton, with the low point of the year in September 2022 at $2,080 per metric ton.

While global inventories declined in 2022, high LME inventories could lead to a reduction in the price of aluminum and declines in the LME price have had a negative impact on our business, financial condition, and results of operations. Regional premiums tend to vary based on the supply of and demand for metal in a particular region, associated transportation costs, and import tariffs. Product premiums generally are a function of supply and demand for a given primary aluminum shape and alloy combination in a particular region. Periods of industry overcapacity may also result in a weak aluminum pricing environment.

A sustained weak LME aluminum pricing environment, deterioration in LME aluminum prices, or a decrease in regional premiums or product premiums could have a material adverse effect on our business, financial condition, or results of operations. Similarly, our operating results are affected by significant changes in key costs of production that are commodity or LME-linked.

Most of our alumina contracts contain two pricing components: (1) the API price basis and (2) a negotiated adjustment basis that takes into account various factors, including freight, quality, customer location, and market conditions. Because the API component can exhibit significant volatility due to market exposure, revenues associated with our alumina operations are exposed to market pricing.

Our participation in increasingly competitive and complex global markets exposes us to risks, including legal and regulatory risks and changes in conditions beyond our control, that could adversely affect our business, financial condition, or results of operations.

We have operations or activities in numerous countries and regions outside the United States, including Australia, Brazil, Canada, Europe, Guinea, and the Saudi Arabia. The risks associated with the Company's global operations include:

- Geopolitical risks, such as political instability, coups d'états, civil unrest, strikes and work stoppages, expropriation, nationalization of properties by a government, imposition of sanctions, changes to import or export regulations and fees, renegotiation, revocation or nullification of existing agreements, leases, licenses, and permits, and changes to mining royalty rules or laws;
- Economic and commercial instability risks, including those caused by sovereign and private debt default, corruption, and changes in local government laws, regulations, and policies, such as those related to tariffs and trade barriers, trade tensions, taxation, exchange controls, employment regulations, and repatriation of earnings;
- Weakening macroeconomic conditions;
- Contracting manufacturing activity, especially in the global automotive sector;
- War or terrorist activities;
- Major public health issues, such as an outbreak of a pandemic or epidemic, which could cause disruptions in our operations, supply chain, or workforce;
- Information systems failures or disruptions, including due to cyber attacks;
- Difficulties enforcing intellectual property and contractual rights, or limitations in the protection of technology, data, and intellectual property, in certain jurisdictions; and,
- Unexpected events, accidents, or environmental incidents, including natural disasters.

We have experienced some of these events, and while the impact of any of the foregoing factors is difficult to predict, any one or more of them could adversely affect our business, financial condition, or results of operations. Existing insurance arrangements may not provide sufficient coverage or reimbursement for significant costs that may arise from such events.

Unexpected or uncontrollable events or circumstances in any of the foreign markets in which we operate, including actions by foreign governments such as changes in foreign policy or fiscal regimes, termination of our leases or agreements with such foreign governments, increased government regulation, or forced curtailment or continuation of operations, could materially and adversely affect our business, financial condition, or results of operations.

We may be unable to obtain, maintain, or renew permits or approvals necessary for our mining operations, which could materially adversely affect our operations and profitability.

Our mining operations are subject to extensive permitting and approval requirements. These include permits and approvals issued by various government agencies and regulatory bodies at the federal, state, and local levels of governments in the countries in which we operate. The permitting and approval rules are complex, are often subject to interpretations by regulators, which may change over time, and may be impacted by heightened levels of regulatory oversight and stakeholder focus on addressing environmental and social impacts of mining activities. Changing expectations and increased information required by regulators could make our ability to comply with the applicable requirements more difficult, inhibit or delay our ability to timely obtain the necessary approvals, if at all, result in approvals being conditioned in a manner that may restrict the Company's ability to efficiently and economically conduct its mining activities, require us to adjust our mining plans, or preclude the continuation of certain ongoing operations and mining activities or the development of future mining operations. Failure to obtain, maintain, or renew permits or approvals, or permitting or approval delays, restrictions, or conditions may impact the quality of the bauxite we are able to mine and could increase our costs and affect our ability to efficiently and economically conduct our operations, potentially having a materially adverse impact on our results of operations and profitability.

In addition, the permitting processes, restrictions, and requirements imposed by conditional permits or approvals, and associated costs and liabilities, may be extensive and may delay or prevent commencing or continuing exploration or production operations, which could adversely affect the Company's mining operations and production, and consequently our refining and smelting operations, and could require us to curtail, close, or otherwise modify our production, operations, and sites. Additionally, the Company's mining permits may be rescinded or modified, or our mining plans may be adjusted, to mitigate against adverse impacts to sites within or near our mining areas that have environmental, biodiversity, or cultural significance, potentially having a materially adverse impact on our results of operations and profitability. Due to mining plan approval delays in Western Australia, the Company is currently mining and processing lower grade bauxite, which has caused increased production costs.

Our operations and profitability have been and could continue to be adversely affected by unfavorable changes in the cost, quality, or availability of raw materials or other key inputs, or by disruptions in the supply chain.

Our business, financial condition, and results of operations have been and could continue to be negatively affected by unfavorable changes in the cost, quality, or availability of energy, raw materials, including carbon products, caustic soda, and other key inputs, such as bauxite, as well as freight costs associated with transportation of raw materials and key inputs to refining and smelting locations. We may not be able to fully offset the effects of higher raw material or energy costs through price increases, productivity improvements, cost reduction programs, or reductions or curtailments to production at our operations. A decrease in the quality of raw materials or key inputs has in the past and could continue to cause increased production costs, which also has in the past and could continue to result in lower production volumes. For example, the Company is currently mining and processing lower grade bauxite in Western Australia, which has caused increased production costs. Changes in the costs of bauxite, alumina, energy and other inputs during a particular period may not be adequate to offset concurrent sharper decreases in the price of alumina or aluminum and could have a material adverse effect on our operating results.

In addition, due to global supply chain disruptions, we may not be able to obtain sufficient supply of our raw materials, energy, or other key inputs in a timely manner, including due to shortages, inflationary cost pressures, or transportation delays, which could cause disruption in our operations or production curtailments. Though we have been able to source our raw materials and other key inputs in adequate amounts from other suppliers or our own stockpiles to date, there can be no guarantee that our operations or profitability will not be adversely affected in the future. Our suppliers, vendors, and customers could experience similar constraints that could impact our operations and profitability.

Our operations consume substantial amounts of energy and could be disrupted, and our profitability could decline, if energy costs rise or if energy supplies are interrupted or become uncertain.

Our refineries and smelters consume substantial amounts of natural gas and electricity in the production of alumina and aluminum. The prices for and availability of energy are subject to volatile market conditions that can be affected by factors beyond our control such as weather, political, regulatory, and economic conditions. For example, significantly higher market power prices in Europe in 2022 have caused competitors' smelters to announce production cuts, as well as the production cuts announced by Alcoa in 2022 due to rising energy costs (see Part 1 Item 1 of this Form 10-K).

Though we have ownership in certain hydroelectricity assets, we rely on third parties for our supply of energy resources consumed in the manufacture of our products. Energy supply contracts for our operations vary in length and market exposure, and we could be, and have been, negatively impacted by:

- Significant increases in LME prices, or spot electricity, fuel oil and/or natural gas prices;
- Unavailability of or interruptions or uncertainty in energy supply or unplanned outages due to political instability, droughts, hurricanes, wildfires, other natural disasters, equipment failure, or other causes;
- Unavailability of long-term energy from renewable sources in particular locations or at competitive rates;

- Curtailment of one or more refineries or smelters due to the inability to extend energy contracts upon expiration or negotiate new arrangements on cost-effective terms, the unavailability of energy at competitive rates; and,
- Curtailment of one or more facilities due to high energy costs that render their continued operation uneconomic, discontinuation of power supply interruptibility rights granted to us under a regulatory regime in the country in which the facility is located, or due to a determination that energy arrangements do not comply with applicable laws, thus rendering the operations that had been relying on such country's energy framework uneconomic.

Events, such as those listed above, can result in high energy costs, the disruption of an energy source, finding a replacement energy source at a higher cost, the requirement to repay all or a portion of the benefit we received under a power supply interruptibility regime, or the requirement to remedy any non-compliance of an energy framework to comply with applicable laws. These events could disrupt our operations or result in production curtailments that could have a material adverse effect on our business, financial condition or results of operations.

Business Strategy Risks

We have incurred, and may incur in the future, significant costs associated with our strategy to be a lower cost, competitive, and integrated aluminum production business and we may not be able to realize the anticipated benefits from announced plans, programs, initiatives relating to our portfolio, capital investments, and developing technologies.

We are executing a strategy to be a low cost, competitive, and integrated aluminum production business by implementing productivity and cost-reduction initiatives, optimizing our portfolio of assets, and investing in technology to advance sustainably. We have been taking decisive actions to lower the cost base of our operations through procurement strategies for raw materials, labor productivity, improving operating performance, deploying Company-wide business process models, and reducing overhead costs. In 2019, the Company announced a five year strategic portfolio review of smelting and refining capacity. Through 2021, Alcoa reached approximately 75 and 58 percent of its target to improve cost positioning, including curtailment, closure or divestiture of 1.5 and 4 million metric tons of smelting and refining capacity, respectively. While no actions were taken in 2022 related to these targets, the Company took actions in response to market conditions, and the strategic portfolio review is continuing. Though we have made progress on this strategy, we may not be able to realize the expected benefits or cost savings from this strategy.

We have made and may continue to plan and execute other actions to grow or streamline our portfolio. There is no assurance that anticipated benefits of our strategic actions will be realized. With respect to portfolio optimization actions such as divestitures, curtailments, closures, and restarts, we may face barriers to exit from unprofitable businesses or operations, including high exit costs or objections from various stakeholders, the lack of availability of buyers willing to purchase such assets at prices acceptable to us, delays due to any regulatory approvals or government intervention, continuing environmental obligations, and third parties unwilling to release us from guarantees or other credit support provided in connection with the sale of assets. In addition, we may retain liabilities from such transactions, have ongoing indemnification obligations, and incur unforeseen liabilities for divested entities if a buyer fails to honor all commitments.

Our business operations are capital intensive, and portfolio optimization actions such as the curtailment or closure of operations or facilities may include significant costs and charges, including asset impairment charges and other measures. There can be no assurance that such actions will be undertaken or completed in their entirety as planned at the anticipated cost or will result in being beneficial to the Company. The effect of closures, curtailments, and divestitures over time will reduce the Company's cash flow and earnings capacity and result in a less diversified portfolio of businesses, and we will have a greater dependency on remaining businesses for our financial results. Additionally, curtailing certain existing facilities, whether temporarily or permanently, may require us to incur curtailment and carrying costs related to those facilities, as well as further increased costs should production be resumed at any curtailed facility, which could have an adverse effect on our business, financial results, and results of operations.

Our announced multi-year portfolio review of Company assets includes evaluating our portfolio to assess each facility's strategic benefits, competitiveness, and viability. Following this review, we expect to be a low cost, first quartile producer across our product segments of bauxite, alumina, and aluminum, and have up to 85% of smelting production from renewable energy sources, which aligns with our long-term goal of having the lowest carbon-producing refineries and smelters in the industry. Our announced roadmap of technologies under development to support our long-term goal of having the lowest carbon-producing alumina refineries and aluminum smelters includes investments to develop, implement, and commercialize new technologies to reduce carbon emissions in the aluminum production process. We may not be able to implement, fully or in a cost-effective or timely way, the actions necessary to achieve this strategy and goal, which actions could include capturing, maintaining and/or expanding margins from new products, continued product innovation investment in research and development projects and new technologies, successful deployment and commercialization of effective new technologies, and cost-effective long-term energy solutions. We may not achieve the expected results from technology innovation or other benefits, including certain emissions or environmental-related goals, or expected profitability associated with this strategy. In addition, even if we are able to cost effectively develop our technologies, alternatives to technologies may be more acceptable to the market. Executing these actions also diverts senior management time and resources from our regular business operations, each of which could adversely affect the Company's business, financial condition, and results of operations.

Joint ventures, other strategic alliances, and strategic business transactions may not achieve intended results. We may experience operational challenges in integrating or segregating assets for such a venture or transaction, and such a venture or transaction could increase the number of our outstanding shares or amount of outstanding debt and affect our financial position.

We participate in joint ventures, have formed strategic alliances, and may enter into other similar arrangements in the future. For example, AWAC is an unincorporated global joint venture between Alcoa and Alumina Limited. AWAC consists of a number of affiliated entities, which own, operate, or have an interest in, bauxite mines and alumina refineries, as well as an aluminum smelter, in seven countries. In addition, Alcoa is minority owner of a joint venture with the Saudi Arabian Mining Company (Ma'aden). Although the Company has, in connection with these and our other existing joint ventures and strategic alliances, sought to protect our interests, joint ventures, and strategic alliances inherently involve special risks. Whether or not the Company holds majority interests or maintains operational control in such arrangements, our joint venture and other business partners may take certain actions and positions, or experience difficulties, that may negatively impact the Company and/or its reputation, such as:

- Advancing economic, political, social, or business interests or goals that are inconsistent with, or opposed to those of, the Company and our stakeholders;
- Exercising veto rights to block actions that we believe to be in our or the joint venture's or strategic alliance's best interests;
- Taking action contrary to our policies or objectives with respect to our investments; and,
- As a result of financial or other difficulties, be unable or unwilling to fulfill their obligations under the joint venture, strategic alliance, or other agreements, such as contributing capital to expansion or maintenance projects.

We continuously evaluate and may in the future enter into additional strategic business transactions. Any such transactions could happen at any time, could be material to our business, and could take any number of forms, including, for example, an acquisition, merger, sale or distribution of certain assets, refinancing, or other recapitalization or material strategic transaction. There can be no assurance that our joint ventures, strategic alliances, or additional strategic business transactions will be beneficial to us, whether due to the above-described risks, unfavorable global economic conditions, increases in costs, foreign currency fluctuations, political risks, government interventions, retained liabilities, indemnification obligations, or other factors. Evaluating potential transactions and integrating completed ones may divert the attention of our management from ordinary operating matters. In addition, to the extent we consummate an agreement for the sale and disposition of an asset or asset group we may experience operational difficulties segregating them from our retained assets and operations, which could impact the execution or timing of such dispositions and could result in disruptions to our operations and/or claims for damages, among other things.

If we engage in a strategic transaction, we may require additional financing that could result in an increase in the number of our outstanding shares of stock or the aggregate amount and/or cost of our debt, which may result in an adverse impact to our credit ratings or adversely impact our business, financial condition, or results of operations. The number of shares of our stock or the aggregate principal amount of our debt that we may issue in connection with such a transaction could be significant.

Global Operational Risks

Our global operations expose us to risks related to economic, political, and social conditions, including the impact of trade policies and adverse industry publicity, which may negatively impact our business and our ability to operate in certain locations.

We are subject to risks associated with doing business internationally, including foreign or domestic government fiscal and political crises, political and economic disputes and sanctions, social requirements and conditions, and adverse industry publicity. These factors, among others, bring uncertainty to the markets in which we compete, and may adversely affect our business, financial condition, and results of operations.

In addition, we operate in communities around the world, and social issues in the communities where we operate could affect our ability to maintain our operations; furthermore, incidents related to our industry could generate negative publicity and impact the social acceptability of our operations in such locations, including by damaging our reputation, our relationships with stakeholders, and our competitive position. Growing expectations of hosting communities as well as increasing social activism pose additional challenges to us maintaining our social license to operate and expand our business. For example, community and stakeholder concerns in Juruti, Brazil have affected our ability to access certain mining areas at times. In certain jurisdictions, there are increasing regulatory developments to protect minority groups, such as Indigenous People in Australia. This could have an adverse effect on our ability to secure expansions to our operations at all or in the expected timeframe, could significantly increase our cost of doing business, and could disrupt our operations.

In the United States, in recent years, the U.S. government has taken actions with respect to the implementation of significant changes to certain trade policies, including import tariffs and quotas, modifications to international trade policy, the withdrawal from or renegotiation of certain trade agreements, and other changes that have affected U.S. trade relations with other countries, any of which may require us to significantly modify our current business practices or may otherwise materially and adversely affect our business or those of our customers. The U.S. government continues to review trade policies and negotiate new agreements with countries globally that could impact the Company. For example, the U.S. government is negotiating agreements with countries in relation to the tariffs initially applied under Section 232 of the Trade Expansion Act of 1962 (Section 232) in 2018. In 2021, the U.S. and European Union (EU) reached agreement whereby the U.S. lifted the Section 232 duties and applied a tariff-rate-quota allowing duty-free importation of aluminum from the EU based on historical volumes, and the EU suspended its retaliatory tariffs that had been in place on certain U.S. products. To the extent that further agreements are reached on a broader range of imports, or these tariffs and other trade actions result in a decrease in international demand for aluminum produced in the United States or otherwise negatively impact demand for our products, our business may be adversely impacted, and could further exacerbate aluminum and alumina price volatility and overall market uncertainty.

We are exposed to fluctuations in foreign currency exchange rates and interest rates, as well as inflation and other economic factors in the countries in which we operate.

Economic factors, including inflation and fluctuations in foreign currency exchange rates and interest rates, competitive factors in the countries in which we operate, and volatility or deterioration in the global economic and financial environment, could affect our business, financial condition, and results of operations. Changes in the valuation of the U.S. dollar against other currencies, particularly the Australian dollar, Brazilian real, Canadian dollar, euro, and Norwegian kroner, which are the currencies of certain countries in which we have operations, may affect our profitability, as some important inputs are purchased in other currencies, while our products are generally sold in U.S. dollars. As the U.S. dollar strengthens, the cost curve shifts down for smelters outside the United States, but costs for our U.S. smelting portfolio may not decline.

Changes in tax laws or exposure to additional tax liabilities could affect our future profitability.

We are subject to income taxes in both the United States and various non-U.S. jurisdictions. Changes in foreign and domestic tax laws, regulations, or policies, or their interpretation and application by regulatory bodies, or exposure to additional tax liabilities could affect our future profitability. For example, in October 2021, a new framework for international tax was agreed to by 137 member countries and jurisdictions of the Organisation for Economic Co-operation and Development (OECD), with rules targeted to be finalized in 2023 and implemented by participating jurisdictions as early as 2024. The impact to the Company of such an agreement is uncertain until applicable rules are promulgated and implemented by the participating jurisdictions. In December 2022, the European Union Council formally adopted the Global Minimum Tax portion of this framework, requiring member states to implement certain tax rules for tax years beginning in 2024. Our domestic and international tax liabilities are dependent upon the distribution of profits among these different jurisdictions. Our tax expense includes estimates of additional tax that may be incurred for tax exposures and reflects various estimates and assumptions. The assumptions include assessments of future earnings of the Company that could impact the valuation of our deferred tax assets. Our future results of operations could be adversely affected by changes in the effective tax rate as a result of a change in the mix of earnings in countries with differing statutory tax rates, changes in the overall profitability of the Company, changes in tax legislation and rates, changes in generally accepted accounting principles, and changes in the valuation of deferred tax assets and liabilities. Significant changes to tax laws or regulations and the positions of taxing authorities could have a substantial impact, positive or negative, on our effective tax rate, cash tax expenditures and cash flows, and deferred tax assets and liabilities.

We are subject to tax audits by various tax authorities in many jurisdictions, such as Australia, Brazil, Canada, and Spain. For example, in July 2020, AofA received Notices of Assessment (the Notices) from the Australian Taxation Office (ATO) related to the pricing of certain historic third-party alumina sales. The Notices asserted claims for income tax payable by AofA of approximately $143 (A$214), exclusive of interest and penalties. The Notices also include claims for compounded interest on the tax amount totaling approximately $474 (A$707). In accordance with the ATO's dispute resolution practices, AofA paid 50% of the assessed income tax amount exclusive of interest and any penalties to the ATO during the third quarter of 2020, and the ATO is not expected to seek further payment prior to final resolution of the matter. If AofA is ultimately successful, any amounts paid to the ATO as part of the 50% payment would be refunded. The ATO has also issued a position paper with its preliminary view on the imposition of administrative penalties related to the tax assessment, proposing penalties of approximately $86 (A$128). AofA disagrees with the ATO's proposed position on penalties and submitted a response to the position paper in the fourth quarter of 2020. After the ATO completes its review of AofA's response, the ATO could issue a penalty assessment. The Company does not agree with the ATO's positions, and AofA will continue to defend this matter in the Australian Courts. We regularly assess the potential outcomes of examinations by tax authorities in determining the adequacy of our provision for income taxes. The results of tax audits and examinations of previously filed tax returns or related litigation and continuing assessments of our tax exposures could materially affect our financial results. See Part II Item 8 of this Form 10-K in Notes Q and S to the Consolidated Financial Statements under captions Unrecognized Tax Benefits and Contingencies, respectively.

On August 16, 2022, the U.S. enacted the Inflation Reduction Act of 2022, which includes a 15% minimum tax on book income of certain large corporations, a 1% excise tax on net stock repurchases after December 31, 2022 and several tax incentives to promote clean energy. This legislation did not have a material impact on the Company's Consolidated Financial Statements as of December 31, 2022.

We face significant competition globally within and beyond the aluminum industry, which may have an adverse effect on profitability.

We compete with a variety of both U.S. and non-U.S. aluminum industry competitors as well as with producers of other materials, such as steel, titanium, plastics, composites, ceramics, and glass, among others. Use of such materials could reduce the demand for aluminum products, which may reduce our profitability and cash flow. Factors affecting our ability to compete include increased competition from overseas producers, our competitors' pricing strategies, the introduction or advancement of new technologies and equipment by our competitors or our customers, changes in our customers' strategy or material requirements, and our ability to maintain the cost-efficiency of our facilities. Certain competitors possess financial, technical and management resources to develop and market products that may compete favorably against our products, and consolidation among our competitors may also allow them to compete more effectively. In addition, our competitive position depends, in part, on our ability to operate as an integrated aluminum value chain, leverage innovation expertise across businesses and key end markets, and access an economical power supply to sustain our operations in various countries. See Business—Competition.

We may not be able to obtain or maintain adequate insurance coverage.

We maintain various forms of insurance, including insurance covering claims related to our properties and risks associated with our operations. Our existing property and liability insurance coverages contain exclusions and limitations on coverage. In connection with renewals of insurance, we have experienced, or could experience in the future, additional exclusions and limitations on coverage, significantly increased self-insured retentions and deductibles, and significantly higher premiums. We may not be able to procure adequate insurance coverage for certain risks, if at all, and existing insurance arrangements may not provide sufficient coverage or reimbursement for significant costs that may arise. As a result, in the future our insurance coverage may not cover claims to the extent that it has in the past and the costs that we incur to procure insurance may increase significantly, either of which could have an adverse effect on our results of operations.

Our business, financial condition and results of operations could be adversely affected by disruptions in the global economy caused by the ongoing conflict between Russia and Ukraine.

The global economy has been negatively impacted by the conflict between Russia and Ukraine. Such adverse and uncertain economic conditions have exacerbated supply chain disruptions and increased our costs for energy, particularly in Spain, and for certain raw materials. During the first quarter of 2022, in response to the conflict, we ceased purchasing raw materials from and selling our products to Russian businesses. To date, these actions have not had a material adverse impact on the Company's business, financial condition and results of operations, but they could have material negative impacts if the conflict continues and global sales of our products are impacted. Furthermore, governments in the U.S., United Kingdom and European Union have each imposed export controls on certain products and financial and economic sanctions on certain industry sectors and parties in Russia. Although we have no operations in Russia or Ukraine and our sales into these regions were historically minimal and have recently been discontinued, we will continue to monitor the conflict between Russia and Ukraine and the potential impact of financial and economic sanctions on the regional and global economy.

Increased trade barriers or restrictions on global trade, or retaliatory measures taken by Russia, or other countries in response, as well as the destabilizing effects of the conflict, could also adversely affect our business, financial condition and results of operations by limiting sales, restricting access to required raw materials, or raising costs thereof. Destabilizing effects that the ongoing conflict may pose for the global oil and natural gas markets could also adversely impact our operations by further increasing our energy costs. In addition, further escalation of geopolitical tensions related to the conflict could result in loss of property, cyberattacks, additional supply disruptions, an inability to obtain key supplies and materials, reduced production and sales, and/or operational curtailments, and adversely affect our business and our supply chain.

Legal and Regulatory Risks

We may be exposed to significant legal proceedings, investigations, or changes in foreign and/or U.S. federal, state, or local laws, regulations, or policies.

Our results of operations or liquidity in a particular period could be affected by new or increasingly stringent laws, regulatory requirements or interpretations, or outcomes of significant legal proceedings or investigations adverse to the Company. We may become subject to unexpected or rising costs associated with business operations, compliance measures, or provision of health or welfare benefits to employees due to changes in laws, regulations, or policies. We are also subject to a variety of legal and compliance risks, including, among other things, potential claims relating to health and safety, environmental matters, intellectual property rights, product liability, data privacy, taxes and compliance with U.S. and foreign export, anti-bribery, and competition laws, and sales and trading practices. We could be subject to fines, penalties, interest, or damages (in certain cases, treble damages). In addition, if we violate the terms of our agreements with governmental authorities, we may face additional monetary sanctions and other remedies as a court deems appropriate.

While we believe we have adopted appropriate risk management and compliance programs to address and reduce these risks, the global and diverse nature of our operations means that these risks continue to exist, and additional legal proceedings and contingencies may arise from time to time. In addition, various factors or developments can lead the Company to change current estimates of liabilities or make estimates for matters previously not susceptible of reasonable estimates, such as a significant judicial ruling, judgment, or settlement, or significant regulatory developments or changes in applicable law. A future adverse ruling or settlement or unfavorable changes in laws, regulations or policies, or other contingencies that the Company cannot predict with certainty could have a material adverse effect on our results of operations or cash flows in a particular period. See Part I Item 3 of this Form 10-K and Part II Item 8 of this Form 10-K in Note S to the Consolidated Financial Statements under caption Contingencies.

Climate change, climate change legislation or regulations, and efforts to reduce greenhouse gases and build operational resilience to extreme weather conditions may adversely impact our operations and markets.

Energy is a significant input in a number of our operations and there is growing recognition that consumption of energy derived from fossil fuels is a contributor to climate change. Several governments or regulatory bodies in areas where we operate, such as in Canada and the EU, have introduced or are contemplating legislative and regulatory change in response to the potential impacts of climate change, which could result in changes to the margins of greenhouse gas (GHG) intensive assets and energy-intensive assets. These regulatory mechanisms relating to carbon may be either voluntary or legislated and the inconsistency of associated regulations may impact our operations directly or indirectly through customers or our supply chain. Assessments of the potential impact of future climate change legislation, regulation, and international treaties and accords are uncertain, given the wide scope of potential regulatory change in countries in which we operate and the diversity in the scope and development of such regulations. For example, in 2021, the European Commission proposed a Carbon Border Adjustment Mechanism (CBAM) as a levy on carbon-intensive imports, which was provisionally approved in December 2022 and would include aluminum in the first phase of implementation beginning in 2023. We may realize increased capital expenditures, costs, or taxes resulting from required compliance with revised or new legislation or regulations, including costs to purchase or profits from sales of allowances or credits under a carbon credit/pricing or “cap and trade” system, increased insurance premiums and deductibles as new actuarial tables are developed to reshape coverage, a change in competitive position relative to industry peers, and changes to profit or loss arising from increased or decreased demand for goods produced by the Company and, indirectly, from changes in costs of goods sold.

Though we are investing in technology to reduce the production of greenhouse gases in the manufacture of our products, such as our ELYSIS joint venture aluminum smelting technology and other technologies that limit the production of carbon in alumina refining, in certain aspects of our operations, our ability to reduce our greenhouse gas emissions is also dependent on the actions of third parties, especially energy providers, and our ability to make significant changes in our greenhouse gas emissions. As a result, we could face additional costs associated with any new regulation of GHG emissions, and our ability to modify our operations to avoid these costs may be limited in the near term.

In addition, regulations to combat climate change could impact the competitiveness of the Company, including the attractiveness of the locations of some of the Company’s assets. The global focus on climate is raising awareness in all countries, such as the agreement at the 26th United Nations Climate Change Conference of the Parties (COP26) by many governments of countries where the Company operates to combat deforestation, which could adversely affect our ability to mine and operate in sensitive areas like the Jarrah Forest and the Amazon.

The potential physical impacts of climate change or extreme weather conditions on the Company's operations are highly uncertain and will be particular to the geographic circumstances. These may include changes in rainfall patterns, wildfires, heat waves, shortages of water or other natural resources, changing sea levels, changing storm patterns, flooding, increased frequency and intensities of storms, and changing temperature levels. Any of these may disrupt our operations, hinder transportation of products to us or of our products to customers, prevent access to our facilities, negatively impact our suppliers' or customers' operations and their ability to fulfill contractual obligations to us, and/or cause damage to our facilities, all of which may increase our costs, reduce production, and adversely affect our business, financial condition, or results of operations.

From time to time, we establish strategies and expectations related to climate change and other environmental matters. Our ability to achieve any such strategies or expectations is subject to numerous factors and conditions, many of which are outside of our control. Examples of such factors include, but are not limited to, evolving legal, regulatory, and other standards, processes, and assumptions, the pace of scientific and technological developments, increased costs, the availability of requisite financing, and changes in carbon markets. Failures or delays (whether actual or perceived) in achieving our strategies or expectations related to climate change and other environmental matters could adversely affect our business, operations, and reputation, and increase the risk of litigation.

We are subject to a broad range of health, safety and environmental laws, regulations, and other requirements in the jurisdictions in which we operate that may expose us to substantial claims, costs, and liabilities.

Our operations worldwide are subject to numerous complex and increasingly stringent federal, state, local and foreign laws, regulations, policies, and permitting, licensing, and other requirements, including those related to health, safety, environmental, and waste management and disposal matters, which may expose us to substantial claims, costs, and liabilities. We may be subject to fines, penalties, and other damages, such as natural resource or community damages and the costs associated with the investigation and cleanup of soil, surface water, groundwater, and other media under laws such as CERCLA (commonly known as Superfund) or similar U.S. and foreign regulations. These laws, regulations, policies, and permitting, licensing, and other requirements could change or could be, and have been, applied or interpreted in ways that could (i) require us to enjoin, curtail, close or otherwise modify our operations and sites, including the implementation of corrective measures, the installation of additional equipment or structures, or the undertaking of other remedial actions, or (ii) subject us to enforcement risk or impose on or require us to incur additional capital expenditures, compliance or other costs, fines, penalties, or damages, any of which could adversely affect our results of operations, cash flows and financial condition, and the trading price of our common stock.

The costs of complying with such laws, regulations, policies, and other requirements, including participation in assessments, remediation activities, and cleanups of sites, as well as internal voluntary programs, are significant and will continue to be so for the foreseeable future. Environmental laws may impose cleanup liability on owners and occupiers of contaminated property, including previously owned, non-operational, or divested properties, regardless of whether the owners and occupiers caused the contamination or whether the activity that caused the contamination was lawful at the time it was conducted. As a result, we may be subject to claims arising from current or former conditions at sites that we own or operate currently, as well as at sites that we owned or operated in the past, and at contaminated sites that have always been owned or operated by third parties, regardless of whether we caused the contamination or whether the activity that caused the contamination was lawful at the time it was conducted. Liability may be without regard to fault and may be joint and several, so that we may be held responsible for more than our share of the contamination or other damages, or even for the entire share.

In addition, because environmental laws, regulations, policies, and other requirements are constantly evolving, we will continue to incur costs to maintain compliance and such costs could increase materially and prove to be more limiting and costly than we anticipate. Evolving standards and expectations can result in increased litigation and/or increased costs, all of which can have a material and adverse effect on our business operations, earnings, and cash flows. Future compliance with environmental, health and safety legislation and other regulatory requirements or expectations may prove to be more limiting and costly than we anticipate and may disrupt our business operations and require significant expenditures. Our business, financial condition, or results of operations in a particular period could be materially affected by certain health, safety, or environmental matters, including remediation costs and damages related to certain sites.

Our operations include impoundment structures, which could impact the environment or cause exposure to hazardous substances or other damage, which could result in material liabilities to us.

Some of our operations generate hazardous waste and other byproducts, which we contain in tailing facilities, residue storage areas, and other structural impoundments that are subject to extensive regulation and increasingly strict industry standards. Overtopping of storage areas caused by extreme weather events, erosion, or unanticipated structural failure of impoundments could result in severe, and in some cases catastrophic, damage to the environment, natural resources, or property, or personal injury and loss of life. These and other similar impacts that our operations may have on the environment, as well as exposures to hazardous substances or wastes associated with our operations, could result in significant costs, civil or criminal damages, fines or penalties, and enforcement actions issued by regulatory or judicial authorities enjoining, curtailing, or closing operations or requiring corrective measures, any of which could materially and adversely affect us.

Cybersecurity Risks

Cyber attacks, security breaches, system failures, software or application vulnerabilities, or other cyber incidents may threaten the integrity of our information technology infrastructure and other sensitive business information, disrupt our operations and business processes, expose us to potential liability, and result in reputational harm and other negative consequences that could have a material adverse effect on our business, financial condition, and results of operations.

We depend on information and communications technology, networks, software, and related systems to operate our business, including production controls and operating systems at our facilities and systems for recording and processing transactions, interfacing with customers, financial reporting, and protecting the personal data of our employees and other confidential information. Our global operations require increased reliance on technology, which expose us to risks of theft of proprietary information, including trade secrets and other intellectual property that could have a material adverse effect on our business, financial condition, and results of operations. The protection of such information, as well as sensitive customer information, personal data of our employees, and other confidential information, is critical to us. We face global cybersecurity threats, which may range from uncoordinated individual attempts to sophisticated and targeted measures, known as advanced persistent threats, directed at the Company. In addition, a greater number of our employees are working remotely since the COVID-19 pandemic, which has increased cybersecurity vulnerabilities and risk to our information technologies systems.

Cyber attacks and other cyber incidents are becoming more frequent and sophisticated, are constantly evolving, and are being made by groups and individuals with significant resources and a wide range of expertise and motives. Cyber attacks and security breaches may include, but are not limited to, unauthorized attempts to access information or digital infrastructure, efforts to direct payments to fictitious parties, viruses, ransomware, malicious codes, hacking, phishing (including through social engineering), denial of service, human error, and other electronic security breaches, any of which could have a material adverse effect on our business, financial condition, and results of operations. As techniques used in cyber attacks change frequently and may not be immediately detectable, we may be unable to anticipate or detect these techniques, such as use of a zero-day exploit or unknown malware, immediately identify the scope and impact of an incident, contain the incident within our systems, or implement preventative or remediation measures. In addition, we utilize third-party vendors for certain software applications, storage systems, and cloud computing services. Cyber attacks, security breaches, or other incidents on the information technology systems of our service providers or business partners could materially impact us. We have in the past experienced attempts and incidents by external parties to penetrate our and our service providers or business partners networks and systems. Such attempts and incidents to date have not resulted in any material breaches, disruptions, or loss of information.

We continue to assess potential cyber threats and invest in our information technology infrastructure to address these threats, including by monitoring networks and systems, training employees on cyber threats, and enhancing security policies of the Company and its third-party providers. While the Company continually works to strengthen our systems and security measures, safeguard information, and mitigate potential risks, there is no assurance that such actions will be sufficient to prevent or timely detect cyber attacks or security breaches. Such intrusions could manipulate or improperly use our systems or networks, disclose, or compromise confidential or protected information, destroy, or corrupt data, or otherwise disrupt our operations, any of which could have a material adverse effect on our business, financial condition, and results of operations.

In addition, cybersecurity incidents could negatively impact our reputation and competitive position, and could result in litigation with third parties, regulatory action, loss of business, theft of assets, and significant remediation costs, any of which could have a material adverse effect on our financial condition and results of operations. Such security breaches could also result in a violation of applicable U.S. and international privacy and other laws, and subject us to litigation and governmental investigations and proceedings, any of which could result in our exposure to material civil or criminal liability. For example, the European Union's General Data Privacy Regulation subjects companies to a range of compliance obligations regarding the handling of personal data. In the event our operations are found to be in violation of the GDPR's requirements, we may be subject to significant civil penalties, business disruption and reputational harm, any of which could have a material adverse effect on our business, financial condition, or results of operations. Cyber attacks or breaches could require significant management attention and resources and result in the diminution of the value of our investment in research and development, which could have a material adverse effect on our business, financial condition, or results of operations.

Though we have disaster recovery and business continuity plans in place, if our information technology systems, or those of our third-party providers, are damaged, breached, interrupted, or cease to function properly for any reason, and, if the disaster recovery and business continuity plans do not effectively resolve the incident on a timely basis, we may suffer interruptions in our ability to manage or conduct business and we may be exposed to reputational, competitive and business harm as well as litigation and regulatory action, which may materially and adversely impact our business, financial condition, or results of operations.

Available Capital and Credit-Related Risks

Our business and growth prospects may be negatively impacted by limits on our ability to fund capital expenditures.

We require substantial capital to invest in growth opportunities and to maintain and prolong the life and capacity of our existing facilities. Our ability to generate cash flows is affected by many factors, including market and pricing conditions. Insufficient cash generation or capital project overruns may negatively impact our ability to fund as planned our sustaining and return-seeking capital projects, and such postponement in funding capital expenditures or inadequate funding to complete projects could result in operational issues. For 2023, we project capital expenditures of $600 million, of which $485 million is for sustaining capital and $115 million for return-seeking capital. If our technology research and development projects prove feasible with an acceptable expected rate of return, our capital expenditures for return-seeking projects would increase significantly over the next several years. To the extent our access to competitive financial, credit, capital, and/or banking markets becomes impaired, our operations, financial results, and cash flows could be adversely impacted. We may also need to address commercial, political, and social issues in relation to capital expenditures in certain of the jurisdictions in which we operate. If our interest in our joint ventures is diluted or we lose key concessions, our growth could be constrained. Any of the foregoing could have a material adverse effect on our business, results of operations, financial condition, and prospects.

We cannot guarantee that we will continue to return capital to our stockholders through the payment of cash dividends and/or the repurchase of our common stock. The reduction or discontinuation of the payment of cash dividends to our stockholders or the repurchase of our shares of common stock could adversely affect the market price or liquidity of our shares.

In October 2021, the Company's Board of Directors initiated a quarterly cash dividend program, at $0.10 per share and authorized a $500 share repurchase program, which was fully used with the completion of $150 in repurchases during the third quarter of 2022. In July 2022, the Board of Directors approved an additional common stock repurchase program under which the Company may purchase shares of its outstanding common stock up to an aggregate transactional value of $500, depending on the Company's continuing analysis of market, financial, and other factors (the New Repurchase Program). This share repurchase authorization does not have a predetermined expiration date. The Company is under no obligation to pay any cash dividends to stockholders or to repurchase our outstanding shares of common stock at any particular price or at all, and the payment of dividends and/or repurchases of stock may be limited, suspended, or discontinued at any time in our discretion and without notice. The Company set each of the current dividend and new share repurchase program authorizations at a level it believes is sustainable throughout the commodity cycle, based on our current financial position and reasonable expectations of cash flow. In addition, as described elsewhere in this "Risk Factors" section, the Company's Revolving Credit Facility (as defined below) could inhibit the Company's ability to make certain restricted payments, including the amount of dividends and payments to redeem, repurchase, or retire equity securities or other indebtedness, if the Company does not maintain certain financial ratios.

The Company intends to pay dividends on a quarterly basis. Dividends on Alcoa Corporation common stock are subject to authorization by the Company's Board of Directors. The payment, amount, and timing of dividends, if any, depends upon matters deemed relevant by the Company's Board of Directors, such as Alcoa Corporation's financial position, results of operations, cash flows, capital requirements, business condition, future prospects, any limitations imposed by law, credit agreements or senior securities, and other factors deemed relevant and appropriate.

Declines in asset values or increases in liabilities, including liabilities associated with benefit plans or taxes, can reduce stockholders' equity. A deficit in stockholders' equity could limit our ability under Delaware law to pay dividends and repurchase shares in the future.

The reduction, suspension, or elimination of our cash dividend or our share repurchase program could adversely affect the market price of our stock and/or significantly increase its trading price volatility. The payment of any future dividends and the existence of a share repurchase program could cause our stock price to be higher than it would otherwise be and could potentially reduce the market liquidity for our stock. Additionally, any future payment of dividends or repurchases of our common stock could negatively impact our financial position and our ability to fund ordinary and existing operations, capital expenditures, the payment of taxes, and growth or other opportunities.

Deterioration in our credit profile or increases in interest rates could increase our costs of borrowing money and limit our access to the capital markets and commercial credit.

The major credit rating agencies evaluate our creditworthiness and give us specified credit ratings. These ratings are based on a number of factors, including our financial strength and financial policies as well as our strategies, operations, and execution of announced actions. These credit ratings are limited in scope and do not address all material risks related to an investment in us, but rather reflect only the view of each rating agency at the time its rating is issued. Nonetheless, the credit ratings we receive impact our borrowing costs as well as our access to sources of capital on terms advantageous to our business. Failure to obtain or maintain sufficiently high credit ratings could adversely affect our interest rates in financings, our liquidity, or our competitive position, and could also restrict our access to capital markets. In addition, our credit ratings could be lowered or withdrawn entirely by a rating agency if, in its judgment, the circumstances warrant. If a rating agency were to downgrade our rating, our borrowing costs could increase, our funding sources could decrease, and we would need to rely on our cash flows from operations. As a result of these factors, a downgrade of our credit ratings could have a materially adverse impact on our future operations, cash flows, and financial position.

Our indebtedness restricts our current and future operations, which could adversely affect our ability to respond to changes in our business and manage our operations, and failure to comply with the agreements relating to our outstanding indebtedness, including due to events beyond our control, could result in an event of default that could materially and adversely affect our business, financial condition, results of operations, or cash flows.

Alcoa and Alcoa Nederland Holding B.V. (ANHBV), a wholly-owned subsidiary of Alcoa, are party to a revolving credit agreement with a syndicate of lenders and issuers named therein (as subsequently amended, the Revolving Credit Facility). The terms of the Revolving Credit Facility and the indentures governing our outstanding notes contain covenants that could impose significant operating and financial restrictions on us upon non-compliance with them, including on our ability to, among other things:

- Make investments, loans, advances, and acquisitions;
- Amend certain material documents;
- Dispose of assets;
- Incur or guarantee additional debt and issue certain disqualified equity interests and preferred stock;
- Make certain restricted payments, including limiting the amount of dividends on equity securities and payments to redeem, repurchase or retire equity securities or other indebtedness;
- Engage in transactions with affiliates;
- Materially alter the business we conduct;
- Enter into certain restrictive agreements;
- Create liens on assets to secure lenders and issuers;
- Consolidate, merge, sell or otherwise dispose of all or substantially all of Alcoa's, ANHBV's or a subsidiary guarantor's assets; and,
- Take any actions that would reduce our ownership of AWAC entities below an agreed level.

The Revolving Credit Facility requires us to comply with financial covenants which includes maintaining an interest expense coverage ratio of not less than 4.00 to 1.00, and a debt to capitalization ratio not to exceed .60 to 1.00 (replaced the maximum leverage ratio upon a ratings upgrade to investment grade by Moody's Investor Service (Moody's) on July 26, 2022). The results of the calculation of these ratios, when considering the Company's existing debt obligations, affects and could restrict the amount of additional borrowing capacity under the Company's Revolving Credit Facility or other credit facilities, and ANHBV's ability to make restricted payments, to make investments and to incur indebtedness.

The Revolving Credit Facility released the collateral package that had previously secured the Revolving Credit Facility, which will continue so long as certain credit ratings are maintained. If Alcoa Corporation or ANHBV, as applicable, fails to have a rating of at least Ba1 from Moody's and BB+ from S&P, then the Company would be required to execute all security documents to re-secure collateral under the Revolving Credit Facility by, subject to certain exceptions, a first priority security interest in substantially all assets of Alcoa Corporation, ANHBV, the material domestic wholly-owned subsidiaries of Alcoa Corporation, and the material foreign wholly-owned subsidiaries of Alcoa Corporation located in Australia, Brazil, Canada, Luxembourg, the Netherlands, Norway, and Switzerland including equity interests of certain subsidiaries that directly hold equity interests in AWAC entities. Our ability to comply with these agreements may be affected by events beyond our control, including prevailing economic, financial, and industry conditions. These covenants could have an adverse effect on our business by limiting our ability to take advantage of financing, merger and acquisition, or other opportunities. The breach of any of these covenants or restrictions could result in a default under the Revolving Credit Facility or the indentures governing our notes and other outstanding indebtedness, including such indebtedness for which the Company is a guarantor.

See Part II Item 7 of this Form 10-K in Management's Discussion and Analysis of Financial Condition and Results of Operations under caption Liquidity and Capital Resources – Financing Activities for more information on the restrictive covenants in the Revolving Credit Facility.

If an event of default were to occur under any of the agreements relating to our outstanding indebtedness, including the Revolving Credit Facility and the indenture governing our notes, we may not be able to incur additional indebtedness under the Revolving Credit Facility and the holders of the defaulted debt could cause all amounts outstanding with respect to that debt to be due and payable immediately. We cannot assure that our assets or cash flow would be sufficient to fully repay borrowings under our outstanding debt instruments if accelerated upon an event of default, which could have a material adverse effect on our ability to continue to operate as a going concern. Further, if we are unable to repay, refinance, or restructure our secured indebtedness, the holders of such indebtedness could proceed against the collateral securing that indebtedness. In addition, any event of default or declaration of acceleration under one debt instrument also could result in an event of default under one or more of our other debt instruments.

Labor- and Pension-Related Risks

Union disputes and other employee relations issues, as well as labor market conditions, could adversely affect our business, financial condition, or results of operations.

A significant portion of our employees are represented by labor unions in a number of countries under various collective bargaining agreements with varying durations and expiration dates. Union disputes and other employee relations issues could, and have, adversely affected our business, financial condition, or results of operations. For example, in 2022, a strike at the Mosjøen (Norway) smelter commenced, after negotiations for a nationwide collective labor agreement between Industri Energi, a federation of Norwegian industries that includes Alcoa and Norsk Industri, which represents workers reached an impasse. The strike affected numerous industrial plants representing the Norwegian electrochemical industry. The strike ended on August 24, 2022, with a solution reached on the labor dispute, and normal operations resumed at the Mosjøen smelter with no material impact on the Company.

We may not be able to satisfactorily renegotiate collective bargaining agreements when they expire. In addition, existing collective bargaining agreements may not prevent strikes, work stoppages, work slowdowns, union organizing campaigns, or lockouts at our facilities in the future. We may also be subject to general country strikes or work stoppages unrelated to our business or collective bargaining agreements. A labor dispute or work stoppage of employees could have a material adverse effect on production at one or more of our facilities, and depending on the length of work stoppage, on our business, financial condition, or results of operations. Additionally, in the current competitive labor market, if we lose critical or a significant number of workers to attrition, it may be difficult or costly to find and recruit replacement employees, which could have a material adverse effect on our business, financial condition, and results of operations.

A decline in the liability discount rate, lower-than-expected investment return on pension assets and other factors could affect our business, financial condition, results of operations, or amount of pension funding contributions in future periods.

Our results of operations may be negatively affected by the amount of expense we record for our pension and other postretirement benefit plans, reductions in the fair value of plan assets, and other factors. We calculate income or expense for our plans using actuarial valuations in accordance with accounting principles generally accepted in the United States of America (GAAP).

These valuations reflect assumptions about financial market and other economic conditions, which may change based on changes in key economic indicators. The most significant year-end assumptions used by the Company to estimate pension or other postretirement benefit income or expense for the following year are the discount rate applied to plan liabilities and the expected long-term rate of return on plan assets. In addition, the Company is required to make an annual measurement of plan assets and liabilities, which may result in a significant charge to stockholders' equity. See Part II Item 7 of this Form 10-K in Management's Discussion and Analysis of Financial Condition and Results of Operations under caption Critical Accounting Policies and Estimates—Pension and Other Postretirement Benefits and Part II Item 8 of this Form 10-K in Note O to the Consolidated Financial Statements. Although GAAP expense and pension funding contributions are impacted by different regulations and requirements, the key economic factors that affect GAAP expense would also likely affect the amount of cash or securities we would contribute to the pension plans.

Potential pension contributions include both mandatory amounts required under federal law and discretionary contributions to improve the plans' funded status. While the Company took several actions in 2022 to improve the funded status of its pension plans and adjust its asset allocation to reduce variance risk, declines in the discount rate or lower-than-expected investment returns on plan assets could have a material negative effect on our cash flows. Adverse capital market conditions could result in reductions in the fair value of plan assets and increase our liabilities related to such plans, adversely affecting our liquidity and results of operations.

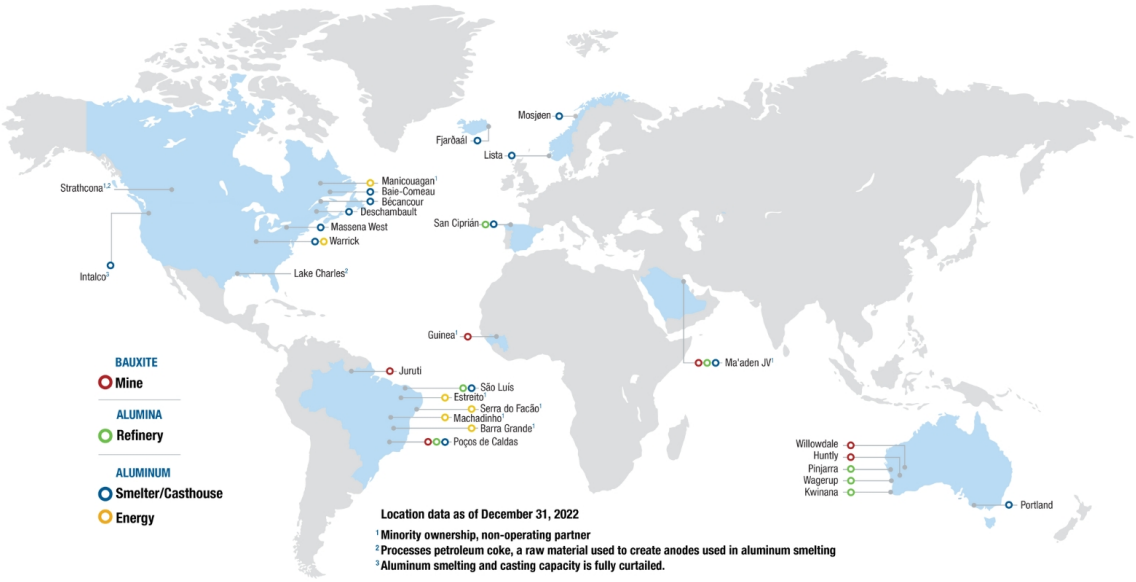
Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

Alcoa Corporation's principal executive office, located at 201 Isabella Street, Suite 500, Pittsburgh, Pennsylvania 15212-5858, is leased. Alcoa also leases several office facilities and sites, both domestically and internationally. In addition, Alcoa owns or has an ownership interest in its production sites, both domestically and internationally. Alcoa owns active mines and plants classified under the Bauxite, Alumina, and Aluminum segments of its business. These include facilities and assets around the world used for Alcoa's bauxite mining, alumina refining, aluminum smelting, and casting production and energy generation. Capacity and utilization of these facilities varies by segment and the level of demand for each product. See Part I Item 1 of this Form 10-K for additional information, including the ownership, capacity, and utilization of these facilities, used in the Alumina and Aluminum segments. A discussion of our bauxite mining properties is below.

The following map shows the locations of our operations as of December 31, 2022:



Alcoa Locations and Properties.

Although Alcoa's facilities vary in terms of age and condition, management believes that its facilities are suitable and generally adequate to support the current and projected operations of the business. See Part II Item 8 of this Form 10-K in Notes B and K to the Consolidated Financial Statements for more information on properties, plants, and equipment.

Bauxite Mining Properties

Alcoa has access to large bauxite deposit areas with mining rights that extend in many cases more than 15 years from the date of this Form 10-K. The Company obtains bauxite from its own resources and from those belonging to AWAC, located in the countries listed in the table below, as well as pursuant to both long-term and short-term contracts and mining leases. Tons of bauxite are reported on a zero-moisture basis in millions of dry metric tons (mdmt) unless otherwise stated.

As of December 31, 2022, the Company's individually material mining properties, as determined in accordance with subpart 1300 of Regulation S-K, are our bauxite mining properties in the Darling Range of Western Australia (Darling Range) and Juruti, Brazil (Juruti).

As used in this Form 10-K, the terms “mineral resource,” “measured mineral resource,” “indicated mineral resource,” “inferred mineral resource,” “mineral reserve,” “proven mineral reserve” and “probable mineral reserve” are defined and used in accordance with subpart 1300 of Regulation S-K. Under subpart 1300 of Regulation S-K, mineral resources may not be classified as “mineral reserves” unless the determination has been made by a qualified person (as defined under subpart 1300 of Regulation S-K) that the mineral resources can be the basis of an economically viable project. Part or all of the mineral deposits (including any mineral resources) in these categories may never be converted into mineral reserves. Further, except for the portion of mineral resources classified as mineral reserves, mineral resources do not have demonstrated economic value. Estimates of inferred mineral resources have too high of a degree of uncertainty as to their existence and may not be converted to a mineral reserve. Therefore, it should not be assumed that all or any part of an inferred mineral resource exists, that it can be the basis of an economically viable project, or that it will ever be upgraded to a higher category. Likewise, it should not be assumed that all or any part of measured or indicated mineral resources will ever be converted to mineral reserves. Management relies on estimates of our recoverable mineral reserves, which estimation is complex due to geological characteristics of the properties and the number of assumptions made and variable factors, some of which are beyond our control.

The following table shows the AWAC and/or Alcoa share (proportion) of annual production tonnage at each of our bauxite mining properties and in the aggregate for each of the last three fiscal years.

Summary of Attributable Annual Bauxite Production (mdmt) for the years ended December 31, 2022, 2021, and 2020, respectively:

Country	Property (Region)	2022	2021	2020
Australia	Darling Range (Western Australia, WA)	31.4	34.7	34.8
Brazil	Juruti (Pará State)	4.9	5.8	6.1
Brazil	Trombetas (Pará State) (1)	0.5	2.0	2.1
Brazil	Poços de Caldas (Minas Gerais)	0.4	0.4	0.2
Guinea	Boké (Sangaredi)	3.6	3.5	3.6
Saudi Arabia	Al Ba’itha (Al Qassim)	1.3	1.2	1.2
		42.1	47.6	48.0

(1) Represents production prior to the Company’s sale of its interest in the MRN property on April 30, 2022. Related mining operations are not material to the Company’s business or financial condition after consideration of both quantitative and qualitative factors assessed in the context of the Company’s overall business and financial condition.

The following tables summarize certain information regarding our bauxite mining properties. The information that follows relating to Darling Range and Juruti is derived, for the most part, from the technical report summaries relating to such properties prepared in compliance with Item 601(b)(96) and subpart 1300 of Regulation S-K. Portions of the following information are based on assumptions, qualifications, and procedures that are not fully described herein. Reference should be made to the full text of the Technical Report Summary for Darling Range, Western Australia, dated February 23, 2023, with an effective date of December 31, 2022, filed as Exhibit 96.1 to this Form 10-K (the Darling Range TRS), and the Technical Report Summary for Juruti, Brazil, dated February 24, 2022, with an effective date of December 31, 2021, incorporated by reference as Exhibit 96.2 to this Form 10-K (the Juruti TRS), which are incorporated by reference herein.

Bauxite Interests and Operators:

Property (Region)	Access/Transportation	Operator	Owners' Mining Rights[1]	Expiration Date of Mining Rights	Titles, Rights, Leases or Options	Area (hectares)
Darling Range[2] (WA)	Accessed by road. Ore transported via long-distance conveyor and rail to refineries.	AofA	100%	2024[5]	Mining lease from the WA Government. ML1SA.	702,261
Juruti[3] (Pará State)	Accessed by road from Juruti town, by boat along the Amazon River, or by air from Juruti Airport. Ore transported from the mine to Juruti port by company-operated rail.	AWAB	100%	2100[4]	Mining licenses from the Government of Brazil and Pará. Mining rights do not have a legal expiration date. Operating licenses for the mine, washing plant, and exploration are in the process of being renewed.	227,276
Poços de Caldas (Minas Gerais)	Accessed by road. Ore transported from the mine to the refinery by road.	Alcoa Alumínio	100%	2031[4]	Mining licenses from the Government of Brazil and Minas Gerais. Company claims and third-party leases. Operation licenses were renewed and unified and now expires in 2032.	7,424
Boké (Sangaredi)	Accessed by road from Sangaredi and public airports. Ore transported by company-operated rail to Kamsar port.	CBG	22.95%	2038	Mining lease from Government of Guinea. The lease is renewable in 25-year increments. CBG's rights are specified within the Basic Agreement and Amendment 1 to the Basic Agreement with the Government of Guinea.	293,900
Al Ba'itha (Al Qassim)	Accessed by road. Ore is transported to the refinery by rail and truck.	MBAC	25.1%	2037	Mining lease granted to Ma'aden by Kingdom of Saudi Arabia Ministry of Petroleum and Mineral Resources, with a duration of 30 years. Exclusive rights to utilize bauxite and annexed minerals.	14,776

(1) Owners' Mining Rights reflects AWAC's and/or Alcoa's ownership interest(s) in the properties and related share (proportion) of the mineral resources and reserves and annual production.

(2) For more information, see "Individual Property Disclosure—Darling Range" below.

(3) For more information, see "Individual Property Disclosure—Juruti" below.

(4) Brazilian mineral legislation does not limit the duration of mining concessions; rather, the concession remains in force until the deposit is exhausted. These concessions may be extended later or expire earlier than estimated, based on the rate at which these deposits are exhausted and on obtaining any additional governmental approval, as necessary.

(5) Prior to September 24, 2024, Alcoa will notify the State Government of Western Australia of its intention to exercise its right to renew for a further 21-year period to extend the concession to 2045. Subject to Alcoa having complied with the Alumina Refinery Agreement Act, 1961, the State Government will grant Alcoa the renewal.

Bauxite Mine Types and Facilities:

Property (Region)	Development Stage	Type of Mine and Mineralization	Processing Plant	Other Facilities
Darling Range[1] (WA)	Production/ Operating	Open-cut mines. Bauxite is lateritic formed through weathering of Archean granites and gneisses	N/A Ore crushing only.	Administrative buildings and workshops, crushers, long-distance conveyors. Power supplied from natural gas.
Juruti[2] (Pará State)	Production/ Operating	Open-cut mines. Bauxite is lateritic formed through weathering of Cretaceous Alter do Chao Formation sedimentary sequence.	Fixed plant for ore crushing and washing.	Mine: Administrative buildings and workshops, water supply pumps and pipeline from Juruti Grande, ore stockpiles, railroad, tailings thickening and settling ponds. Port: Administrative buildings, port control, ore stockpiles, rail siding, and ship loader. Power supplied by thermoelectric units at the mine and port.
Poços de Caldas (Minas Gerais)	Production/ Operating	Open-cut mines. Bauxite derived from the weathering of nepheline syenite and phonolite.	N/A Run of mine (ROM) trucked to refinery stockpiles.	Mining offices and services are located at the refinery. Power supplied by commercial grid.
Boké (Sangaredi)	Production/ Operating	Open-cut mines: The bauxite deposits within the CBG lease are of two general types. TYPE 1: In-situ laterization of Ordovician and Devonian plateau sediments locally intruded by dolerite dikes and sills. TYPE 2: Sangaredi type deposits are derived from clastic deposition of material eroded from the TYPE 1 laterite deposits and possibly some of the proliths from the TYPE 1 plateaus deposits.	N/A Ore crushed and dried at Kamsar port facilities.	Mine: Administrative buildings, workshops, and water/power supply are in Sangaredi. Port: Administrative buildings, port control, ore stockpiles, ore drying facilities, rail siding, and ship loader. Power supplied by fuel oil generators at the mine and port.
Al Ba'itha (Al Qassim)	Production/ Operating	Open-cut mine. Bauxite occurs as a paleolaterite profile developed at an angular unconformity between underlying late Triassic to early Cretaceous sediments (parent rock sequence Biyadh Formation) and the overlying late Cretaceous Wasia Formation (overburden sequence).	Fixed plant for ore crushing and train loading	The mine includes fixed plants for crushing and train loading; workshops and ancillary services; power plant; and water supply. There is a company village with supporting facilities

(1) For more information, see "Individual Property Disclosure—Darling Range Mines" below.

(2) For more information, see "Individual Property Disclosure—Juruti" below.

Bauxite Mineral Resources and Mineral Reserves

In accordance with subpart 1300 of Regulation S-K, management engaged SLR International Corporation as the qualified persons to prepare technical report summaries for the disclosure of mineral resources and reserves at Darling Range and Juruti. The tables shown below of resources and reserves by mining property were prepared using the results of the procedures performed by the qualified persons, which have no affiliation with or interest in Alcoa or our mining properties.

Summary of Attributable Bauxite Mineral Resources at December 31, 2022:

	Measured			Indicated			Measured + Indicated			Inferred		
Property (Region)	Tonnage (mdmt)[1]	Alumina (%)	Silica (%)	Tonnage (mdmt)[1]	Alumina (%)	Silica (%)	Tonnage (mdmt)[1]	Alumina (%)	Silica (%)	Tonnage (mdmt)[1]	Alumina (%)	Silica (%)
Darling Range (WA)[2]	44.9	31.2	1.2	51.8	31.4	1.2	96.7	31.3	1.2	140.3	32.9	1.3
Juruti (Pará State)[3]	5.7	44.5	5.3	58.6	45.3	4.4	64.2	45.3	4.5	563.7	45.7	4.7
Poços de Caldas (Minas Gerais)[4]	2.5	38.3	4.7	10.7	36.9	5.6	13.2	37.1	5.5	21.4	35.2	5.9
Boké (Sangaredi)[5]	—	—	—	1,350.7	46.6	2.3	1,350.7	46.6	2.3	168.1	45.8	2.4
Al Ba'itha (Al Qassim)[6]	—	—	—	—	—	—	—	—	—	0.7	48.3	11.7

(1) This table shows only the AWAC and/or Alcoa share (proportion) of mineral resources. The reference point for the mineral resource is the in situ predicted dry tonnage and grade of material to be delivered to the refinery stockpile following the application of mining design parameters. Certain totals may not sum due to rounding.

(2) Alumina for the Darling Range is stated as Available Alumina (as $A.Al_2O_3$) and Silica is stated as Reactive Silica (as $R.SiO_2$). Further, mineral resources are estimated using a reasonable market expectation of arms-length sales of bauxite from Darling Range, approximately $21 per ton. Darling Range mineral resources are estimated at a $\geq$ 27.5% $A.Al_2O_3$ and $\leq$3.5% $R.SiO_2$ cut-off grade and at a minimum mining thickness of 1.5 m.

(3) Alumina for Juruti is stated as Available Alumina (as $A.Al_2O_3$) and Silica is stated as Reactive Silica (as $R.SiO_2$). Juruti mineral resources are estimated at a pit discard cut-off value based on a benefit calculation that determines whether a block is economically viable. Further, mineral resources are estimated using a long-term bauxite price of approximately $35 (wet-base) per ton, representing a 30% increase over the mineral reserve bauxite price.

(4) Alumina for Poços de Caldas is stated as Available Alumina (as A.Al_2O_3) and Silica is stated as Reactive Silica (as R.SiO_2). Poços de Caldas mineral resources are estimated at a pit discard cut-off value based on a benefit calculation that determines whether a block is economically viable.

(5) Alumina for Boké is stated as Total Alumina (as T.Al_2O_3) and Silica is stated as Total Silica (as T.SiO_2). Boké resources are estimated at a ≥ 41% T.Al_2O_3 and ≤10% T.SiO_2 cut-off grade. Tonnage reported on a 3% moisture basis.

(6) Alumina for Al Ba'itha is stated as Total Available Alumina (as TAA) and Silica is stated as Total Silica (as T.SiO_2). Al Ba'itha mineral resources are estimated at a ≥ 40% TAA cut-off grade and a minimum mining thickness of 1.0 m.

The following table shows only the AWAC and/or Alcoa share (proportion) of mineral reserves. These estimates are periodically updated to reflect past bauxite production, updated mine plans, new exploration information, and other geologic or mining data. Given the Company's extensive bauxite resources, the abundant supply of bauxite globally, and the length of the Company's rights to bauxite, it is not cost-effective to establish bauxite reserves that reflect the total size of the bauxite resources available to the Company. Certain totals may not sum due to rounding.

Summary of Attributable Bauxite Mineral Reserves at December 31, 2022:

	Proven			Probable			Total		
Property (Region)	**Tonnage** (mdmt)(1)	**Alumina** (%)	**Silica** (%)	**Tonnage** (mdmt)(1)	**Alumina** (%)	**Silica** (%)	**Tonnage** (mdmt)(1)	**Alumina** (%)	**Silica** (%)
Darling Range(2)	145.8	31.4	1.2	255.8	32.4	1.2	401.6	32.1	1.2
Juruti (Pará State)(3)	48.6	47.6	3.5	36.8	46.4	3.4	85.4	47.1	3.5
Poços de Caldas (Minas Gerais)(4)	1.1	39.6	3.7	1.8	38.8	4.0	3.0	39.1	3.9
Boké (Sangaredi)(5)	79.0	47.0	1.9	4.1	49.3	2.5	83.1	47.1	1.9
Al Ba'itha (Al Qassim)(6)	17.2	50.0	8.1	31.0	46.7	10.4	48.2	47.9	9.5

(1) The reference point for the mineral reserve is the refinery processing plant gate, with crushing, washing (as applicable), and transportation being the only process employed. Metallurgical recovery factors are not applicable to the mineral reserve estimate.

(2) Alumina for the Darling Range is stated as Available Alumina (as A.Al_2O_3) and Silica is stated as Reactive Silica (as R.SiO_2). Darling Range mineral reserves are estimated at variable cut-off grades, dependent on operating costs and ore quality for blending to meet refinery target grades. Mineral reserves are estimated using a reasonable market expectation of arms-length sales of bauxite from Darling Range, approximately $21 per ton.

(3) Alumina for Juruti is stated as Available Alumina (as A.Al_2O_3) and Silica is stated as Reactive Silica (as R.SiO_2). Juruti mineral reserves are estimated at a pit discard cut-off value based on a benefit calculation that determines whether a block is economically viable. Further, mineral reserves are estimated using a one-year weighted average bauxite price of approximately $27 per ton, based on contractual agreements with an Alumina segment refinery.

(4) Alumina for Poços de Caldas is stated as Available Alumina (as A.Al_2O_3) and Silica is stated as Reactive Silica (as R.SiO_2). Poços de Caldas mineral reserves are estimated at a pit discard cut-off value based on a benefit calculation that determines whether a block is economically viable.

(5) Alumina for Boké is stated as Total Alumina (as T.Al_2O_3) and Silica is stated as Total Silica (as T.SiO_2). Boké reserves are estimated at a ≥ 45% T.Al_2O_3 and ≤10% T.SiO_2 cut-off grade. Tonnage reported on a 3% moisture basis.

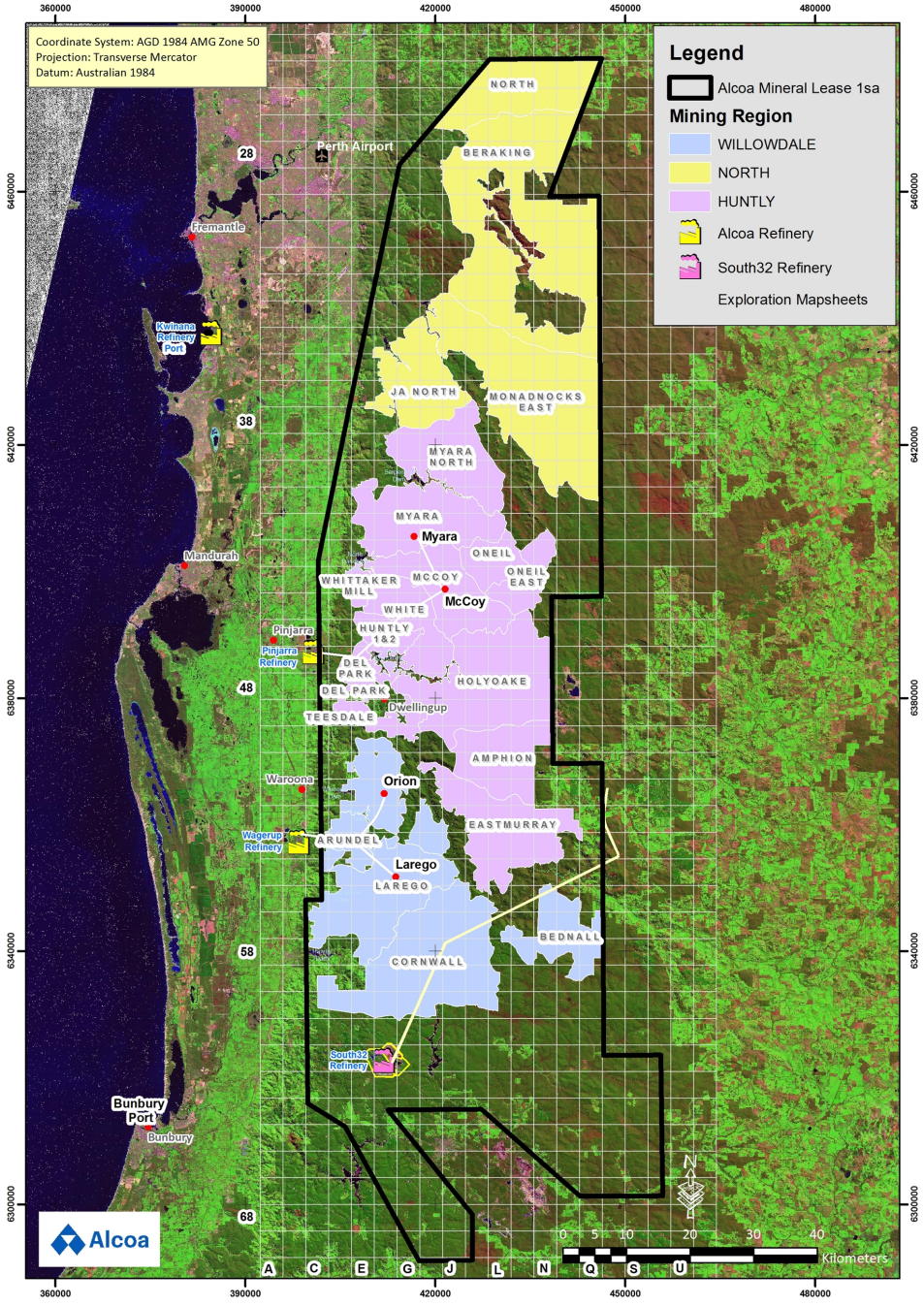
(6) Alumina for Al Ba'itha is stated as Total Available Alumina (as TAA) and Silica is stated as Total Silica (as T.SiO_2). Al Ba'itha mineral reserves are estimated at a ≥ 40% TAA cut-off grade.

Individual Property Disclosure—Darling Range

Property Location and Description

The Darling Range bauxite deposits comprise the mining centers of (i) Huntly, located approximately 80 kilometers (km) to the southeast of Perth and 30 km east of Pinjarra, Western Australia, Australia, and (ii) Willowdale, located approximately 100 km south-southeast of Perth and 15 km east of Waroona, Western Australia, Australia. The Huntly and Willowdale mining centers/regions are separate open pit, surface mines and are both located within Mining Lease ML1SA. Darling Range is owned and operated by Alcoa through AofA.

All spatial data used for mineral resource and reserve estimation are reported using a local grid based on Australian Map Grid 1984 system (Zone 50) and using the Australian Geodetic Datum 1984 coordinate set. The approximate coordinates of the mining areas are 410,000 meters (m) East and 6,390,000 m North (Huntly) and 410,000 m East and 6,365,000 m North (Willowdale).



Darling Range Location, Lease Area, Mining Centers, and Mining Regions

Refer to the Darling Range TRS in Sections 2.0 through 5.0 for more information on the Darling Range mining centers – their history, location, accessibility, and other relevant details.

Infrastructure

The figure above illustrates the relative location of each of the individual mining areas within the Huntly and Willowdale centers. These areas include, but are not limited to, Myara, Larego, Orion, and Arundel.

Mining infrastructure in the Darling Range is generally concentrated in the Myara area in the northwest of the Huntly mining center, and at the Larego area (20 km southeast of the Wagerup refinery) in the center of the Willowdale mining center. Both infrastructure areas include:

- Ore crushing and handling facilities;
- Ore stockpile stacker/reclaimer;
- Maintenance facilities;
- Sampling stations;
- Site offices including a production tracking room;
- Haul road networks;
- Overland conveyors, as illustrated on the above map;
- Water supplies consisting of abstraction from licensed surface water sources supplemented with treated wastewater from vehicle washdowns, stormwater runoff, and maintenance workshops; and,
- Power supply lines direct from certain of the Company's refineries.

Personnel are sourced from the area around Perth, Western Australia, which benefits from a skilled workforce due to the relatively large number of operating mines in the region.

Huntly is accessible from the South Western Highway via Del Park Road, which connects the town of North Dandalup in the north with Dwellingup in the south. From Del Park Road, a 3 km road following the route of the bauxite conveyor to the Pinjarra refinery provides access to the Huntly site administration offices. Willowdale is similarly accessible, 19 km from the South Western Highway via Willowdale Road, a road to the south of Waroona. There are several airstrips in the region, although the closest major airport is in Perth, approximately 70 km north of North Dandalup. The nearest commercial port is at the Kwinana refinery, approximately 40 km south of Perth.

While an extensive haul road network and overland conveyors transport crushed bauxite from the main mining hub to the Wagerup and Pinjarra refineries, bauxite is also transferred to the Kwinana refinery via the Kwinana freight railway system, using the Kwinana–Mundijong line.

Alcoa's Darling Range mining operations do not produce mine waste in the same manner as conventional mining operations and waste dumps are not constructed.

Alcoa's Darling Range facilities are in a well-maintained condition. Net book value of these facilities for the year-ended 2022 is $434 million included in Properties, plants, and equipment, net on the Consolidated Balance Sheet.

Refer to the Darling Range TRS in Sections 14.0 and 15.0 for more information on the surface infrastructure and facilities of the Darling Range.

Land Tenure and Permitting

Bauxite occurrences were first recorded in the Darling Range in 1902, with studies and exploration subsequently conducted by the Geological Survey of Western Australia until the 1950s. Commercial exploration took place from 1957 by Western Mining Corporation Ltd (WMC, later WANL), across a large portion of southwest Western Australia within a Special Mineral Lease (ML1SA) granted in 1961. Commercial mining first took place within the Darling Range in 1963 at the former Jarrahdale mining center with WANL having joined with Alcoa. The Huntly and Willowdale mines commenced commercial production in 1972 and 1984, respectively. Huntly supplies bauxite to the Kwinana and Pinjarra refineries (approximately 25 Mtpa), while Willowdale supplies the Wagerup refinery (approximately 10 Mtpa).

The ML1SA lease allows for exploration and mining of bauxite within the tenement boundaries. ML1SA was granted in 1961, by the State Government of Western Australia under the Alumina Refinery Act, 1961, for four 21-year periods, and the current lease expires on September 24, 2024. Prior to September 24, 2024, Alcoa will notify the State Government of Western Australia of its intention to exercise its right to renew for a further 21-year period to extend the concession to 2045. The State Government concession agreement includes the provision for conditional renewal beyond 2045. Alcoa pays rent for each square mile of ML1SA in accordance with the Alumina Refinery Agreement Act 1961 (WA), providing exclusive rights to explore for and mine bauxite on all Crown Land within the ML1SA. The current lease covers an area of 702,261 hectares (ha).

There are certain annual requirements to maintain the existing permits and approvals associated with ML1SA, including:

- Submission of annual mine plans for mining associated with the Wagerup refinery;
- Maintain public Completion Criteria documentation for its bauxite mining operations;
- Annual submission and approval of Mining and Management Programs (MMPs) that include five-year mining schedules;
- Annual reporting of bauxite processed and any non-compliances to maintain environmental operational licenses; and,
- Maintain compliance with environmental protection orders.

The ML1SA area includes sub-lease arrangements made between Alcoa and the Worsley Alumina joint venture participants. The agreements, made in August 2001 and September 2016, provide bauxite mining concessions to the Worsley Participants. No mineral resources or mineral reserves attributable to the Darling Range mining areas have been declared within these sub-lease areas.

Constraints on mining activities within the ML1SA concession are in place, among others, which prevent mining within: 200 m of the top water level of drinking water reservoirs; National Parks; Aboriginal Heritage Sites; Old Growth Forest; formal Conservation Areas; and 50 m of granite outcrop (greater than 1 ha). Mineral resources and mineral reserves have not been defined in these restricted areas.

Mining on a day-only basis is conducted in “noise zones” where noise from the mining operations will potentially exceed allowable levels. The operation actively seeks to maintain lower noise levels than those mandated, thus mining in these areas is undertaken by contract miners using smaller equipment on day shifts only.

The Company has all environmental permits and operating licenses required for current mining activities. Outcomes of and compliance with the management and monitoring programs are tracked within Alcoa’s Environmental Management System and reported within the Annual Environmental Review report.

Refer to the Darling Range TRS in Section 3.0 for more information on Land Permitting and Tenure for the Darling Range.

Geology and Exploration

The Darling Range comprises a low incised plateau formed by uplift along the north-south trending Darling Fault, a major structural lineament that extends for over 250 km, from Bindoon in the north to Collie in the south. Bauxite deposits have been identified throughout the Darling Range and generally occur as erratically distributed alumina-rich lenses. Lateralization and subsequent periodic activity of the Darling Fault has resulted in the current landform of scarps and deeply incised valleys on the western edge of the Darling Range.

Systematic exploration for bauxite within the region commenced in the 1960s and is currently conducted on a continuous basis to establish optimal mine plans to achieve a uniform quality of bauxite production. Current mine plans include further exploration throughout all areas where Alcoa has mining permits to sustain future production.

Refer to the Darling Range TRS in Sections 6.0 through 11.0 for more information on the geology, mineralization, and exploration history of the Darling Range, including Quality Assurance / Quality Control (QA/QC) procedures and data used in the current mineral resource estimate.

Mining and Processing

The Huntly and Willowdale mines employ conventional open pit surface mining practices and equipment. Following definition of mineral reserve blocks, vegetation is cleared after which Alcoa operations commence stripping topsoil and secondary overburden removal using small excavators, scrapers, and trucks. Soil is stockpiled at the site, away from the proposed pit, for rehabilitation purposes. After completion of mining, overburden is progressively backfilled into adjacent exhausted pits, topsoiled, and rehabilitated by re-establishment of native vegetation, creating a stable post-mining landform that replicates the pre-existing environment.

The process plant for the Darling Range operations consists of two separate crushing facilities at the Huntly and Willowdale mines, respectively. Both facilities crush the run of mine (ROM) ore and convey the crushed ore to three separate refineries located at Pinjarra, Kwinana, and Wagerup. The Pinjarra refinery is located adjacent to the east of the town of Pinjarra and is approximately 25 km southwest of the Huntly mining areas. The Kwinana refinery, also supplied by Huntly, is approximately 50 km northwest of Huntly in the city of Kwinana, approximately 40 km south of Perth. The Wagerup refinery, supplied by Willowdale, is located immediately adjacent to the west of the South Western Highway, approximately 8 km south of Waroona and 20 km west of the Willowdale mining area.

The process plant is a dry crushing operation and therefore water is not required as a consumable for the plant. Alcoa's Darling Range mining operations do not produce mine waste in the same manner as conventional mining operations and waste dumps are not constructed.

Refer to the Darling Range TRS in Sections 12.0 and 13.0 for a detailed description of the mineral reserves and mining methods used in the Darling Range.

Environmental and Social

Alcoa's mine sites are monitored in accordance with the conditions of Government authorizations and its operational licenses at Huntly and Willowdale. Outcomes of and compliance with the management and monitoring programs are tracked within Alcoa's Environmental Management System and reported within a Triennial Environmental Review report.

Alcoa works proactively with key regulatory agencies to address operational incidents and implement operational improvements to reduce releases to the environment.

Refer to the Darling Range TRS in Section 17.0 for more information on the environmental, social, compliance, and permitting aspects of the Darling Range.

Mineral Resources and Mineral Reserves

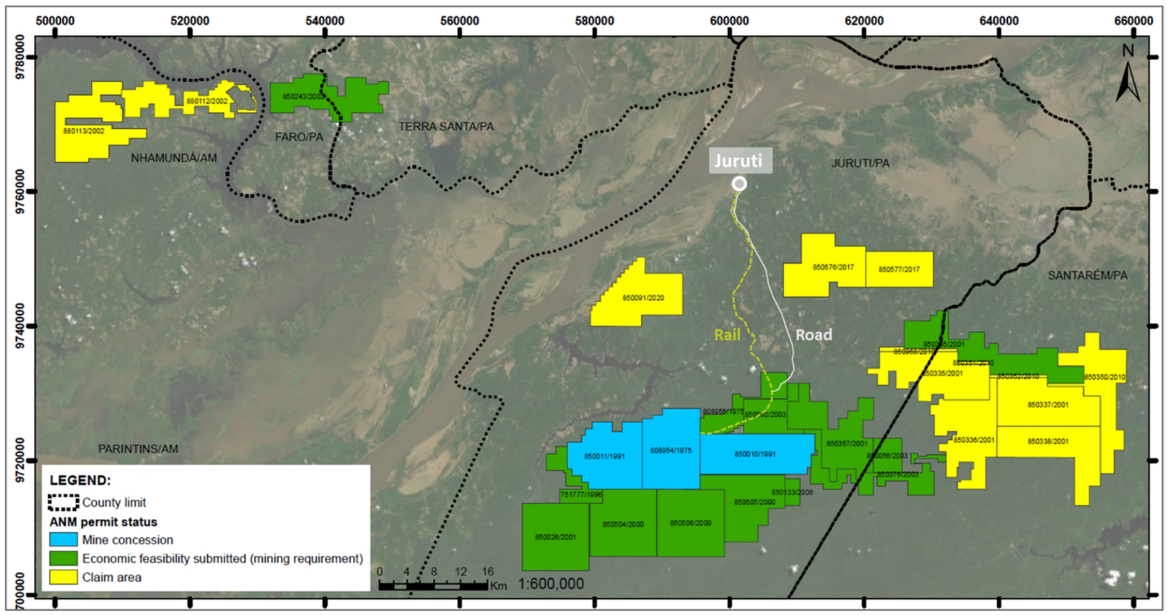
For information on Darling Range mineral resources and mineral reserves, refer to the tables above. For comparative purposes, measured and indicated mineral resources were 96.7 mdmt and 82.8 mdmt for the years ended 2022 and 2021, respectively, representing an increase of 17 percent. Inferred mineral resources were 140.3 mdmt and 320.0 mdmt for the years ended 2022 and 2021, respectively, representing a decrease of 56 percent. Probable reserves were 255.8 mdmt and 132.7 mdmt for the years ended 2022 and 2021, respectively, representing an increase of 93 percent, and proven reserves were 145.8 mdmt and 108.6 mdmt for the years ended 2022 and 2021, respectively, representing an increase of 34 percent. The decrease in inferred mineral resources from 2021 is partially reflected in the increase in measured and indicated mineral resources (and the subsequent conversion to mineral reserves). The decrease is mostly attributable to the change to a 3D modelling method and the continued increased confidence through the continuous drilling program. Further mine planning work has allowed subsequent conversion of mineral resources to mineral reserves. The mineral reserves increase is mostly attributable to the conversion from mineral resources to mineral reserves, partially offset by mining depletion in 2022. Additionally, refer to the Darling Range TRS for more information on the mineral resources and mineral reserves of the Darling Range mines.

Individual Property Disclosure—Juruti

Property Location and Description

The Juruti bauxite mine is located in the west of Para State in northern Brazil. The mine is approximately 55 km south from the town of Juruti on the southern shore of the Amazon River. The mine is owned and operated by Alcoa through AWAB. The Juruti bauxite mine represents an established mining operation which commenced commercial production of bauxite in 2009.

All spatial data used for the mineral resource and mineral reserve estimation are reported using a local grid based on SIRGAS 2000 (21S). The approximate coordinates of the mining area for the Capiranga Central, Mauari, São Francisco, Mutum and Santarém plateaus are 618,879 m East and 9,721,768 m North, and for the Nhamundá plateau are 521,657 m East and 9,773,299 m North.



Juruti Location and Bauxite Mine Permit Areas

Refer to the Juruti TRS in Sections 2.0 through 5.0 for more information on the Juruti mine – history, location, accessibility, and other relevant details.

Infrastructure

Infrastructure required for bauxite mining operations is well-established and available, the majority of which is located within the area of the Juruti bauxite mine. The required infrastructure includes the following:

- Rail siding and loading equipment;
- Bauxite beneficiation plant for ore crushing and washing;
- Mine waste facilities including tailings thickening lagoons and tailings disposal ponds;
- ROM and product stockpiles and materials handling conveyors;
- Ancillary buildings (offices, warehouses, laboratory, workshops);
- Fuel station;
- Water supply intake raft, pumps, and approximate 9 km pipeline from the Juruti Grande stream;
- Power generation via thermoelectric units at the mine and port;
- Surface water management including drainage channels and pumps;
- Off-site rail corridor between the mine and port; and,
- Port facilities including rail siding, material handling equipment, ship loader.

The Juruti mining area is connected to Juruti town and port facilities by a road that joins to the PA-257 road near the town, and a dedicated railway between the mining area and port. There are very few major roads across the region and the only major road in this area is the PA-257.

The nearest major city to Juruti is Santarem, approximately 160 km to the east and is only accessible by boat or by air from Juruti Airport (JRT) to Santarem-Maestro Wilson Fonseca Airport (STM). National roads connect Santarem to wider Para State including the port city of Belem on Brazil's northern coast, approximately 1,300 km by road via the 230 and PA-151 roads.

Juruti began production in 2009 and the facilities are in a well-maintained condition. Net book value of these facilities for the year-ended 2022 is $464 million included in Properties, plants, and equipment, net on the Consolidated Balance Sheet.

Refer to the Juruti TRS in Sections 14.0 and 15.0 for more information on the surface infrastructure and facilities of the Juruti mine.

Land Tenure and Permitting

All exploration and mining activities are managed by the National Mining Agency, Agencia Nacional de Mineracao (ANM), under the Mining Code (1967). Permits are granted by the ANM falls into two categories:

- Exploration Permits: granted to support ongoing exploration activities. On submittal of an approved Exploration Report, the holder is then granted one year to present a Mining Plan as a precursor to obtaining a Mining Concession. Exploration Permits require:
    - Initial application fee and submission by a registered professional geologist or mining engineer;
    - Annual fee payment to the ANM;
    - Declaration of exploration expenditures on an annual basis; and,
    - Survey visit fee payment to the ANM.
- Mining Concession: following a successful Mining Plan submission, enabling exploitation once Environmental Licenses are granted. Concession holders are required to:
    - Commence mining activities within 6 months of being granted;
    - Submit annual reports on all mining / processing activities (Relatorio Annual de Lavra, or RAL) to the ANM;
    - Make compensation payments to landowners in line with the agreements made for mining easement; and,
    - Make Brazilian Mineral Royalty payments (Compensacao Financeira pela Exploracao de Recursos Minerais, or CFEM).

At Juruti there are three continuous mining concessions for an aggregated 29,410 hectares (ha), where current mineral reserves are determined. Brazilian mineral legislation does not limit the duration of mining concessions and instead the concession remains in force until the deposit is exhausted. These concessions may be extended later or expire earlier than estimated, based on the rate at which the deposits are exhausted and on obtaining any additional governmental approval, as necessary, such as operational licenses and environmental approvals.

In addition to the mining rights, there are thirteen requests for mining concessions, fourteen exploration permits, and two requests for exploration permits. The aggregated area for these permits is 197,866 ha.

The mining operations at Juruti take place on third-party land and, in accordance with the Mining Concession requirements, Alcoa currently has agreements in place with respective landowners. Agreements form a “mining easement,” which grants Alcoa access to the mining areas in exchange for compensation payments. As a result, there are no other titles, claims, leases, or options applicable to the exploration or mining permit areas which may limit Alcoa’s rights. Similarly, there are no liens or encumbrances.

The Company has all environmental permits and operating licenses required for current mining activities; there are no liens or encumbrances.

Refer to the Juruti TRS in Sections 3.0 and 17.0 for more information on Land Permitting and Tenure for the Juruti mine.

Geology and Exploration

The bauxite deposit of the Juruti bauxite mine consist of several lateritic bauxite plateaus which exist over a large lateral extent (several km) in comparison to the total thickness of the deposit (typically up to 20 m below surface).

Systematic exploration for bauxite within the region has persisted since Alcoa’s ownership and is currently conducted on a continuous basis to establish optimal mine plans to achieve a uniform quality of bauxite production. Current mine plans include further exploration throughout all areas where Alcoa has mining permits to sustain future production.

Refer to the Juruti TRS in Sections 6.0 through 11.0 for more information on the geology, mineralization, and exploration history of the Juruti mine, including QA/QC procedures and data used in the current mineral resource estimate.

Mining and Processing

Juruti is an active mining operation using surface strip mining methods over a total of eight plateaus whereby land clearance, topsoil removal, and overburden stripping is followed by bauxite deposit excavation and stockpiling. Waste is subsequently backfilled, and overburden and topsoil are re-instated for surface rehabilitation.

Juruti produces both a washed and unwashed bauxite product; however, all tonnage is presented on a zero-moisture basis. Bauxite processing takes place at a dedicated plant facility located at the Juruti mine site which has been operating since 2009 and comprises a simple comminution (crushing, screening) and washing circuit designed to remove fine particles from the ore.

Fine materials removed from ore are deposited in a thickening pond for settling and water reclamation, after which solid tailings are discarded into separate tailings ponds. There is currently one thickening pond and seven disposal ponds.

Refer to the Juruti TRS in Sections 12.0 and 13.0 for a detailed description of the mineral reserves and mining methods used in the Juruti mine.

Environmental and Social

Alcoa submits an Annual Environmental Report in compliance with the Juruti operating licenses and approvals. This report includes detailed descriptions of activities undertaken for the year and environmental and social monitoring. No significant compliance issues were identified in the 2020/2021 and 2021/2022 Annual Environmental Reports, although certain environmental incidents were recorded in December 2020 and February 2021 which involved siltation of downstream watercourses following extreme rainfall events.

Additionally, Alcoa works proactively with key regulatory agencies to address operational non-compliances and implement operational improvements to reduce releases to the environment. None of the reportable non-compliances represent a risk that could adversely affect its license to operate.

Refer to the Juruti TRS in Section 17.0 for more information on the environmental, social, compliance, and permitting aspects of the Juruti mine.

Mineral Resources and Mineral Reserves

For information on Juruti mineral resources and mineral reserves, refer to the tables above. For comparative purposes, probable reserves were 36.8 mdmt and 37.7 mdmt for the years ended 2022 and 2021, respectively, representing a decrease of 2 percent. Proven reserves were 48.6 mdmt and 50.9 mdmt for the years ended 2022 and 2021, respectively, representing a decrease of 5 percent. The decrease in mineral reserves from 2021 reflects mining depletion during 2022. Mineral resources were unchanged from 2021. Additionally, refer to the Juruti TRS for more information on the mineral resources and mineral reserves of the Juruti mine.

Internal Controls

Alcoa has a long history of mining bauxite, with the majority of bauxite production having been used to supply Alcoa refineries. Despite having longstanding and robust processes for sampling, analysis, ore definition, and grade control, it is only within the last ten years that structured and documented QA/QC practices have spread beyond the laboratories of many of the operations.

Internal controls used by the Company are informed by internal reviews, representation on Technical Committees of Joint Venture operations, and by reviews, audits, and studies performed by third-party mining consultants. The controls include: surveying of drillhole collar locations, drill sample logging, collection and security, database verification and security, QA/QC programs, internal and third-party qualified person statistical analysis, internal and third-party qualified person model validation, and reconciliation. Modelling and analysis of the Company's resources is completed internally and reviewed by a qualified person, with the exception of Al Ba'itha where modelling and analysis is completed by a third-party consultant.

As the ore bodies are shallow and generally horizontal, two-dimensional seam modelling has been the standard practice; however, many operations are implementing more conventional 3D block modelling using geostatistical interpolation methods. Mineral resource estimation is validated internally through visual comparison of drillholes and model blocks as well as through the use of swath plots and statistical distributions. Mineral resource estimation is reviewed and adopted by a qualified person. Mineral reserve estimation is completed internally and reviewed by a qualified person, with the exception of Boké and Al Ba'itha where reserve estimation is completed by a third-party consultant.

Labelled samples from the drill site are securely transported for logging or temporary storage by the drilling contractor or Alcoa personnel. Additional transport to internal or external laboratories is controlled and completed, as necessary, by Alcoa personnel or by courier.

Drillhole databases are all site specific; most sites use industry standard drillhole database software, applications, and processes with security and backup protocols in place. Prior to modelling, secondary validation and cleansing of the modelling datasets is performed. Wherever possible, data collection is digital to allow direct loading into the database.

The Company has well-established QA/QC programs that are site specific and range from in-development to mature. Although some programs are limited to laboratory protocols only covering analysis of duplicate pulps and standards, others involve, to varying degrees, the range of activities from twin hole drilling and collection of field duplicates, submission of blind duplicates and standards and submission of duplicate samples to umpire laboratories. Regardless of the level of QA/QC, all sites have well established and documented sampling and analysis regimes. QA/QC practices and available data is reviewed by a qualified person.

As discussed above, management relies on estimates for our mineral reserves and these estimates could change due to a number of factors, including future changes in: permitting requirements, geological conditions, ongoing mine planning, macroeconomic and industry conditions, and regulatory disclosure requirements. See Part I Item 1A of this Form 10-K for more information on risks.

Item 3. Legal Proceedings.

In the ordinary course of its business, Alcoa is involved in a number of lawsuits and claims, both actual and potential. Proceedings that were previously disclosed may no longer be reported because, as a result of rulings in the case, settlements, changes in our business, or other developments, in our judgment, they are no longer material to Alcoa's business, financial position or results of operations. See Part II Item 8 of this Form 10-K in Note S to the Consolidated Financial Statements for additional information.

In addition to the matters discussed below, various other lawsuits, claims, and proceedings have been or may be instituted or asserted against Alcoa Corporation, including those pertaining to environmental, safety and health, commercial, tax, product liability, intellectual property infringement, employment, employee and retiree benefit matters, and other actions and claims arising out of the normal course of business. While the amounts claimed in these other matters may be substantial, the ultimate liability is not readily determinable because of the considerable uncertainties that exist. Accordingly, it is possible that the Company's liquidity or results of operations in a particular period could be materially affected by one or more of these other matters. However, based on facts currently available, management believes that the disposition of these other matters that are pending or asserted will not have a material adverse effect, individually or in the aggregate, on the financial position of the Company.

Environmental Matters

Alcoa is involved in proceedings under CERCLA and analogous state or other statutory or jurisdictional provisions regarding the usage, disposal, storage, or treatment of hazardous substances at a number of sites. The Company has committed to participate, or is engaged in negotiations with authorities relative to its alleged liability for participation, in clean-up efforts at several such sites. The most significant of these matters are discussed in Part II Item 8 of this Form 10-K in Note S to the Consolidated Financial Statements under the caption Contingencies.

In August 2005, Dany Lavoie, a resident of Baie-Comeau in the Canadian Province of Québec, filed a Motion for Authorization to Institute a Class Action and for Designation of a Class Representative against Alcoa Canada Ltd., Alcoa Limitée, Société Canadienne de Metaux Reynolds Limitée, and Canadian British Aluminum in the Superior Court of Québec in the District of Baie-Comeau, alleging that defendants, as the present and past owners and operators of an aluminum smelter in Baie-Comeau, had negligently allowed the emission of certain contaminants from the smelter on the lands and houses of the St. Georges neighborhood and its environs causing property damage and personal injury. In May 2007, the court authorized a class action suit on behalf of all people who suffered property or personal injury damages caused by the emission of polycyclic aromatic hydrocarbons from the Company's aluminum smelter in Baie-Comeau. In September 2007, plaintiffs filed the claim against the original defendants. The Soderberg smelting operations that plaintiffs allege to be the source of emissions of concern ceased operations in 2013 and have been dismantled. A court appointed expert, engaged to perform analysis of the potential impacts from the emissions in accordance with a sampling protocol agreed to by the parties, submitted its report to the court in May 2019. In 2021, plaintiffs filed their amended claim and expert reports, and defendants filed their amended defense and expert reports. In October 2021, the parties participated in mediation. In March 2022, the parties reached a settlement for damages that is subject to court approval. On May 31, 2022, the court entered a judgement approving the settlement and formally concluding the litigation. The settlement does not have a material impact on the Company's financial results.

Intalco (Washington) Notice of Violation—In May 2022, the Company received a Notice of Violation (NOV) from the U.S. Environmental Protection Agency (the EPA). The NOV alleges violations under the Clean Air Act at the Company's curtailed Intalco (Washington) smelter from when the smelter was operational. The EPA has referred the matter to the U.S. Department of Justice, Environment and Natural Resources Division (the DOJ). The DOJ and the Company are engaged in discussions with respect to a resolution of this matter.

Asbestos Litigation

Some of our subsidiaries as premises owners are defendants in active lawsuits filed in various jurisdictions on behalf of persons seeking damages for alleged personal injury as a result of occupational exposure to asbestos at various facilities. Our subsidiaries and acquired companies all have had numerous insurance policies over the years that provide coverage for asbestos based claims. Many of these policies provide layers of coverage for varying periods of time and for varying locations. We have significant insurance coverage and believe that our reserves are adequate for known asbestos exposure related liabilities. The costs of defense and settlement have not been and are not expected to be material to the results of operations, cash flows, and financial position of Alcoa Corporation.

Item 4. Mine Safety Disclosures.

Not applicable.

PART II

Item 5. Market for Registrant's Common Equity, Related Stockholder Matters, and Issuer Purchases of Equity Securities.

Shares of the Company's common stock are listed on the New York Stock Exchange and trade under the symbol "AA."

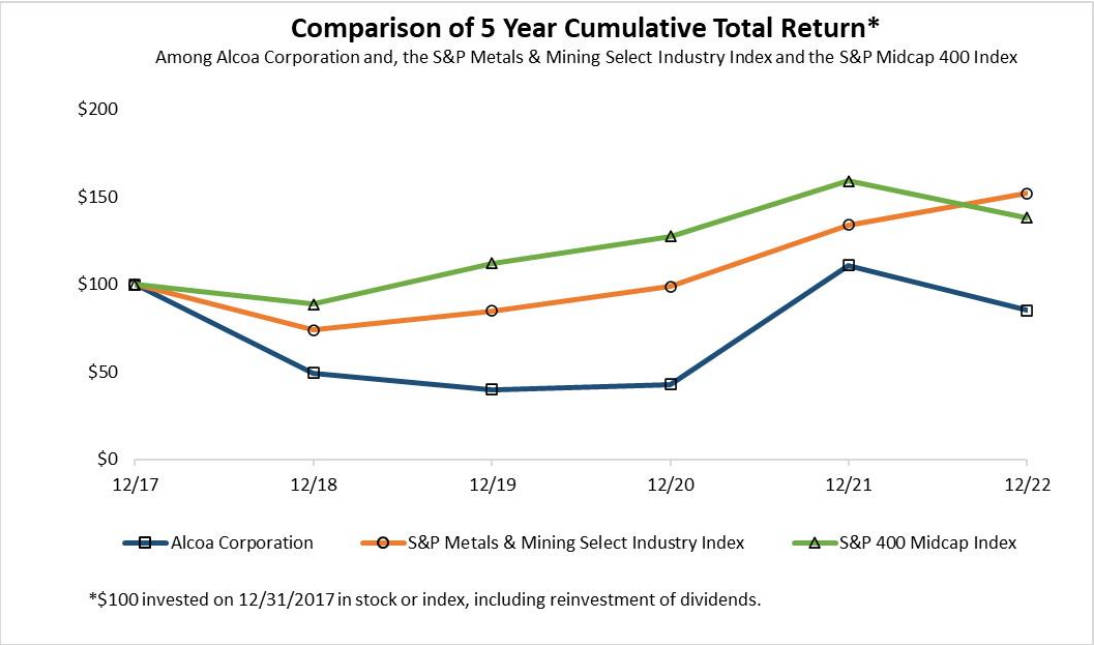
On October 14, 2021, Alcoa Corporation announced the initiation of a quarterly cash dividend program and the Board of Directors declared the first quarterly cash dividend of $0.10 per share of the Company's common stock, which was paid during the fourth quarter of 2021. Alcoa Corporation paid quarterly cash dividends of $0.10 per share in 2022. The Company intends to pay cash dividends on a quarterly basis. Dividends on Alcoa Corporation common stock are subject to authorization by the Company's Board of Directors. The payment, amount, and timing of dividends, if any, depends upon matters deemed relevant by the Company's Board of Directors, such as Alcoa Corporation's financial position, results of operations, cash flows, capital requirements, business condition, future prospects, any limitations imposed by law, credit agreements or senior securities, and other factors deemed relevant and appropriate. See Part II Item 7 of this Form 10-K in Management's Discussion and Analysis of Financial Condition and Results of Operations under caption Liquidity and Capital Resources – Financing Activities for more information.

As of February 17, 2023, there were approximately 8,000 holders of record of shares of the Company's common stock. Because many of Alcoa Corporation's shares are held by brokers and other institutions on behalf of stockholders, the Company is unable to estimate the total number of stockholders represented by these holders.

Stock Performance Graph

The following graph compares Alcoa Corporation's cumulative total stockholder return (i.e., stock price change plus reinvestment of dividends) with the cumulative total stockholder returns of (1) the S&P MidCap 400® Index, and (2) the S&P Metals & Mining Select Industry Index. This comparison was based on an initial investment of $100, including the reinvestment of any dividends, on December 31, 2017 through December 31, 2022.

The stock performance information included in this graph is based on historical results and is not necessarily indicative of future stock price performance.



December 31,	2017	2018	2019	2020	2021	2022
Alcoa Corporation	$ 100	$ 49	$ 40	$ 43	$ 111	$ 85
S&P Metals & Mining Select Industry Index	100	74	85	99	134	152
S&P 400 Midcap Index	100	89	112	128	159	138

Issuer Purchases of Equity Securities

Fourth Quarter 2022	Total Number of Shares Purchased	Weighted Average Price Paid Per Share	Total Number of Shares Purchased as Part of Publicly Announced Program	Approximate Dollar Value of Shares that May Yet be Purchased Under the Program(1)
October 1 to October 31	-	$ -	-	$ 500,000,000
November 1 to November 30	-	-	-	500,000,000
December 1 to December 31	-	-	-	500,000,000
Total	-	-	-	

(1) On July 20, 2022, Alcoa Corporation announced that its Board of Directors approved an additional common stock repurchase program under which the Company may purchase shares of its outstanding common stock up to an aggregate transactional value of $500, depending on the Company's continuing analysis of market, financial, and other factors (the New Repurchase Program).

As of the date of this report, the Company is currently authorized to repurchase up to a total of $500, in the aggregate, of its outstanding shares of common stock under the New Repurchase Program. Repurchases under this program may be made using a variety of methods, which may include open market purchases, privately negotiated transactions, or pursuant to a Rule 10b5-1 plan. This program may be suspended or discontinued at any time and does not have a predetermined expiration date. Alcoa Corporation intends to retire repurchased shares of common stock.

Item 6. [RESERVED]

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations.

(dollars in millions, except per-share amounts, average realized prices, and average cost amounts; dry metric tons in millions (mdmt); metric tons in thousands (kmt))

Forward-Looking Statements

This report contains statements that relate to future events and expectations and as such constitute forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Forward-looking statements include those containing such words as "aims," "ambition," "anticipates," "believes," "could," "develop," "endeavors," "estimates," "expects," "forecasts," "goal," "intends," "may," "outlook," "potential," "plans," "projects," "reach," "seeks," "sees," "should," "strive," "targets," "will," "working," "would," or other words of similar meaning. All statements by Alcoa Corporation that reflect expectations, assumptions or projections about the future, other than statements of historical fact, are forward-looking statements, including, without limitation, forecasts concerning global demand growth for bauxite, alumina, and aluminum, and supply/demand balances; statements, projections or forecasts of future or targeted financial results, or operating or sustainability performance (including our ability to execute on strategies related to environmental, social and governance matters); statements about strategies, outlook, and business and financial prospects; and statements about capital allocation and return of capital. These statements reflect beliefs and assumptions that are based on Alcoa Corporation's perception of historical trends, current conditions, and expected future developments, as well as other factors that management believes are appropriate in the circumstances.

Forward-looking statements are not guarantees of future performance and are subject to known and unknown risks, uncertainties, and changes in circumstances that are difficult to predict. Although Alcoa Corporation believes that the expectations reflected in any forward-looking statements are based on reasonable assumptions, it can give no assurance that these expectations will be attained and it is possible that actual results may differ materially from those indicated by these forward-looking statements due to a variety of risks and uncertainties. Such risks and uncertainties include, but are not limited to: (a) current and potential future impacts to the global economy and our industry, business and financial condition caused by various worldwide or macroeconomic events, such as the COVID-19 pandemic and the ongoing conflict between Russia and Ukraine, and related regulatory developments; (b) material adverse changes in aluminum industry conditions, including global supply and demand conditions and fluctuations in London Metal Exchange-based prices and premiums, as applicable, for primary aluminum and other products, and fluctuations in indexed-based and spot prices for alumina; (c) changes in global economic and financial market conditions generally, such as inflation, recessionary conditions, and interest rate increases, which may also affect Alcoa Corporation's ability to obtain credit or financing upon acceptable terms or at all; (d) unfavorable changes in the markets served by Alcoa Corporation; (e) the impact of changes in foreign currency exchange and tax rates on costs and results; (f) unfavorable changes in cost, quality, or availability of key inputs, including energy and raw materials, or uncertainty of or disruption to the supply chain including logistics; (g) the inability to execute on strategies related to or achieve improvement in profitability and margins, cost savings, cash generation, revenue growth, fiscal discipline, environmental- and social-related goals and targets (including due to delays in scientific and technological developments), or strengthening of competitiveness and operations anticipated from portfolio actions, operational and productivity improvements, technology advancements, and other initiatives; (h) the inability to realize expected benefits, in each case as planned and by targeted completion dates, from acquisitions, divestitures, restructuring activities, facility closures, curtailments, restarts, expansions, or joint ventures; (i) political, economic, trade, legal, public health and safety, and regulatory risks in the countries in which Alcoa Corporation operates or sells products; (j) labor disputes and/or work stoppages and strikes; (k) the outcome of contingencies, including legal and tax proceedings, government or regulatory investigations, and environmental remediation; (l) the impact of cyberattacks and potential information technology or data security breaches; (m) risks associated with long-term debt obligations; (n) the timing and amount of future cash dividends and share repurchases; (o) declines in the discount rates used to measure pension and other postretirement benefit liabilities or lower-than-expected investment returns on pension assets, or unfavorable changes in laws or regulations that govern pension plan funding; and, (p) the other risk factors discussed in Part 1 Item 1A of this Form 10-K and other reports filed by Alcoa Corporation with the U.S. Securities and Exchange Commission, including those described in this report.

Alcoa Corporation disclaims any obligation to update publicly any forward-looking statements, whether in response to new information, future events or otherwise, except as required by applicable law. Market projections are subject to the risks described above and other risks in the market.

Overview

Our Business

Alcoa Corporation (Alcoa or the Company) is a vertically integrated aluminum company comprised of bauxite mining, alumina refining, aluminum production (smelting and casting), and energy generation. Aluminum is a commodity that is traded on the London Metal Exchange (LME) and priced daily. Additionally, alumina is subject to market pricing through the Alumina Price Index (API), which is calculated by the Company based on the weighted average of a prior month's daily spot prices published by the following three indices: CRU Metallurgical Grade Alumina Price, Platts Metals Daily Alumina PAX Price, and FastMarkets Metal Bulletin Non-Ferrous Metals Alumina Index. As a result, the price of both aluminum and alumina is subject to significant volatility and, therefore, influences the operating results of Alcoa Corporation.

Through direct and indirect ownership, Alcoa Corporation has 27 operating locations in nine countries around the world, situated primarily in Australia, Brazil, Canada, Iceland, Norway, Spain, and the United States. Governmental policies, laws and regulations, and other economic factors, including inflation and fluctuations in foreign currency exchange rates and interest rates, affect the results of operations in these countries.

Business Update

In 2022, world events, including the on-going conflict between Russia and Ukraine, influenced costs for raw materials and created a global energy crisis, particularly in Europe. The Company saw significant decreases in market pricing for alumina and aluminum between the first and the second half of the year.

Despite the significant change in alumina and aluminum prices during 2022, the alumina and aluminum markets ended 2022 balanced or in a slight volume deficit, respectively, while the cost for raw materials remained high throughout the year. All direct material costs increased since the end of 2021, driven by inflation pressures and multiple supply chain disruptions.

Alcoa worked to offset negative market impacts, including the high costs of energy in Europe. The Company partially curtailed two facilities, adjusting production rates to approximately 50 percent of the 1.6 million metric tons of annual capacity at the San Ciprián alumina refinery in Spain due to high costs of natural gas, and curtailing one of three potlines at the Lista aluminum smelter in Norway due to high electricity costs. Additionally, in July, the Company curtailed one aluminum potline at Warrick Operations in the U.S. due to workforce shortages in the region, and sold the excess power into the market.

The Company also continued its work to support the planned restart of the San Ciprián smelter in Spain. Alcoa signed two power purchase agreements for wind-based electricity for up to approximately 75 percent of the smelter's power needs.

The Company continued to progress the full restart at the Alumar smelter in Brazil and in the fourth quarter 2022 completed the restart of some modest capacity at the Portland Aluminium joint venture in Australia. Those sites have competitive, multi-year energy agreements; with fully renewable power sources (hydropower) for the Alumar smelter.

Lower bauxite quality in areas where the Company is currently mining in Australia impacted production levels in 2022 at certain of the Australia refineries.

During 2022, the Company maintained a strong balance sheet and further reduced pension liabilities by completing a $1,000 transfer of obligations and related assets for certain U.S. retirees and their beneficiaries.

In 2019, the Company announced a five year strategic portfolio review of smelting and refining capacity to improve cost positioning, including curtailment, closure, or divestiture. Through 2021, Alcoa reached approximately 75 and 58 percent of its target to improve, curtail, close, or divest 1.5 and 4 million metric tons of smelting and refining capacity, respectively. While no actions were taken in 2022 related to these targets, the Company took actions in response to market conditions as noted above, and the strategic portfolio review is continuing.

Although 2022 was an unusual year with global events influencing energy and raw material costs, the Company continues to project strong long-term demand for aluminum, as a key material for a global economy with a growing focus on lower carbon dioxide emissions, including renewable energy infrastructure and transmission, electric and electric-intensive vehicles and packaging markets.

Even in a challenging market, the Company saw continued evidence of the growth of aluminum demand. In 2022, Alcoa saw a significant increase in year-over-year demand for its EcoLum aluminum, which is part of our Sustana brand, through both increased margins and deliveries while still a relatively small portion of the Company's overall sales volume. The year-over-year volume increase for EcoLum, which is aluminum produced with no more than 4.0 metric tons of carbon dioxide equivalents per metric ton of aluminum produced, grew more than four times over 2021, driven mostly by the European market.

Due to renewable energy sources and low carbon dioxide intensity in our operations, Alcoa believes that it is well positioned as a supplier of choice, especially in a world that is working to further reduce greenhouse gas emissions. The Company has a global refining system with the industry's lowest carbon dioxide intensity (per CRU Group's 2021 results published in third quarter 2022), and 86 percent of the Company's smelting portfolio was powered by renewable energy sources in 2022.

San Ciprián Smelter

In January 2022, Alcoa completed the curtailment of the San Ciprián aluminum smelter's 228 kmt of annual capacity while the casthouse continues to operate. The curtailment is a result of an agreement that was reached with the workers' representatives in December 2021 to suspend production until January 2024 due to exorbitant energy prices in Spain. In 2022, cash payments of $26 were made to reduce the related reserve for certain employee and contractual obligations that was recorded in December 2021. In connection with the agreement, the Company has restricted cash of $103 to be made available for $68 in capital improvements at the site and $35 in smelter restart costs.

During 2022, Alcoa signed two long-term power purchase agreements for wind-based electricity for up to approximately 75 percent of the San Ciprián smelter's power needs upon restart, although permitting approvals are required by the regional and national Spanish governments before construction can begin.

On February 3, 2023, the Company reached an updated agreement with the workers' representatives to commence the restart process in phases beginning in January 2024. Alcoa plans that all pots will be restarted by October 1, 2025, and from October 1, 2025 until the end of 2026, the minimum production will be 75 percent of the annual capacity of 228 kmt. Under the terms of the updated agreement, the Company is responsible for certain employee obligations during the extended curtailment period. As a result, the Company will record charges of approximately $50 (pre- and after-tax) in the first quarter of 2023 in Restructuring and other charges, net on the Statement of Consolidated Operations. Cash outlays related to these obligations are expected in 2024 and 2025. In connection with the updated agreement, the Company made additional commitments of $78 for capital improvements at the site to be spent primarily between 2024 and 2025.

During the second quarter of 2022, the Company repaid carbon dioxide credits related to the San Ciprián smelter. Spain has a compensatory mechanism for the indirect cost of carbon dioxide and provides associated credits. Upon receipt of the credits in each of the applicable years, the Company recorded the cash received as deferred income (liability) due to a three-year clawback provision based on continued operations and employment. In June 2021, the Spanish Ministry of Industry, Trade and Tourism (the Ministry) initiated the process to request repayment of 2018 and 2019 credits due to Alcoa's decision to implement the collective dismissal process and its potential impact on operations and employment at San Ciprián. Alcoa disagreed with the Ministry's position as the collective dismissal process was not concluded and qualifying operations and employment at San Ciprián were maintained during the relevant three-year period. The Company requested to suspend the payment of the claimed credits (and interest) in exchange for a bank guarantee. On April 26, 2022, the Spanish National Court rejected the Company's request and the Company made a repayment of approximately $41 (€37) for the 2018 and 2019 compensation credits and interest.

Alumar Smelter

On September 20, 2021, the Company announced its plan to restart its 268 kmt per year share of capacity at the Alumar smelter in São Luís, Brazil, which had been fully curtailed since 2015. Alcoa incurred restart expenses of $75 during 2022. The first metal sales occurred in the second quarter of 2022 and the Company continues to progress the restart of the smelter.

The restart leverages the site's integration with an alumina refinery, new long-term contracts for renewable energy and an available skilled workforce, as well as tax efficiencies and a strong U.S. dollar. With the completion of the planned restart, Alcoa will have approximately 76 percent of its 2.97 million metric tons of global aluminum smelting capacity operating.

Other Portfolio Actions

Kwinana—In January 2023, the Company reduced production at the Kwinana (Australia) refinery by approximately 30 percent in response to a domestic natural gas shortage in Western Australia due to production challenges experienced by key gas suppliers.

Portland—In October 2022, the Company completed the restart of 35 kmt (19 kmt Alcoa share) of previously curtailed annual capacity at the Portland aluminum smelter in Australia that was previously announced in November 2021. With the restart complete, the plant is operating at approximately 95 percent of its total capacity and Alcoa has approximately 186 kmt of consolidated annual capacity at Portland.

Lista—On August 30, 2022, the Company announced the curtailment of one third of the production capacity (31 kmt) at the Lista smelter in Norway to mitigate high energy costs for the site. The site was exposed to spot energy pricing, which had increased to above $600 per megawatt hour. In July 2022, the Company entered into a fixed price power agreement effective for the fourth quarter of 2022 through December 31, 2023. In February 2023, the agreement was amended with improved fixed pricing and lower volume commitments.

Warrick—On July 1, 2022, Alcoa curtailed one of the three operating smelting potlines (54 kmt) at its Warrick Operations site due to operational challenges stemming from labor shortages in the region.

Addy, Washington—In July 2022, Alcoa made the decision to permanently close the previously curtailed magnesium smelter in Addy (Washington). The facility has been fully curtailed since 2001. The Company recorded a charge of $29 to establish reserves for environmental and demolition obligations in Restructuring and other charges, net on the Statement of Consolidated Operations in the third quarter of 2022. Associated cash outlays are expected to be paid over the next three to five years.

MRN—On April 30, 2022, Alcoa completed the sale of its investment in MRN for proceeds of $10. An additional $30 in cash could be paid to the Company in the future if certain post-closing conditions related to future MRN mine development are satisfied. Related to this transaction, the Company recorded an asset impairment of $58 in the first quarter of 2022 in Restructuring and other charges, net on the Statement of Consolidated Operations. In addition, the Company entered into several bauxite offtake agreements with South32 to provide bauxite supply for existing long-term supply contracts.

Capital Returns

On July 20, 2022, Alcoa Corporation announced that its Board of Directors approved a new common stock repurchase program under which the Company may purchase shares of its outstanding common stock up to an aggregate transactional value of $500, depending on the Company's continuing analysis of market, financial, and other factors (the New Repurchase Program). The Company had $500 available for share repurchases at the end of 2021 from a prior authorization in October 2021. The share repurchase programs may be suspended or discontinued at any time and do not have predetermined expiration dates.

In 2022, the Company repurchased 8,565,200 shares of its common stock for $500 under the previously authorized program; the shares were immediately retired. As of the date of this report, the Company is currently authorized to repurchase up to a total of $500, in the aggregate, of its outstanding shares of common stock under the New Repurchase Program. Refer to Liquidity and Capital, for more information.

In each quarter of 2022, the Board of Directors declared a quarterly cash dividend of $0.10 per share of the Company's common stock, totaling $72 for the year.

Balance Sheet Actions

In the third quarter of 2022, the Company purchased group annuity contracts to transfer the obligation to pay remaining retirement benefits for approximately 4,400 retirees and beneficiaries from its U.S. defined benefit pension plans. The transfer of approximately $1,000 in both plan obligations and plan assets was completed in August 2022. As a result, Alcoa recognized a non-cash settlement loss of $617 (pre- and after-tax) in Restructuring and other charges, net on the Statement of Consolidated Operations. See Part II Item 2 of this Form 10-K in Note O to the Consolidated Financial Statements for additional information.

On June 27, 2022, the Company successfully amended and restated its Revolving Credit Facility, which includes terms that provide improved flexibility to execute on Alcoa's long-term strategies. Among other improvements, the Revolving Credit Facility released the collateral package that had previously secured the Revolving Credit Facility, which will continue so long as certain credit ratings are maintained, and provides a debt to capitalization ratio not to exceed .60 to 1.00 to replace the maximum leverage ratio upon a ratings upgrade to investment grade by Moody's or S&P. On July 26, 2022, Moody's upgraded the rating of ANHBV's senior unsecured notes to Baa3 (investment grade) from Ba1 and set the current outlook to stable. Refer to Liquidity and Capital, for more information.

Other Matters

During the fourth quarter of 2022, the Norwegian government approved a 2023 budget proposal that sets a floor for the carbon dioxide compensation to be paid in 2023 based on 2022 power purchased. The Company recorded an adjustment of $25 in the fourth quarter of 2022 to Cost of goods sold to reverse amounts accrued for 2022 credits earned through September 30, 2022 under the prior carbon dioxide compensation program.

On August 16, 2022, the U.S. enacted the Inflation Reduction Act of 2022, which includes a 15% minimum tax on book income of certain large corporations, a 1% excise tax on net stock repurchases after December 31, 2022, and several tax incentives to promote clean energy. This legislation did not have a material impact on the Company's Consolidated Financial Statements.

In the first quarter of 2022, the Company recorded a charge of $77 in Restructuring and other charges, net to reflect its estimate for the agreement reached with the workers of the divested Avilés and La Coruña facilities (Spain) to settle various legal disputes related to the 2019 divestiture. In April 2022, the Company received unanimous acceptance of the offer from all active workers of the divested Avilés and La Coruña facilities and a Global Settlement Agreement (GSA) was fully executed. The Company recorded a charge of $2 in Restructuring and other charges, net in second quarter of 2022 to reflect an update to its estimated liability for the GSA. The Company expects to make cash payments in 2023 upon completion of certain administrative and judicial approvals (See Note S).

On March 31, 2022, Ma'aden's put option and the Company's call option, relating to additional interests in the joint venture, expired with neither party exercising their options. In accordance with the joint venture agreement, the call and put options were exercisable for a period of six months after October 1, 2021.

In March 2022, in response to the conflict between Russia and Ukraine, Alcoa announced that it would cease the purchase of raw materials from, or the selling of products to, Russian businesses. The Company identified alternate sources for securing the limited number of materials that would have been purchased from Russian suppliers without any supply interruption or material financial impact on the Company.

See the below sections for additional details on the above-described actions.

Basis of Presentation

The Consolidated Financial Statements of Alcoa Corporation are prepared in conformity with accounting principles generally accepted in the United States of America (GAAP). In accordance with GAAP, certain situations require management to make estimates based on judgments and assumptions, which may affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the financial statements. They also may affect the reported amounts of revenues and expenses during the reporting periods. Actual results could differ from those estimates upon subsequent resolution of identified matters.

Results of Operations

The discussion that follows includes a comparison of our results of operations and liquidity and capital resources for the fiscal years ended December 31, 2022 and 2021. For a comparison of changes for the fiscal years ended December 31, 2021 and 2020, refer to Management's Discussion and Analysis of Financial Condition and Results of Operation in Part II Item 7 of Alcoa Corporation's Annual Report on Form 10-K for the year ended December 31, 2021 (filed February 24, 2022).

	For the year ended December 31,	
Statement of Operations	**2022**	**2021**
Sales	$ 12,451	$ 12,152
Cost of goods sold (exclusive of expenses below)	10,212	9,153
Selling, general administrative, and other expenses	204	227
Research and development expenses	32	31
Provision for depreciation, depletion, and amortization	617	664
Restructuring and other charges, net	696	1,128
Interest expense	106	195
Other income, net	(118)	(445)
Total costs and expenses	11,749	10,953
Income before income taxes	702	1,199
Provision for income taxes	664	629
Net income	38	570
Less: Net income attributable to noncontrolling interest	161	141
Net (loss) income attributable to Alcoa Corporation	$ (123)	$ 429

Selected Financial Metrics	**2022**	**2021**
Diluted (loss) income per share attributable to Alcoa Corporation common shareholders	$ (0.68)	$ 2.26
Third-party shipments of alumina (kmt)	9,169	9,629
Third-party shipments of aluminum products (kmt)	2,570	3,007
Average realized price per metric ton of alumina	$ 384	$ 326
Average realized price per metric ton of primary aluminum	$ 3,457	$ 2,879
Average Alumina Price Index (API)(1)	$ 365	$ 324
Average London Metal Exchange (LME) 15-day lag(2)	$ 2,726	$ 2,443

(1) API (Alumina Price Index) is a pricing mechanism that is calculated by the Company based on the weighted average of a prior month's daily spot prices published by the following three indices: CRU Metallurgical Grade Alumina Price, Platts Metals Daily Alumina PAX Price, and FastMarkets Metal Bulletin Non-Ferrous Metals Alumina Index.

(2) LME (London Metal Exchange) is a globally recognized exchange for commodity trading, including aluminum. The LME pricing component represents the underlying base metal component, based on quoted prices for aluminum on the exchange.

Earnings Summary

Annual Comparison

Overview

Net (loss) income attributable to Alcoa Corporation decreased $552 primarily as a result of:

- Higher raw material costs due to inflation pressures and multiple supply chain disruptions
- Higher energy costs, primarily in Europe
- Higher costs primarily associated with maintenance, transportation, direct material usage, and labor
- Absence of gains on the sale of non-core assets
- Valuation allowance recorded against the deferred tax assets of Alcoa Alumínio
- Lower shipments across all segments

Partially offset by:

- Higher average realized prices of aluminum and alumina
- Lower restructuring charges
- Favorable mark-to-market results on derivative instruments
- Favorable currency impacts
- Increase in value add product sales

Sales

Sales increased $299 primarily as a result of:

- Higher average realized prices of aluminum and alumina
- Increase in value add product sales
- Higher shipments from the Alumar smelter and Portland smelter due to the restarts
- Favorable changes to customer mix in the Alumina segment

Partially offset by:

- Lower trading activities
- Lower shipments across all segments
- Absence of sales from the divested Warrick Rolling Mill
- Decreased sales from the San Ciprián smelter due to the smelter curtailment
- Lower pricing at the Brazil hydro-electric facilities as 2021 drought conditions elevated prices in the prior year period

Cost of goods sold

Cost of goods sold as a percentage of sales increased 7% primarily as a result of:

- Higher raw material costs due to inflation pressures and multiple supply chain disruptions
- Higher energy costs, primarily in Europe
- Higher costs primarily associated with maintenance, transportation, direct material usage, and labor

Partially offset by:

- Higher average realized prices of aluminum and alumina
- Increase in value add product sales

Selling, general administrative, and other expenses

Selling, general administrative, and other expenses decreased $23 primarily as a result of:

- Lower variable compensation

Provision for depreciation, depletion, and amortization

The Provision for depreciation, depletion, and amortization decreased $47 primarily as a result of:

- Currency translation impacts

Interest expense

Interest expense decreased $89 primarily as a result of:

- Absence of interest on $750 6.75% Senior Notes redeemed early in April 2021 and early redemption costs
- Absence of interest on $500 7.00% Senior Notes redeemed early in September 2021 and early redemption costs

Partially offset by:

- Interest on $500 4.125% Senior Notes issued in March 2021

Other income, net

Other income, net decreased $327 primarily as a result of:

- Absence of gains on the sale of the former Rockdale site, the former Eastalco site, and the Warrick Rolling Mill
- Decrease in equity earnings from the Ma'aden bauxite and alumina joint venture and aluminum joint venture primarily due to higher raw material and energy costs primarily driven by inflation, partially offset by higher alumina and aluminum prices

Partially offset by:

- Favorable mark-to-market results on derivative instruments primarily due to higher power prices in the current year

Restructuring and other charges, net

In 2022, Restructuring and other charges, net of $696, primarily related to:

- $632 for U.S. pension group annuity contracts and lump sum settlements
- $79 for the agreement reached with the workers of the divested Avilés and La Coruña facilities
- $58 for an asset impairment related to the sale of the Company's interest in the MRN mine
- $29 for the permanent closure of the previously curtailed magnesium smelter in Addy (Washington)

Partially offset by:

- $83 reversal of Brazil state VAT valuation allowance associated with the restart of the Alumar smelter

In 2021, Restructuring and other charges, net of $1,128, primarily related to:

- $858 for U.S. pension group annuity contracts and lump sum settlements
- $80 for the permanent closure of the previously curtailed Wenatchee (Washington) smelter
- $63 for Suriname pension group annuity contract
- $62 for the temporary curtailment of the San Ciprián (Spain) smelter
- $47 for the settlement of certain pension benefits
- $27 for the permanent closure of the anode portion of the Lake Charles (Louisiana) facility
- $9 in settlements and curtailments of certain other postretirement benefits related to the sale of the Warrick Rolling Mill

Partially offset by:

- $22 of reversals for environmental and asset retirement obligation reserves at previously closed locations
- $17 for the reversal of a reserve related to the divested Avilés and La Coruña entities

Provision for income taxes

The Provision for income taxes in 2022 was $664 on income before taxes of $702 or 94.6%. In comparison, the 2021 Provision for income taxes was $629 on income before taxes of $1,199 or 52.5%.

The increase in tax expense is primarily attributable to a charge to record a full valuation allowance of $217 against the deferred tax assets of Alcoa Alumínio (Alumínio), and a charge of $30 primarily to write off the deferred tax assets of Alcoa Norway ANS due to a legal entity restructuring in 2022. This increase was partially offset by a tax benefit of $33 recognized due to changes in the utilization of the tax holiday rate in AWAB, lower income in some of the jurisdictions where the Company records taxes, and a valuation allowance of $103 recorded in 2021 against the net deferred tax assets of Alúmina Española, S.A (Española).

The 2022 full valuation allowance for Alumínio was a result of Alumínio's three-year cumulative loss position for the period ended December 31, 2022. Although the Company entered into aluminum contracts to manage exposures associated with the restart, these contracts were held by another legal entity, and the associated realized gains are not available to Alumínio to offset the restart losses. While management believes Alumínio will return to profitability in the future with the restart of the Alumar smelter, current volatility in the market does not provide a reliable basis for concluding that it is more likely than not that Alumínio's net deferred tax assets, which consist primarily of tax loss carryforwards with indefinite life, will be realized. Alumar smelter profitability in future periods could prompt the Company to evaluate the realizability of the deferred tax asset and assess the possibility of a reversal of the valuation allowance, which could have a significant impact on net income in the quarter the valuation allowance is reversed.

In 2021, a valuation allowance of $103 was recorded against the net deferred tax assets of Española. Management concluded that it was more likely than not that Española's net deferred tax assets, which consist primarily of tax loss carryforwards, would not be realized as the entity's sole operating asset, the San Ciprián refinery, was in a three-year cumulative loss position for the period ended December 31, 2021.

Noncontrolling interest

Net income attributable to noncontrolling interest was $161 in 2022 compared with $141 in 2021. These amounts are entirely related to Alumina Limited's 40% ownership interest in several affiliated operating entities.

The increase is primarily a result of higher average realized prices of alumina, lower elimination of intercompany profit in inventory, higher other income primarily related to favorable mark-to-market results on derivative instruments, lower taxes on lower profits before taxes and the absence of the Española valuation allowance, lower restructuring charges primarily due to lower pension actions, and a decrease in equity earnings from the Ma'aden bauxite and alumina joint venture, partially offset by higher raw material costs, energy prices and production costs.

Segment Information

Alcoa Corporation is a producer of bauxite, alumina, and aluminum products. The Company's operations consist of three worldwide reportable segments: Bauxite, Alumina, and Aluminum. Segment performance under Alcoa Corporation's management reporting system is evaluated based on a number of factors; however, the primary measure of performance is the Adjusted EBITDA (Earnings before interest, taxes, depreciation, and amortization) of each segment. The Company calculates Segment Adjusted EBITDA as Total sales (third-party and intersegment) minus the following items: Cost of goods sold; Selling, general administrative, and other expenses; and Research and development expenses. Alcoa Corporation believes that the presentation of Adjusted EBITDA is useful to investors because such measure provides both additional information about the operating performance of Alcoa Corporation and insight on the ability of Alcoa Corporation to meet its financial obligations. The presentation of Adjusted EBITDA is not intended to be a substitute for, and should not be considered in isolation from, the financial measures reported in accordance with GAAP. Alcoa Corporation's Adjusted EBITDA may not be comparable to similarly titled measures of other companies.

Segment Adjusted EBITDA totaled $2,275 in 2022, $3,053 in 2021, and $1,317 in 2020. The following information provides production, shipments, sales, and Segment Adjusted EBITDA data for each reportable segment, as well as certain realized price and average cost data, for each of the three years in the period ended December 31, 2022. See Part II Item 8 of this Form 10-K in Note E to the Consolidated Financial Statements for additional information.

Bauxite

	2022	2021
Production (mdmt)	42.1	47.6
Third-party shipments (mdmt)	3.5	5.7
Intersegment shipments (mdmt)	39.5	42.4
Total shipments (mdmt)	43.0	48.1
Third-party sales	$ 204	$ 236
Intersegment sales	680	711
Total sales	$ 884	$ 947
Segment Adjusted EBITDA	$ 82	$ 172
Operating costs	$ 919	$ 912
Average cost per dry metric ton of bauxite shipped	$ 21	$ 19

Production in the above table can vary from Total shipments due primarily to differences between the equity allocation of production, offtake agreements with the respective equity investment, and other supply agreements. Additionally, Total shipments include dry metric tons that were not produced by the Bauxite segment. Such bauxite was purchased to satisfy certain customer commitments. The Bauxite segment bears the risk of loss of the purchased bauxite until control of the product has been transferred to this segment's customers. Operating costs in the table above includes all production-related costs: conversion costs, such as labor, materials, and utilities; depreciation, depletion, and amortization; and plant administrative expenses.

Overview. This segment represents the Company's global bauxite mining operations. A portion of this segment's production represents the offtake from equity method investments in Brazil (prior to the MRN sale in April 2022) and Guinea, as well as AWAC's share of production related to the equity investment in Saudi Arabia. The bauxite mined by this segment is sold primarily to internal customers within the Alumina segment; a portion of the bauxite is sold to external customers. Bauxite mined by this segment and used internally is transferred to the Alumina segment at negotiated terms that are intended to approximate market prices; sales to third-parties are conducted on a contract basis. Generally, this segment's sales are transacted in U.S. dollars while costs and expenses are transacted in the local currency of the respective operations, which are the Australian dollar and the Brazilian real. Most of the operations that comprise the Bauxite segment are part of AWAC (see Noncontrolling Interest in Earnings Summary above).

Business Update. Total shipments decreased 5.1 million dry metric tons compared to 2021 primarily due to lower demand from certain Alumina segment refineries, the cessation of bauxite sales to Russian aluminum businesses, decreased demand in the Atlantic bauxite market, and the expiration of the Company's license to export bauxite from Australia.

On April 30, 2022, Alcoa completed the sale of its investment in MRN for proceeds of $10. An additional $30 in cash could be paid to the Company in the future if certain post-closing conditions related to future MRN mine development are satisfied. Related to this transaction, the Company recorded an asset impairment of $58 in the first quarter of 2022 in Restructuring and other charges, net on the Statement of Consolidated Operations. In addition, the Company entered into several bauxite offtake agreements with South32 Minerals S.A. to provide bauxite supply for existing long-term supply contracts.

Mining operations are relocated periodically in support of optimizing the value extracted from bauxite reserves. In 2022, the Company continued the process of moving the Juruti mining operations, which is scheduled to be completed in the first quarter of 2023. During 2022, the Company incurred $41 in capital expenditures related to the Juruti mining operation relocation.

Production
Production decreased 12% primarily as a result of:
- Lower demand from certain Alumina segment refineries
- Sale of the Company's interest in the MRN mine
- Cessation of bauxite sales to Russian aluminum businesses
- Expiration of the Company's license to export bauxite from Australia

Third-party sales
Third-party sales decreased $32 primarily as a result of:
- Lower shipments primarily due to lower customer demand from Juruti and the cessation of bauxite sales to Russian aluminum businesses, decreased demand in the Atlantic bauxite market, and the expiration of the Company's license to export bauxite from Australia

Partially offset by:
- Higher volumes from offtake and supply agreements caused by the shift to third-party sales due to reduced production at the San Ciprián refinery

Intersegment sales
Intersegment sales decreased $31 primarily as a result of:
- Lower intersegment shipments primarily due to lower demand from certain Alumina segment refineries

Partially offset by:
- Higher average internal prices on sales to the Alumina segment

Segment Adjusted EBITDA
Segment Adjusted EBITDA decreased $90 primarily as a result of:
- Lower shipments as discussed above
- Higher production costs primarily due to inefficiencies at lower production rates
- Higher energy costs, primarily diesel costs in Australia
- Lower average margins on sales to the Alumina segment

Partially offset by:
- Favorable currency impacts
- Higher earnings from equity investments

Forward-Look. Beginning in January 2023, financial information for the activities of the bauxite mines and the alumina refineries will be combined and the Company will report its financial results in the following two segments: (i) Alumina, and (ii) Aluminum. Accordingly, segment information for all prior periods presented will be updated to reflect the new segment structure in future Quarterly Report on Form 10-Q and Annual Report on Form 10-K filings.

In Australia, the Company seeks annual approvals from relevant state government agencies for a rolling five-year mine plan and related forest clearing activities that are needed to sustain bauxite mining. The Company's annual mine plan approvals process for the Huntly and Willowdale mines is currently taking longer than it has historically. Alcoa will mine bauxite with a lower bauxite grade from April 2023 through December 2023 at the Huntly mine to extend operations permitted under existing approvals, providing more time to work through the approvals process. See Alumina Forward Look below.

Alumina

	2022	2021
Production (kmt)	12,544	13,259
Third-party shipments (kmt)	9,169	9,629
Intersegment shipments (kmt)	3,958	4,287
Total shipments (kmt)	13,127	13,916
Third-party sales	$ 3,520	$ 3,139
Intersegment sales	1,754	1,586
Total sales	$ 5,274	$ 4,725
Segment Adjusted EBITDA	$ 701	$ 1,002
Average realized third-party price per metric ton of alumina	$ 384	$ 326
Operating costs	$ 4,406	$ 3,678
Average cost per metric ton of alumina shipped	$ 336	$ 264

In the above table, total shipments include metric tons that were not produced by the Alumina segment. Such alumina was purchased to satisfy certain customer commitments. The Alumina segment bears the risk of loss of the purchased alumina until control of the product has been transferred to this segment's customers. Additionally, operating costs in the table above includes all production-related costs: raw materials consumed; conversion costs, such as labor, materials, and utilities; depreciation and amortization; and plant administrative expenses.

Overview. This segment represents the Company's worldwide refining system, which processes bauxite into alumina. The alumina produced by this segment is sold primarily to internal and external aluminum smelter customers; a portion of the alumina is sold to external customers who process it into industrial chemical products. Approximately two-thirds of Alumina's production is sold under supply contracts to third parties worldwide, while the remainder is used internally by the Aluminum segment. Alumina produced by this segment and used internally is transferred to the Aluminum segment at prevailing market prices. A portion of this segment's third-party sales are completed through the use of alumina traders. Generally, this segment's sales are transacted in U.S. dollars while costs and expenses are transacted in the local currency of the respective operations, which are the Australian dollar, the Brazilian real, and the euro. Most of the operations that comprise the Alumina segment are part of AWAC (see Noncontrolling Interest in Earnings Summary above). This segment also includes AWAC's 25.1% ownership interest in the mining and refining joint venture company in Saudi Arabia.

Business Update. During 2022, the average API of $365 per metric ton trended favorably compared to 2021 reflecting a 13% sequential increase.

Alumina production decreased 5% in 2022 compared to 2021 primarily due to the reduced production at the Australian refineries, and the reduction in the daily production rate at the San Ciprián refinery, partially offset by increased production at the Alumar refinery due to the non-recurrence of the ship unloader outage in 2021. Australian refinery production in 2022 was less than 2021 due to extended and unplanned maintenance periods and lower bauxite quality impacting production levels.

During 2022, the Alumina segment experienced higher raw material costs, higher energy costs predominantly related to the San Ciprián refinery, and higher caustic usage at certain Australian refineries related to lower bauxite quality, due to the location of mining areas.

In the third quarter of 2022, the Company reduced production at the San Ciprián refinery to 50 percent of the 1.6 million metric tons of annual capacity to lessen the financial impact from rising natural gas prices in Spain.

In December 2022, the Company recorded a charge of $25 to Cost of goods sold to increase the AROs at the Alumar refinery when updated estimates became available for improvements required on closed bauxite residue areas.

During the second quarter of 2022, the Company recorded the reversal of a valuation allowance on Brazil state VAT of $46 in Cost of goods sold. In the fourth quarter of 2018, after an assessment of the future realizability of the state VAT credits, Alcoa established an allowance on the accumulated state VAT credit balances and stopped recording any future credit benefits. With the restart of the Alumar smelter in Brazil and the first metal sales in June 2022, the Company has the ability to monetize these credits and reversed the valuation allowance in the second quarter of 2022.

During 2022, the Company recorded a charge of $48 to Cost of goods sold and an increase to the capitalized asset retirement cost of $9 to increase the AROs at the Poços de Caldas refinery for improvements required on both operating and closed bauxite residue areas to comply with updated impoundment regulations in the region.

Capacity. The Alumina segment had a base annual capacity of 13,843 kmt with 1,014 kmt of curtailed refining capacity. In the third quarter of 2022, curtailed capacity increased 800 kmt, due to the partial curtailment of the San Ciprián refinery (see above).

Annual Comparison

Production

Production decreased 5% primarily as a result of:

- Reduced alumina production at the Australian refineries due to extended and unplanned equipment maintenance and lower bauxite quality impacting production levels
- Decreased production at the San Ciprián refinery due to the partial curtailment in the third quarter of 2022

Partially offset by:

- Increased production at Alumar refinery due to non-recurrence of ship unloader outage in 2021

Third-party sales

Third-party sales increased $381 primarily as a result of:

- Higher average realized price of $58/ton principally driven by a higher average API
- Favorable changes to customer mix

Partially offset by:

- Lower shipments due to decreased production at the Australian refineries

Intersegment sales

Intersegment sales increased $168 primarily as a result of:

- Higher average realized prices on sales to the Aluminum segment

Partially offset by:

- Lower shipments due to the San Ciprián smelter curtailment

Segment Adjusted EBITDA

Segment Adjusted EBITDA decreased $301 primarily as a result of:

- Higher raw material costs primarily due to higher market prices for caustic and lime
- Higher energy costs, primarily in Europe
- Higher costs primarily associated with increased maintenance costs, direct material usage, and higher transportation costs
- Higher costs associated with impoundments
- Lower shipments primarily from Australian refineries due to decreased production

Partially offset by:

- Higher average realized price of $58/ton principally driven by a higher average API
- Favorable changes to customer mix
- Favorable currency impacts
- Reversal of a valuation allowance on Brazil VAT associated with the restart of the Alumar smelter

Forward-Look. Beginning in January 2023, financial information for the activities of the bauxite mines and the alumina refineries will be combined and the Company will report its financial results in the following two segments: (i) Alumina, and (ii) Aluminum. Accordingly, segment information for all prior periods presented will be updated to reflect the new segment structure in future Quarterly Report on Form 10-Q and Annual Report on Form 10-K filings.

In January 2023, the Company reduced production at the Kwinana (Australia) refinery by approximately 30 percent in response to a domestic natural gas shortage in Western Australia due to production challenges experienced by key gas suppliers.

Alcoa will mine bauxite with a lower bauxite grade from April 2023 through December 2023 to provide additional time for an extended mining approvals process. This change is isolated to the Huntly mine that supplies the Pinjarra and Kwinana refineries. Operating those refineries with lower quality bauxite decreases alumina output and increases caustic usage.

The Company projects total alumina shipments to range between 12.7 and 12.9 million metric tons in 2023, down from 2022 primarily due to the full year impact of the partial curtailment of the San Ciprián refinery and the reduction of bauxite grade at the Huntly mine.

As discussed above, in the third quarter of 2022, the Company reduced production at the San Ciprián refinery to 50 percent of the 1.6 million tons of annual capacity in an effort to reduce the refinery's losses related to natural gas prices. The Company is actively reviewing the refinery's operating levels, commercial options, and other support, given the ongoing volatility in European energy markets. Commercial actions taken in late 2022 to mitigate the impact of energy and raw material costs at the San Ciprián refinery are expected to improve segment profitability in 2023.

Aluminum

Total Aluminum information		**2022**		**2021**
Third-party aluminum shipments (kmt)		2,570		3,007
Third-party sales	$	8,735	$	8,766
Intersegment sales		27		18
Total sales	$	8,762	$	8,784
Segment Adjusted EBITDA	$	1,492	$	1,879

Primary aluminum information		**2022**		**2021**
Production (kmt)		2,010		2,193
Third-party shipments (kmt)		2,570		2,924
Third-party sales	$	8,887	$	8,420
Average realized third-party price per metric ton	$	3,457	$	2,879
Total shipments (kmt)		2,570		2,949
Operating costs	$	7,278	$	6,593
Average cost per metric ton of primary aluminum shipped	$	2,831	$	2,235

In the above table, total aluminum third-party shipments and total primary aluminum shipments include metric tons that were not produced by the Aluminum segment. Such aluminum was purchased by this segment to satisfy certain customer commitments. The Aluminum segment bears the risk of loss of the purchased aluminum until control of the product has been transferred to this segment's customer. Until the sale of the Warrick Rolling Mill on March 31, 2021, total aluminum information includes flat-rolled aluminum while primary aluminum information does not. Primary aluminum third-party sales exclude realized gains and losses related to embedded derivative instruments designated as cash flow hedges of forward sales of aluminum. Operating costs includes all production-related costs: raw materials consumed; conversion costs, such as labor, materials, and utilities; depreciation and amortization; and plant administrative expenses.

The average realized third-party price per metric ton of primary aluminum includes three elements: a) the underlying base metal component, based on quoted prices from the LME; b) the regional premium, which represents the incremental price over the base LME component that is associated with the physical delivery of metal to a particular region (e.g., the Midwest premium for metal sold in the United States); and c) the product premium, which represents the incremental price for receiving physical metal in a particular shape (e.g., billet, slab, rod, etc.) or alloy.

Overview. This segment consists of the Company's (i) worldwide smelting and casthouse system, which processes alumina into primary aluminum, and the (ii) portfolio of energy assets in Brazil, Canada, and the United States.

Aluminum's combined smelting and casting operations produce primary aluminum products, virtually all of which are sold to external customers and traders. The smelting operations produce molten primary aluminum, which is then formed by the casting operations into either common alloy ingot (e.g., t-bar, sow, standard ingot) or into value add ingot products (e.g., foundry, billet, rod, and slab). A variety of external customers purchase the primary aluminum products for use in fabrication operations, which produce products primarily for the transportation, building and construction, packaging, wire, and other industrial markets. Results from the sale of aluminum powder and scrap are also included in this segment, as well as the impacts of embedded aluminum derivatives related to energy supply contracts.

The energy assets supply power to external customers in Brazil and, to a lesser extent, in the United States, as well as internal customers in the Aluminum (Canadian smelters and Warrick (Indiana) smelter) and Alumina segments (Brazilian refineries).

Generally, this segment's aluminum sales are transacted in U.S. dollars while costs and expenses of this segment are transacted in the local currency of the respective operations, which are the U.S. dollar, the euro, the Norwegian krone, the Icelandic króna, the Canadian dollar, the Brazilian real, and the Australian dollar.

This segment also includes Alcoa Corporation's 25.1% ownership interest in the smelting joint venture company in Saudi Arabia.

Business Update. During 2022, third-party sales were flat compared to 2021 on higher LME and regional premiums, partially offset by lower trading activities, as well as lower shipments. Metal prices increased with LME prices on a 15-day lag averaging $2,726 per metric ton. The Aluminum segment also experienced higher raw material and energy costs during 2022.

During the fourth quarter of 2022, the Norwegian government approved a 2023 budget proposal that sets a floor for the carbon dioxide compensation to be paid in 2023 based on 2022 power purchased. The Company recorded an adjustment of $25 in the fourth quarter of 2022 to Cost of goods sold to reverse amounts accrued for 2022 credits earned through September 30, 2022 under the prior carbon dioxide compensation program.

On December 29, 2021, the Company and workers' representatives at the San Ciprián, Spain aluminum facility reached an agreement for the two-year curtailment of the smelter's 228 kmt of annual capacity due to exorbitant energy prices in Spain. The curtailment was completed in January 2022 while the casthouse continues to operate. During 2022, $26 of payments were made to reduce the employee leave compensation and take or pay contractual obligations of $62 recorded in the fourth quarter of 2021. The Company incurred $5 of capital investment expenditures against the commitments for capital investments of $68 and restart costs of $35. In October 2022, the Company signed an agreement with a renewable energy provider for approximately 30 percent of the smelter's power needs upon restart and continues to negotiate with other generators to secure the remaining power supply needs for the smelter. When combined with the 45 percent of the smelter's power needs secured in the second quarter of 2022, up to approximately 75 percent of the smelter's power needs have been secured under long-term agreements with renewable energy providers to date. On February 3, 2023, the Company reached an updated agreement with the workers' representatives to commence the restart process in phases beginning in January 2024. Alcoa plans that all pots will be restarted by October 1, 2025, and from October 1, 2025 until the end of 2026, the minimum production will be 75 percent of the annual capacity of 228 kmt. See Part II Item 8 of this Form 10-K in Note V to the Consolidated Financial Statements.

In conjunction with the previously announced restart of the Alumar smelter in São Luís, Brazil, Alcoa incurred restart expenses of $75 during 2022. The first metal sales occurred in the second quarter of 2022 and the Company continues to progress the restart of the Alumar smelter.

In October 2022, the Company completed the previously announced restart of 19 kmt (Alcoa share) of previously curtailed capacity at the Portland (Australia) smelter. Alcoa incurred restart expenses of $12 during 2022.

On August 30, 2022, the Company announced the curtailment of one third of the production capacity (31 kmt) at the Lista (Norway) smelter to mitigate high energy costs for the site. The site was exposed to spot energy pricing, which had increased to above $600 per megawatt hour. In July 2022, the Company entered into a fixed price power agreement effective for the fourth quarter 2022 through December 31, 2023.

On July 1, 2022, Alcoa curtailed one of the three operating smelting potlines (54 kmt) at the Warrick Operations site due to operational challenges stemming from labor shortages in the region.

Capacity. At December 31, 2022, the Aluminum segment had 868 kmt of idle smelting capacity on a base capacity of 2,968 kmt, an increase from 2021 of 183 kmt in idle capacity due to the San Ciprián smelter curtailment and partial curtailment of the Warrick and Lista smelters, partially offset by the Alumar and Portland smelter restarts in 2022.

Annual Comparison

Production

Production decreased 8% primarily as a result of:

- Curtailment of the San Ciprián smelter, completed in January 2022
- Partial curtailment of the Warrick smelter in July 2022
- Partial curtailment of the Lista smelter in August 2022

Partially offset by:

- Alumar smelter restart
- Portland smelter restart

Third-party sales

Third-party sales decreased $31 primarily as a result of:

- Lower trading activities
- Absence of sales from the divested Warrick Rolling Mill
- Decreased sales from the San Ciprián smelter due to the smelter curtailment, partially offset by increased price
- Lower pricing at the Brazil hydro-electric facilities as 2021 drought conditions elevated prices in the prior year period
- Lower shipments mainly due to the partial curtailments of the Warrick smelter and the Lista smelter and maintenance at European smelters, partially offset by higher shipments from the Alumar smelter and Portland smelter due to the restarts

Partially offset by:

- Higher average realized price of $578/ton driven by a higher average LME (on a 15-day lag) and regional premiums
- Increase in value add product sales

Segment Adjusted EBITDA

Segment Adjusted EBITDA decreased $387 primarily as a result of:

- Unfavorable raw material costs, primarily on higher market prices for carbon and average alumina input costs
- Higher costs primarily associated with higher transportation costs, increased maintenance costs, and higher labor expenses
- Lower pricing at the Brazil hydro-electric facilities
- Higher energy costs, primarily in Europe
- Lower shipments mainly related to the partial curtailment of the Warrick smelter

Partially offset by:

- Higher average realized price driven by higher average LME (on a 15-day lag) and regional premiums
- Increase in value add product sales
- Favorable currency impacts

Forward-Look. The Company projects total aluminum shipments to range between 2.5 and 2.6 million metric tons in 2023, consistent with 2022 as the restarts at the Alumar and Portland smelters offset the partial curtailments at the Warrick and Lista smelters. Additionally, the Company engages in trading activity when favorable market conditions allow. Availability of trading opportunities in 2023 may impact the Company's shipment projection.

Further, in 2023, the Aluminum segment expects to benefit from lower energy costs in Europe.

Reconciliations of Certain Segment Information

Reconciliation of Total Segment Third-Party Sales to Consolidated Sales

	2022	2021
Bauxite	$ 204	$ 236
Alumina	3,520	3,139
Aluminum:		
Primary aluminum	8,887	8,420
Other[1]	(152)	346
Total segment third-party sales	12,459	12,141
Other	(8)	11
Consolidated sales	$ 12,451	$ 12,152

(1) Other includes third-party sales of flat-rolled aluminum (prior to the sale of the Warrick Rolling Mill on March 31, 2021), and energy, as well as realized gains and losses related to embedded derivative instruments designated as cash flow hedges of forward sales of aluminum.

Reconciliation of Total Segment Operating Costs to Consolidated Cost of Goods Sold

	2022	2021
Bauxite	$ 919	$ 912
Alumina	4,406	3,678
Primary aluminum	7,278	6,593
Other[1]	533	737
Total segment operating costs	13,136	11,920
Eliminations[2]	(2,604)	(2,214)
Provision for depreciation, depletion, and amortization[3]	(595)	(639)
Other[4]	275	86
Consolidated cost of goods sold	$ 10,212	$ 9,153

(1) Prior to the sale of the Warrick Rolling Mill on March 31, 2021, Other largely relates to the Aluminum segment's flat-rolled aluminum product division.

(2) Represents the elimination of Cost of goods sold related to intersegment sales between Bauxite and Alumina and between Alumina and Aluminum.

(3) Provision for depreciation, depletion, and amortization is included in the operating costs used to calculate average cost for each of the bauxite, alumina, and primary aluminum product divisions (see Bauxite, Alumina, and Aluminum above). However, for financial reporting purposes, Provision for depreciation, depletion, and amortization is presented as a separate line item on Alcoa Corporation's Statement of Consolidated Operations.

(4) Other includes costs related to Transformation, and certain other items that are not included in the operating costs of segments (see footnotes 1 and 3 in the Reconciliation of Total Segment Adjusted EBITDA to Consolidated Net (Loss) Income Attributable to Alcoa Corporation below).

Reconciliation of Total Segment Adjusted EBITDA to Consolidated Net (Loss) Income Attributable to Alcoa Corporation

	2022	2021
Net (loss) income attributable to Alcoa Corporation:		
Total Segment Adjusted EBITDA	$ 2,275	$ 3,053
Unallocated amounts:		
Transformation[1]	(66)	(44)
Intersegment eliminations	143	(101)
Corporate expenses[2]	(128)	(129)
Provision for depreciation, depletion, and amortization	(617)	(664)
Restructuring and other charges, net	(696)	(1,128)
Interest expense	(106)	(195)
Other income, net	118	445
Other[3]	(221)	(38)
Consolidated income before income taxes	702	1,199
Provision for income taxes	(664)	(629)
Net income attributable to noncontrolling interest	(161)	(141)
Consolidated net (loss) income attributable to Alcoa Corporation	$ (123)	$ 429

(1) Transformation includes, among other items, the Adjusted EBITDA of previously closed operations.

(2) Corporate expenses are composed of general administrative and other expenses of operating the corporate headquarters and other global administrative facilities, as well as research and development expenses of the corporate technical center.

(3) Other includes certain items that are not included in the Adjusted EBITDA of the reportable segments.

Environmental Matters

See Part II Item 8 of this Form 10-K in Note S to the Consolidated Financial Statements under caption Contingencies—Environmental Matters.

Liquidity and Capital Resources

Alcoa Corporation's primary future cash flows are centered on operating activities, particularly working capital, as well as capital expenditures and capital returns. Alcoa's ability to fund its cash needs depends on the Company's ongoing ability to generate and raise cash in the future.

In 2022, the Company generated lower profitability due to higher raw material, energy and production costs, partially offset by higher prices for aluminum and alumina and lower restructuring charges. Despite the challenging year, the Company maintained a strong cash position and successfully completed the following actions:

- Returned capital to stockholders of $572, including $500 for the repurchase of common stock and $72 of dividends;
- Funded $480 in capital expenditures to sustain and grow our operations;
- Purchased group annuity contracts to transfer the obligation to pay remaining retirement benefits for approximately 4,400 retirees and beneficiaries from its U.S. defined benefit pension plans. Transferred approximately $1,000 in both plan obligations and plan assets;
- Amended and restated the Company's Revolving Credit Facility to provide additional flexibility to the Company and ANHBV by (i) extending the maturity date of the Revolving Credit Facility from November 2023 to June 2027, (ii) reducing the aggregate commitments under the facility from $1,500 to $1,250, (iii) releasing the collateral package that had previously secured the Revolving Credit Facility, which will continue so long as certain credit ratings are maintained, (iv) increasing the maximum leverage ratio from 2.75 to 1.00 to 3.25 to 1.00, which increases following material acquisitions for four consecutive fiscal quarters following an acquisition, (v) providing a debt to capitalization ratio not to exceed .60 to 1.00 to replace the maximum leverage ratio upon a ratings upgrade to investment grade by Moody's or S&P, and (vi) providing flexibility for dividends and other restricted payments, to make investments, and to incur additional indebtedness. The Revolving Credit Facility implements a sustainability adjustment to the applicable margin and commitment fee that may result in a positive or negative adjustment based on two of the Company's existing sustainability metrics;
- Achieved investment grade credit rating. On July 26, 2022, Moody's upgraded the rating of ANHBV's senior unsecured notes to Baa3 (investment grade) from Bal and set the current outlook to stable; and,
- Renewed $79 term loan in Australia with extended maturity date to 2024.

On January 31, 2023, a wholly-owned subsidiary of the Company entered into a one-year Receivables Purchase Agreement to sell up to $150 of certain customer receivables without recourse on a revolving basis. The unsold portion of the specified receivable pool is pledged as collateral to the purchasing bank to secure the sold receivables. Alcoa Corporation will guarantee the performance obligations of the wholly-owned subsidiary under the facility; however no assets (other than the receivables) will be pledged as collateral.

Management believes that the Company's cash on hand, future operating cash flows, and liquidity options, combined with its strategic actions, are adequate to fund its short term and long term operating and investing needs for at least twelve months and the foreseeable future thereafter. Further, the Company has flexibility related to its use of cash; the Company has no significant debt maturities until 2027 and no significant cash contribution requirements related to its U.S. pension plan obligations for the foreseeable future (refer to Material Cash Requirements, below, for more information).

Although management believes that Alcoa's future cash from operations and other liquidity options will provide adequate resources to fund operating and investing needs, the Company's access to, and the availability of, financing on acceptable terms in the future will be affected by many factors, including: (i) Alcoa Corporation's credit rating; (ii) the liquidity of the overall capital markets; (iii) the current state of the economy and commodity markets, and (iv) short- and long-term debt ratings. There can be no assurances that the Company will continue to have access to capital markets on terms acceptable to Alcoa Corporation.

Changes in market conditions caused by global or macroeconomic events, such as the ongoing conflict between Russia and Ukraine, high inflation, and changing global monetary policies could have adverse effects on Alcoa's ability to obtain additional financing and cost of borrowing. Inability to generate sufficient earnings could impact the Company's ability to meet the financial covenants in our outstanding debt and revolving credit facility agreements and limit our ability to access these sources of liquidity or refinance or renegotiate our outstanding debt or credit agreements on terms acceptable to the Company. Additionally, the impact on market conditions from such events could adversely affect the liquidity of Alcoa's customers, suppliers, and joint venture partners and equity method investments, which could negatively impact the collectability of outstanding receivables and our cash flows.

At December 31, 2022, the Company's cash and cash equivalents were $1,363, of which $1,280 was held outside the United States. Alcoa Corporation has a number of commitments and obligations related to the Company's operations in various foreign jurisdictions, resulting in the need for cash outside the United States. Alcoa Corporation continuously evaluates its local and global cash needs for future business operations, which may influence future repatriation decisions. See Part II Item 8 of this Form 10-K in Note Q to the Consolidated Financial Statements for additional information related to undistributed net earnings.

Cash from Operations

Cash provided from operations was $822 in 2022 compared with $920 in 2021. Notable changes to the sources and (uses) of cash include:

- ($964) lower net income generation, excluding the impacts from restructuring charges, primarily due to higher raw materials, energy and production costs, partially offset by higher aluminum and alumina pricing**;**
- ($372) in income taxes paid on prior year earnings, as well as on higher current year earnings in jurisdictions where the Company pays taxes;
- $282 in certain working capital accounts, primarily a lower increase in receivables relating to higher aluminum and alumina prices than in 2021, a lower increase in inventories on higher raw material volumes in 2021, and a lower increase in accounts payable as raw material and energy costs increased less than in 2021; and,
- $562 in lower pension contributions to the Company's defined benefit pension plans.

In the third quarter of 2020, AofA paid approximately $74 (A$107) to the ATO related to the tax dispute described in Note S to the Consolidated Financial Statements in Part II Item 8 of this Form 10-K. Upon payment, AofA recorded a noncurrent prepaid tax asset, as the Company continues to believe it is more likely than not that AofA's tax position will be sustained and therefore is not recognizing any tax expense in relation to this matter. In accordance with Australian tax laws, the initial interest assessment and additional interest are deductible against AofA's taxable income resulting in approximately $169 (A$219) in 2020, $14 (A$19) in 2021, and $15 (A$22) in 2022 in lower cash tax payments. If AofA is ultimately successful, the interest deduction would become taxable as income in the year the dispute is resolved. In addition, should the ATO decide in the interim to reduce any interest already assessed, the reduction would be taxable as income at that point in time. During 2022, AofA continued to record its tax provision and tax liability without effect of the ATO assessment, since it expects to prevail. The tax payable will remain on AofA's balance sheet as a noncurrent liability, increased by the tax effect of subsequent periods' interest deductions, until dispute resolution, which is expected to take several years. At December 31, 2022, the noncurrent liability resulting from the cumulative interest deductions was approximately $174 (A$260).

Financing Activities

Cash used for financing activities was $768 in 2022 compared with $1,158 in 2021.

The use of cash in 2022 was primarily $165 of net cash paid to Alumina Limited (see Noncontrolling interest in Results of Operations above), $500 for the repurchase of common stock, and $72 of dividends paid.

The use of cash in 2021 was primarily $775 for the full, early repayment of $750 aggregate principal amount of 2024 Notes (including $25 redemption premium) in April 2021, $518 for the full, early repayment of $500 aggregate principal amount of 2026 Notes (including $18 redemption premium) in September 2021, $194 in net cash paid to Alumina Limited, $150 for the repurchase of common stock, $19 for dividends paid on common stock, and $17 in financial contributions primarily related to the divested Spanish facilities. The uses of cash were partially offset by the issuance of $500 aggregate principal amount 2029 Notes by ANHBV in March 2021 with net proceeds of approximately $493.

Credit Facilities. On June 27, 2022, Alcoa Corporation and ANHBV, a wholly owned subsidiary of Alcoa Corporation and the borrower, entered into an amendment and restatement agreement (the Third Amendment and Restatement) (as amended and restated, the Revolving Credit Facility) that provides additional flexibility to the Company and ANHBV by (i) extending the maturity date of the Revolving Credit Facility from November 2023 to June 2027, (ii) reducing the aggregate commitments under the facility from $1,500 to $1,250, (iii) releasing the collateral package that had previously secured the Revolving Credit Facility, which will continue so long as certain credit ratings are maintained, (iv) increasing the maximum leverage ratio from 2.75 to 1.00 to 3.25 to 1.00, which increases following material acquisitions for four consecutive fiscal quarters following an acquisition, (v) providing a debt to capitalization ratio not to exceed .60 to 1.00 to replace the maximum leverage ratio upon a ratings upgrade to investment grade by Moody's or S&P, and (vi) providing flexibility for dividends and other restricted payments, to make investments, and to incur additional indebtedness. The Revolving Credit Facility implements a sustainability adjustment to the applicable margin and commitment fee that may result in a positive or negative adjustment based on two of the Company's existing sustainability metrics.

If Alcoa Corporation or ANHBV, as applicable, fails to have a rating of at least Ba1 from Moody's and BB+ from S&P, then the Company would be required to execute all security documents to re-secure collateral under the Revolving Credit Facility.

As of December 31, 2022, the Company was in compliance with all covenants. There were no borrowings outstanding at December 31, 2022 and 2021, and no amounts were borrowed during 2022 and 2021 under the Revolving Credit Facility.

The Company may draw on the facility periodically to ensure working capital needs are met. See Part II Item 8 of this Form 10-K in Note M to the Consolidated Financial Statements for additional information related to the Revolving Credit Facility.

Guarantees of Third Parties. As of December 31, 2022 and 2021, the Company had no outstanding potential future payments for guarantees issued on behalf of a third-party.

Bank Guarantees and Letters of Credit. Alcoa Corporation has outstanding bank guarantees and letters of credit related to, among others, energy contracts, environmental obligations, legal and tax matters, leasing obligations, workers compensation, and customs duties. The total amount committed under these instruments, which automatically renew or expire at various dates between 2023 and 2024, was $293 (includes $131 issued under a standby letter of credit agreement —see below) at December 31, 2022. Additionally, ParentCo has outstanding bank guarantees and letters of credit related to the Company of $14 at December 31, 2022. In the event ParentCo would be required to perform under any of these instruments, ParentCo would be indemnified by Alcoa Corporation in accordance with the Separation and Distribution Agreement. Likewise, the Company has outstanding bank guarantees and letters of credit related to ParentCo of $8 at December 31, 2022. In the event Alcoa Corporation would be required to perform under any of these instruments, the Company would be indemnified by ParentCo in accordance with the Separation and Distribution Agreement.

In August 2017, Alcoa Corporation entered into a standby letter of credit agreement, which expires on June 27, 2024 (extended in August 2018, May 2019, May 2021, and June 2022), with three financial institutions. The agreement provides for a $200 facility used by the Company for matters in the ordinary course of business. Alcoa Corporation's obligations under this facility are secured in the same manner as obligations under the Company's revolving credit facility. Additionally, this facility contains similar representations and warranties and affirmative, negative, and financial covenants as the Company's revolving credit facility. See Part II Item 8 of this Form 10-K in Note M to the Consolidated Financial Statements for additional information related to the Company's debt. As of December 31, 2022, letters of credit aggregating $131 were issued under this facility.

Surety Bonds. Alcoa Corporation has outstanding surety bonds primarily related to tax matters, contract performance, workers compensation, environmental-related matters, and customs duties. The total amount committed under these bonds, which automatically renew or expire at various dates between 2023 and 2027, was $174 at December 31, 2022. Additionally, ParentCo has outstanding surety bonds related to the Company of $11 at December 31, 2022. In the event ParentCo would be required to perform under any of these instruments, ParentCo would be indemnified by Alcoa Corporation in accordance with the Separation and Distribution Agreement. Likewise, the Company has outstanding surety bonds related to ParentCo of $3 at December 31, 2022. In the event Alcoa Corporation would be required to perform under any of these instruments, the Company would be indemnified by ParentCo in accordance with the Separation and Distribution Agreement.

Debt. As of December 31, 2022, Alcoa Corporation had three outstanding Notes maturing at varying times. A summary of the Notes and other long-term debt is shown below. See Part II Item 8 of this Form 10-K in Note M to the Consolidated Financial Statements for additional information related to the Company's debt.

December 31,	2022	2021
5.500% Notes, due 2027	750	$ 750
6.125% Notes, due 2028	500	500
4.125% Notes, due 2029	500	500
Other	84	5
Unamortized discounts and deferred financing costs	(27)	(28)
Total	1,807	1,727
Less: amount due within one year	1	1
Long-term debt, less amount due within one year	$ 1,806	$ 1,726

Ratings. Alcoa Corporation's cost of borrowing and ability to access the capital markets are affected not only by market conditions but also by the short- and long-term debt ratings assigned to Alcoa Corporation's debt by the major credit rating agencies.

On July 26, 2022, Moody's upgraded the rating of ANHBV's senior unsecured notes to Baa3 (investment grade) from Ba1 and set the current outlook to stable.

Dividend. In each quarter of 2022, the Board of Directors declared and paid a quarterly cash dividend of $0.10 per share of the Company's common stock, totaling $72 for the year.

The details of any future cash dividend declaration, including the amount of such dividend and the timing and establishment of the record and payment dates, will be determined by the Board of Directors. The decision of whether to pay future cash dividends and the amount of any such dividends will be based on the Company's financial position, results of operations, cash flows, capital requirements, business conditions, the requirements of applicable law, and any other factors the Board of Directors may deem relevant.

Common Stock Repurchase Program.

In October 2021, Alcoa Corporation's Board of Directors approved a common stock repurchase program under which the Company may purchase shares of its outstanding common stock up to an aggregate transactional value of $500, depending on cash availability, market conditions, and other factors.

On July 20, 2022, Alcoa Corporation announced that its Board of Directors approved an additional common stock repurchase program under which the Company may purchase shares of its outstanding common stock up to an aggregate transactional value of $500, depending on the Company's continuing analysis of market, financial, and other factors (the New Repurchase Program). Prior to this authorization, $150 remained available for share repurchases at the end of the second quarter of 2022 from a prior authorization in October 2021 of $500 which was fully exhausted in 2022 with the Company's repurchase activity (see below).

In 2022, the Company repurchased 8,565,200 shares of its common stock for $500, under the previously authorized program; the shares were immediately retired. As of the date of this report, the Company is currently authorized to repurchase up to a total of $500, in the aggregate, of its outstanding shares of common stock under the New Repurchase Program. Repurchases under this program may be made using a variety of methods, which may include open market purchases, privately negotiated transactions, or pursuant to a Rule 10b5-1 plan. This program may be suspended or discontinued at any time and does not have a predetermined expiration date. Alcoa Corporation intends to retire repurchased shares of common stock.

In 2021, the Company repurchased 3,184,300 shares of its common stock for $150; the shares were immediately retired.

Investing Activities

Cash used for investing activities was $495 in 2022 compared with cash provided from investing activities of $565 in 2021.

In 2022, the use of cash was primarily attributable to $480 of capital expenditures and $32 of cash contributions to the ELYSIS joint venture, partially offset by the sale of the Company's interest in the MRN mine of $10.

In 2021, the source of cash was primarily attributable to proceeds from the sale of assets of $966, primarily the Warrick Rolling Mill, Rockdale, and Eastalco site sales, partially offset by $390 in capital expenditures.

In 2023, Alcoa expects capital expenditures of approximately $600 related to sustaining capital projects and growth projects. The timing and amount of capital expenditures may fluctuate as a result of the Company's normal operations.

Material Cash Requirements

As discussed above, the Company relies primarily on operating cash flows to fund its cash commitments and management believes its operating cash flows, cash on hand, and liquidity options will be adequate to fund its cash needs for at least 12 months and the foreseeable future thereafter. We have committed cash outflows related to pension and postretirement benefit obligations and operating lease agreements. See Part II Item 8 of this Form 10-K in Notes O and T, respectively, to the Consolidated Financial Statements for additional information. As of December 31, 2022, a summary of Alcoa Corporation's outstanding material cash requirements are as follows:

	Total	2023	2024-2025	2026-2027	Thereafter
Operating activities:					
Energy-related purchase obligations	$ 13,911	$ 1,563	$ 2,400	$ 2,241	$ 7,707
Raw material purchase obligations	8,639	2,516	1,872	943	3,308
Other purchase obligations	794	382	186	133	93
Interest related to debt	513	97	185	185	46
Financing activities:					
Long-term debt	1,834	1	81	751	1,001
Totals	$ 25,691	$ 4,559	$ 4,724	$ 4,253	$ 12,155

Purchase obligations—Energy-related purchase obligations consist primarily of electricity and natural gas contracts with expiration dates ranging from 1 year to 25 years. Raw material obligations consist mostly of bauxite (relates to AWAC's bauxite mine interests in Guinea and Brazil), caustic soda, lime, alumina, aluminum fluoride, calcined petroleum coke, anodes and cathode blocks with expiration dates ranging from less than 1 year to 13 years. Other purchase obligations consist principally of freight for bauxite and alumina with expiration dates ranging from 1 to 10 years. Many of these purchase obligations contain variable pricing components, and, as a result, actual cash payments may differ from the estimates provided in the preceding table. In accordance with the terms of several of these supply contracts, obligations may be reduced as a result of an interruption to operations, such as a plant curtailment or a force majeure event.

Interest related to total debt—Interest is based on interest rates in effect as of December 31, 2022 and is calculated on debt with maturities that extend to 2029.

Long-term debt—Total debt amounts in the preceding table represent the principal amounts of all outstanding long-term debt, which have maturities that extend to 2029.

Critical Accounting Policies and Estimates

The preparation of the Company's Consolidated Financial Statements in accordance with GAAP requires management to make certain estimates based on judgments and assumptions regarding uncertainties that affect the amounts reported in the Consolidated Financial Statements and disclosed in the Notes to the Consolidated Financial Statements. Areas that require such estimates include the review of properties, plants, and equipment and goodwill for impairment, and accounting for each of the following: asset retirement and environmental obligations; litigation matters; pension plans and other postretirement benefits obligations; derivatives and hedging activities; and income taxes.

Management uses historical experience and all available information to make these estimates; actual results may differ from those used to prepare the Company's Consolidated Financial Statements at any given time. Despite these inherent limitations, management believes that the amounts recorded in the financial statements related to these items are based on its best estimates and judgments using all relevant information available at the time.

A summary of the Company's significant accounting policies is included in Part II Item 8 of this Form 10-K in Note B to the Consolidated Financial Statements.

Properties, Plants, and Equipment. Properties, plants, and equipment are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of such assets (asset group) may not be recoverable, including in the period when assets have met the criteria to be classified as held for sale. The model used to determine recoverability of an asset or asset group would leverage the model that management uses for planning and strategic review of the entire business, including related inputs and assumptions. Management's impairment assessment process is described in Part II Item 8 of this Form 10-K in Note B to the Consolidated Financial Statements. Refer to Part II Item 8 of this Form 10-K in Note K to the Consolidated Financial Statements for more information regarding properties, plants, and equipment.

Goodwill. Goodwill is reviewed for impairment annually (in the fourth quarter) or more frequently if indicators of impairment exist or if a decision is made to sell or exit a business. A significant amount of judgment is involved in determining if an indicator of impairment has occurred. Such indicators may include, among others, deterioration in general economic conditions, negative developments in equity and credit markets, adverse changes in the markets in which an entity operates, increases in input costs that have a negative effect on earnings and cash flows, or a trend of negative or declining cash flows over multiple periods. The fair value that could be realized in an actual transaction may differ from that used to evaluate goodwill for impairment.

Under the qualitative impairment test, management considers a number of factors in its assessment, such as: general economic conditions, equity and credit markets, industry and market conditions, and earnings and cash flow trends.

Under the quantitative impairment test, management uses a discounted cash flow (DCF) model to estimate the current fair value of its reporting units. A number of significant assumptions and estimates are involved in the application of the DCF model to forecast operating cash flows, including markets and market share, sales volumes and prices, production costs, production capability, tax rates, capital spending, discount rate, and working capital changes. The model used for the goodwill impairment test leverages the model, including related inputs and assumptions, that management uses for planning and strategic review of the entire business.

Management will test goodwill on a qualitative or quantitative basis. Refer to Part II Item 8 of this Form 10-K in Note B to the Consolidated Financial Statements for more information regarding management's impairment assessment process.

Management performed a quantitative assessment for the Bauxite and Alumina reporting units in 2022. As a result of the assessments, the estimated fair values of the Bauxite and Alumina reporting units were substantially in excess of their carrying values, resulting in no impairment. The impact on the estimated fair values of an increase in the discount rate of 1% would not result in a change in the conclusions reached, the estimated fair values would remain in excess of carrying values.

Further, in all years presented, there have been no triggering events that necessitated an impairment test for either the Bauxite or Alumina reporting units. Refer to Part II Item 8 of this Form 10-K in Note L to the Consolidated Financial Statements for more information regarding goodwill.

Asset Retirement and Environmental Obligations. Estimates are used to record environmental remediation and asset retirement obligation (ARO) reserves based on the best available information at the time of recognition. Several assumptions are used to estimate the costs required to demolish, environmentally remediate, or reclaim the site, including:

- Engineering estimates and benchmarks to other similar projects;
- Mining area to be reclaimed and estimated restoration costs;
- Volume of regulated materials to be removed (asbestos, PCB fluids, spent potlining);
- Disposition of materials;
- Extent of contamination based on available data;
- Scope of remediation to mitigate human health or environmental risks and/or to meet likely regulatory requirements; and,
- Commercial availability and pricing for off-site treatment or disposal applications.

As the site is demolished, remediated, or reclaimed, the assumptions and estimates used to record the reserve may change to account for:

- Actual site conditions that require more or less remediation or reclamation;
- Legislation that becomes more or less stringent;
- Regulative authorities requiring updates to final design prior to completion;
- Alternative disposal methods for waste;
- Technological changes which allow remediation to be more efficient;
- Market factors; and,
- Variances in work that is atypical from prior work experience.

Changes to the estimates may result in material changes to the reserve that may require an increase to or a reversal of a previously recorded reserve. Historically, the Company has not had material changes in established reserves. Refer to Part II Item 8 of this Form 10-K in Note R and Note S to the Consolidated Financial Statements for more information regarding current reserves.

Litigation Matters. For asserted claims and assessments, liabilities are recorded when an unfavorable outcome of a matter is deemed to be probable and the loss is reasonably estimable. Management determines the likelihood of an unfavorable outcome based on many factors such as, among others, the nature of the matter, available defenses and case strategy, progress of the matter, views and opinions of legal counsel and other advisors, applicability and success of appeals processes, and the outcome of similar historical matters. Once an unfavorable outcome is deemed probable, management weighs the probability of estimated losses, and the most reasonable loss estimate is recorded. If an unfavorable outcome of a matter is deemed to be reasonably possible, then the matter is disclosed, and no liability is recorded. With respect to unasserted claims or assessments, management must first determine that the probability that an assertion will be made is likely, then, a determination as to the likelihood of an unfavorable outcome and the ability to reasonably estimate the potential loss is made. Legal matters are reviewed on a continuous basis to determine if there has been a change in management's judgment regarding the likelihood of an unfavorable outcome or the estimate of a potential loss. Refer to Part II Item 8 of this Form 10-K in Note B to the Consolidated Financial Statements for more information regarding management's litigation matters policy.

Pension and Other Postretirement Benefits. Liabilities and expenses for pension and other postretirement benefits are determined using actuarial methodologies and incorporate significant assumptions, including the interest rate used to discount the future estimated liability, the expected long-term rate of return on plan assets, and several assumptions relating to the employee workforce (salary increases, health care cost trend rates, retirement age, and mortality).

The yield curve model used to develop the discount rate parallels the plans' projected cash flows and has a weighted average duration of 11 years. The underlying cash flows of the high-quality corporate bonds included in the model exceed the cash flows needed to satisfy the Company's plan obligations multiple times. If a deep market of high-quality corporate bonds does not exist in a country, then the yield on government bonds plus a corporate bond yield spread is used. The impact on the combined pension and other postretirement liabilities of a change in the weighted average discount rate of ¼ of 1% would be approximately $75 and either a charge or credit of approximately $1 to pretax earnings in the following year.

The expected long-term rate of return on plan assets is generally applied to a five-year market-related value of plan assets (a four-year average or the fair value at the plan measurement date is used for certain non-U.S. plans). The process used by management to develop this assumption is one that relies on forward-looking investment returns by asset class. Management incorporates expected future investment returns on current and planned asset allocations using information from various external investment managers and consultants, as well as management's own judgment. A change in the assumption for the weighted average expected long-term rate of return on plan assets of ¼ of 1% would impact pretax earnings by approximately $7 for 2023.

Mortality rate assumptions are based on mortality tables and future improvement scales published by third parties, such as the Society of Actuaries, and consider other available information including historical data as well as studies and publications from reputable sources.

Refer to Part II Item 8 of this Form 10-K in Note O to the Consolidated Financial Statements for more information regarding pension and other postretirement benefits including accounting impacts of current year actions.

Derivatives and Hedging. To calculate the fair value of certain derivatives, management uses discounted cash flow (DCF) and other simulation models that consider the following inputs and assumptions: quoted market prices (e.g., aluminum prices on the 10-year London Metal Exchange (LME) forward curve and energy prices), information concerning time premiums and volatilities for certain option type embedded derivatives and regional premiums for aluminum contracts, aluminum and energy prices beyond those quoted in the market, and the estimated credit spread between Alcoa and the counterparty. The quoted market prices used in the valuation models are dependent on market fundamentals, the relationship between supply and demand at any point in time, seasonal conditions, inventories, and interest rates. For periods beyond the term of quoted market prices, management estimates the price of aluminum by extrapolating the 10-year LME forward curve and estimates the Midwest premium based on recent transactions.

Changes in estimates can have a material impact on the derivative valuations. Refer to Part II Item 8 of this Form 10-K in Note P to the Consolidated Financial Statements for more information regarding derivatives and hedging and related activity during the period.

Income Taxes. Valuation allowances are recorded to reduce deferred tax assets when it is more likely than not (greater than 50%) that a tax benefit will not be realized. In evaluating the need for a valuation allowance, management applies judgment in assessing all available positive and negative evidence and considers all potential sources of taxable income, including income available in carryback periods, future reversals of taxable temporary differences, projections of taxable income, and income from tax planning strategies. Positive evidence includes factors such as a history of profitable operations, projections of future profitability within the carryforward period, including from tax planning strategies, and Alcoa Corporation's experience with similar operations. Existing favorable contracts and the ability to sell products into established markets are additional positive evidence. Negative evidence includes items such as cumulative losses, projections of future losses, or carryforward periods that are not long enough to allow for the utilization of a deferred tax asset based on existing projections of income. In certain jurisdictions, deferred tax assets related to cumulative losses may exist without a valuation allowance where in management's judgment the weight of the positive evidence more than offsets the negative evidence of the cumulative losses. Upon changes in facts and circumstances, management may conclude that deferred tax assets for which no valuation allowance is currently recorded may not be realized, resulting in a future charge to establish a valuation allowance. Financial information utilized in this analysis leverages the same financial information, including related inputs and assumptions, that management uses for planning and strategic review of the entire business.

Tax benefits related to uncertain tax positions taken or expected to be taken on a tax return are recorded when such benefits meet a more likely than not threshold. Otherwise, these tax benefits are recorded when a tax position has been effectively settled, which means that the statute of limitations has expired, or the appropriate taxing authority has completed their examination even though the statute of limitations remains open.

Changes in estimates can have a material impact on the deferred taxes and uncertain tax positions. Refer to Part II Item 8 of this Form 10-K in Note Q to the Consolidated Financial Statements for more information regarding income taxes and deferred tax assets and related activity during the period.

Related Party Transactions

Alcoa Corporation buys products from and sells products to various related companies, consisting of entities in which Alcoa Corporation retains a 50% or less equity interest, at negotiated prices between the two parties. These transactions were not material to the financial position or results of operations of Alcoa Corporation for all periods presented.

Recently Adopted Accounting Guidance

See Part II Item 8 of this Form 10-K in Note B to the Consolidated Financial Statements under caption Recently Adopted Accounting Guidance.

Recently Issued Accounting Guidance

See Part II Item 8 of this Form 10-K in Note B to the Consolidated Financial Statements under caption Recently Issued Accounting Guidance.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

See Part II Item 8 of this Form 10-K in Note P to the Consolidated Financial Statements under caption Derivatives.

Item 8. Financial Statements and Supplementary Data.

Management's Reports to Alcoa Corporation Stockholders

Management's Report on Financial Statements and Practices

The accompanying Consolidated Financial Statements of Alcoa Corporation and its subsidiaries (the Company) were prepared by management, which is responsible for their integrity and objectivity, in accordance with accounting principles generally accepted in the United States of America (GAAP) and include amounts that are based on management's best judgments and estimates. The other financial information included in the Company's Annual Report on Form 10-K for the year ended December 31, 2022 is consistent with that in the Consolidated Financial Statements.

Management recognizes its responsibility for conducting the Company's affairs according to the highest standards of personal and corporate conduct. This responsibility is characterized and reflected in key policy statements issued from time to time regarding, among other things, conduct of its business activities within the laws of the host countries in which the Company operates and potentially conflicting outside business interests of its employees. The Company maintains a systematic program to assess compliance with these policies.

Management's Report on Internal Control over Financial Reporting

Management is responsible for establishing and maintaining adequate internal control over financial reporting, as defined in Rules 13a-15(f) and 15d-15(f) of the U.S. Securities Exchange Act of 1934 (as amended), for the Company. The Company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with GAAP. The Company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the Company, (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with GAAP, and that receipts and expenditures of the Company are being made only in accordance with authorizations of management and directors of the Company, and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the Company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Management conducted an assessment to evaluate the effectiveness of the Company's internal control over financial reporting as of December 31, 2022 using the criteria in *Internal Control—Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. Based on this assessment, management concluded that the Company maintained effective internal control over financial reporting as of December 31, 2022.

PricewaterhouseCoopers LLP, the independent registered public accounting firm that audited the Company's financial statements included in this Annual Report on Form 10-K for the year ended December 31, 2022, has audited the Company's internal control over financial reporting as of December 31, 2022 and has issued an attestation report, which is included herein.

/s/ Roy C. Harvey
Roy C. Harvey
President and
Chief Executive Officer

/s/ Molly S. Beerman
Molly S. Beerman
Executive Vice President and
Chief Financial Officer

February 23, 2023

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of Alcoa Corporation

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of Alcoa Corporation and its subsidiaries (the "Company") as of December 31, 2022 and 2021, and the related consolidated statements of operations, comprehensive income, changes in equity and cash flows for each of the three years in the period ended December 31, 2022, including the related notes (collectively referred to as the "consolidated financial statements"). We also have audited the Company's internal control over financial reporting as of December 31, 2022, based on criteria established in *Internal Control—Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2022 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2022, based on criteria established in *Internal Control—Integrated Framework* (2013) issued by the COSO.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express opinions on the Company's consolidated financial statements and on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that (i) relates to accounts or disclosures that are material to the consolidated financial statements and (ii) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

U.S. Pension Annuitizations

As described in Notes B and O to the consolidated financial statements, the Company had a projected benefit obligation related to its defined pension plans of $2,518 million as of December 31, 2022, including $1,113 million of benefit obligations in the U.S. In the third quarter of 2022, the Company purchased group annuity contracts to transfer the obligation to pay remaining retirement benefits of certain retirees and beneficiaries from its U.S. defined benefit pension plans and transferred approximately $1,000 million in both benefit obligations and plan assets. As a result, the Company remeasured its U.S. defined benefit pension plans and recognized a $617 million settlement loss. As disclosed by management, the remeasurement of its U.S. defined benefit pension plans was performed using actuarial methodologies and incorporated significant assumptions, including the discount rate, expected long-term rate of return on plan assets, and several assumptions relating to the employee workforce (salary increases, retirement age, and mortality rate).

The principal considerations for our determination that performing procedures relating to the U.S. pension annuitizations is a critical audit matter are (i) the significant judgment by management in determining the valuation of the U.S. pension annuitizations, as well as their consideration of the accounting for the non-recurring nature of the U.S. pension annuitizations; (ii) a high degree of auditor judgment, subjectivity, and effort in performing procedures and evaluating audit evidence relating to the accounting for the U.S. pension annuitizations, participants transferred, and significant assumptions related to the discount rate, expected long-term rate of return on plan assets, and mortality rate used in determining the valuation of the U.S. pension annuitizations; and (iii) the audit effort involved the use of professionals with specialized skill and knowledge.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to management's accounting for and valuation of the U.S. pension annuitizations, including controls over management's methodology and significant assumptions. These procedures also included, among others, (i) testing management's process for determining the valuation of the U.S. pension annuitizations; (ii) testing the participants transferred, the settlement loss recognized, and the completeness and accuracy of the underlying data used in the valuation of the U.S. pension annuitizations; and (iii) the involvement of professionals with specialized skill and knowledge to assist in (a) evaluating the appropriateness of the actuarial methodology used by management; and (b) evaluating the reasonableness of the discount rate, expected long-term rate of return on plan assets, and mortality rate assumptions.

/s/ PricewaterhouseCoopers LLP

Pittsburgh, Pennsylvania
February 23, 2023

We have served as the Company's auditor since 2015.

Alcoa Corporation and Subsidiaries
Statement of Consolidated Operations
(in millions, except per-share amounts)

For the year ended December 31,	2022	2021	2020
Sales (E)	$ 12,451	$ 12,152	$ 9,286
Cost of goods sold (exclusive of expenses below)	10,212	9,153	7,969
Selling, general administrative, and other expenses	204	227	206
Research and development expenses	32	31	27
Provision for depreciation, depletion, and amortization	617	664	653
Restructuring and other charges, net (D)	696	1,128	104
Interest expense (U)	106	195	146
Other (income) expenses, net (U)	(118)	(445)	8
Total costs and expenses	11,749	10,953	9,113
Income before income taxes	702	1,199	173
Provision for income taxes (Q)	664	629	187
Net income (loss)	38	570	(14)
Less: Net income attributable to noncontrolling interest	161	141	156
Net (loss) income attributable to Alcoa Corporation	(123)	429	(170)
Earnings per share attributable to Alcoa Corporation common shareholders (F):			
Basic	$ (0.68)	$ 2.30	$ (0.91)
Diluted	$ (0.68)	$ 2.26	$ (0.91)

The accompanying notes are an integral part of the consolidated financial statements.

Alcoa Corporation and Subsidiaries
Statement of Consolidated Comprehensive Income
(in millions)

	Alcoa Corporation			Noncontrolling interest			Total		
For the year ended December 31,	**2022**	**2021**	**2020**	**2022**	**2021**	**2020**	**2022**	**2021**	**2020**
Net (loss) income	$ (123)	$ 429	$ (170)	$ 161	$ 141	$ 156	$ 38	$ 570	$ (14)
Other comprehensive income (loss), net of tax (G):									
Change in unrecognized net actuarial loss and prior service cost/benefit related to pension and other postretirement benefits	944	1,654	(254)	8	54	(11)	952	1,708	(265)
Foreign currency translation adjustments	(71)	(229)	(225)	(103)	(93)	(10)	(174)	(322)	(235)
Net change in unrecognized gains/losses on cash flow hedges	180	(388)	(176)	2	—	(21)	182	(388)	(197)
Total Other comprehensive income (loss), net of tax	1,053	1,037	(655)	(93)	(39)	(42)	960	998	(697)
Comprehensive income (loss)	$ 930	$ 1,466	$ (825)	$ 68	$ 102	$ 114	$ 998	$ 1,568	$ (711)

The accompanying notes are an integral part of the consolidated financial statements.

Alcoa Corporation and Subsidiaries
Consolidated Balance Sheet
(in millions)

December 31,	2022	2021
Assets		
Current assets:		
Cash and cash equivalents (P)	$ 1,363	$ 1,814
Receivables from customers	778	757
Other receivables	131	127
Inventories (J)	2,427	1,956
Fair value of derivative instruments (P)	134	14
Prepaid expenses and other current assets	417	358
Total current assets	5,250	5,026
Properties, plants, and equipment, net (K)	6,493	6,623
Investments (H)	1,122	1,199
Deferred income taxes (Q)	296	506
Fair value of derivative instruments (P)	2	7
Other noncurrent assets (U)	1,593	1,664
Total Assets	$ 14,756	$ 15,025
Liabilities		
Current liabilities:		
Accounts payable, trade	$ 1,757	$ 1,674
Accrued compensation and retirement costs	335	383
Taxes, including income taxes	230	374
Fair value of derivative instruments (P)	200	274
Other current liabilities	481	517
Long-term debt due within one year (M & P)	1	1
Total current liabilities	3,004	3,223
Long-term debt, less amount due within one year (M & P)	1,806	1,726
Accrued pension benefits (O)	213	417
Accrued other postretirement benefits (O)	480	650
Asset retirement obligations (R)	711	622
Environmental remediation (S)	226	265
Fair value of derivative instruments (P)	1,026	1,048
Noncurrent income taxes (Q)	215	191
Other noncurrent liabilities and deferred credits (U)	486	599
Total liabilities	8,167	8,741
Contingencies and commitments (S)		
Equity		
Alcoa Corporation shareholders' equity:		
Common stock (N)	2	2
Additional capital	9,183	9,577
Accumulated deficit	(570)	(315)
Accumulated other comprehensive loss (G)	(3,539)	(4,592)
Total Alcoa Corporation shareholders' equity	5,076	4,672
Noncontrolling interest (A)	1,513	1,612
Total equity	6,589	6,284
Total Liabilities and Equity	$ 14,756	$ 15,025

The accompanying notes are an integral part of the consolidated financial statements.

Alcoa Corporation and Subsidiaries
Statement of Consolidated Cash Flows
(in millions)

For the year ended December 31,	2022	2021	2020
Cash from Operations			
Net income (loss)	$ 38	$ 570	$ (14)
Adjustments to reconcile net income (loss) to cash from operations:			
Depreciation, depletion, and amortization	617	664	653
Deferred income taxes (Q)	219	147	(26)
Equity loss (earnings), net of dividends (H)	4	(138)	20
Restructuring and other charges, net (D)	696	1,128	104
Net loss (gain) from investing activities—asset sales (U)	10	(354)	(173)
Net periodic pension benefit cost (O)	54	47	138
Stock-based compensation (N)	40	39	25
Premium paid on early redemption of debt	—	43	—
(Gain) loss on mark-to-market derivative financial contracts	(44)	(24)	5
Other	53	49	29
Changes in assets and liabilities, excluding effects of divestitures and foreign currency translation adjustments:			
(Increase) decrease in receivables	(59)	(414)	16
(Increase) decrease in inventories (J)	(547)	(639)	122
Decrease (increase) in prepaid expenses and other current assets	44	(41)	17
Increase in accounts payable, trade	189	354	25
Decrease in accrued expenses	(173)	(38)	(153)
(Decrease) increase in taxes, including income taxes	(152)	301	119
Pension contributions (O)	(17)	(579)	(343)
Increase in noncurrent assets	(87)	(160)	(82)
Decrease in noncurrent liabilities	(63)	(35)	(88)
Cash provided from operations	822	920	394
Financing Activities			
Additions to debt (original maturities greater than three months) (M)	4	495	739
Payments on debt (original maturities greater than three months) (M)	(1)	(1,294)	(1)
Proceeds from the exercise of employee stock options (N)	22	25	1
Repurchase of common stock (N)	(500)	(150)	—
Dividends paid on Alcoa common stock (N)	(72)	(19)	—
Payments related to tax withholding on stock-based compensation awards	(19)	(1)	(1)
Financial contributions for the divestiture of businesses (C)	(33)	(17)	(38)
Contributions from noncontrolling interest (A)	214	21	24
Distributions to noncontrolling interest	(379)	(215)	(207)
Other	(4)	(3)	(3)
Cash (used for) provided from financing activities	(768)	(1,158)	514
Investing Activities			
Capital expenditures	(480)	(390)	(353)
Proceeds from the sale of assets and businesses (C)	5	966	198
Additions to investments (H)	(32)	(11)	(12)
Sale of investments (H)	10	—	—
Other	2	—	—
Cash (used for) provided from investing activities	(495)	565	(167)
Effect of exchange rate changes on cash and cash equivalents and restricted cash	(9)	(13)	(14)
Net change in cash and cash equivalents and restricted cash	(450)	314	727
Cash and cash equivalents and restricted cash at beginning of year	1,924	1,610	883
Cash and cash equivalents and restricted cash at end of year	$ 1,474	$ 1,924	$ 1,610

The accompanying notes are an integral part of the consolidated financial statements.

Alcoa Corporation and Subsidiaries
Statement of Changes in Consolidated Equity
(in millions)

	Alcoa Corporation shareholders					
	Common stock	Additional capital	Retained (deficit) earnings	Accumulated other comprehensive (loss) income	Noncontrolling interest	Total equity
Balance at December 31, 2019	$ 2	$ 9,639	$ (555)	$ (4,974)	$ 1,774	$ 5,886
Net (loss) income	—	—	(170)	—	156	(14)
Other comprehensive loss (G)	—	—	—	(655)	(42)	(697)
Stock-based compensation (N)	—	25	—	—	—	25
Common stock issued: Compensation plans (N)	—	1	—	—	—	1
Contributions	—	—	—	—	24	24
Distributions	—	—	—	—	(207)	(207)
Other	—	(2)	—	—	—	(2)
Balance at December 31, 2020	2	9,663	(725)	(5,629)	1,705	5,016
Net income	—	—	429	—	141	570
Other comprehensive income (loss) (G)	—	—	—	1,037	(39)	998
Stock-based compensation (N)	—	39	—	—	—	39
Common stock issued: Compensation plans (N)	—	25	—	—	—	25
Repurchase of common stock (N)	—	(150)	—	—	—	(150)
Dividends paid on Alcoa common stock ($0.10 per share) (N)	—	—	(19)	—	—	(19)
Contributions	—	—	—	—	21	21
Distributions	—	—	—	—	(215)	(215)
Other	—	—	—	—	(1)	(1)
Balance at December 31, 2021	2	9,577	(315)	(4,592)	1,612	6,284
Net (loss) income	—	—	(123)	—	161	38
Other comprehensive income (loss) (G)	—	—	—	1,053	(93)	960
Stock-based compensation (N)	—	40	—	—	—	40
Common stock issued: Compensation plans (N)	—	3	—	—	—	3
Repurchase of common stock (N)	—	(440)	(60)	—	—	(500)
Dividends paid on Alcoa common stock ($0.10 per share) (N)	—	—	(72)	—	—	(72)
Contributions	—	—	—	—	214	214
Distributions	—	—	—	—	(379)	(379)
Other	—	3	—	—	(2)	1
Balance at December 31, 2022	$ 2	$ 9,183	$ (570)	$ (3,539)	$ 1,513	$ 6,589

The accompanying notes are an integral part of the consolidated financial statements.

A. Basis of Presentation

Alcoa Corporation (or the Company) is a vertically integrated aluminum company comprised of bauxite mining, alumina refining, aluminum production (smelting and casting), and energy generation. Through direct and indirect ownership, the Company has 27 operating locations in nine countries around the world, situated primarily in Australia, Brazil, Canada, Iceland, Norway, Spain, and the United States.

Alcoa Corporation became an independent, publicly traded company on November 1, 2016, following its separation (the Separation Transaction) from its former parent company, Alcoa Inc. References herein to "ParentCo" refer to Alcoa Inc. and its consolidated subsidiaries through October 31, 2016, at which time it was renamed Arconic Inc. (Arconic) and since has been subsequently renamed Howmet Aerospace Inc.

Basis of Presentation. The Consolidated Financial Statements of Alcoa Corporation are prepared in conformity with accounting principles generally accepted in the United States of America (GAAP). In accordance with GAAP, certain situations require management to make estimates based on judgments and assumptions, which may affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the financial statements. They also may affect the reported amounts of revenues and expenses during the reporting periods. Management uses historical experience and all available information to make these estimates. Management regularly evaluates the judgments and assumptions used in its estimates, and results could differ from those estimates upon future events and their effects or new information. Certain amounts in previously issued financial statements were reclassified to conform to the current period presentation.

Principles of Consolidation. The Consolidated Financial Statements of the Company include the accounts of Alcoa Corporation and companies in which Alcoa Corporation has a controlling interest, including those that comprise the Alcoa World Alumina & Chemicals (AWAC) joint venture (see below). Intercompany transactions have been eliminated. The equity method of accounting is used for investments in affiliates and other joint ventures over which the Company has significant influence but does not have effective control. Investments in affiliates in which Alcoa Corporation cannot exercise significant influence are accounted at cost less any impairment, a measurement alternative in accordance with GAAP.

AWAC is an unincorporated global joint venture between Alcoa Corporation and Alumina Limited and consists of several affiliated operating entities, which own, have an interest in, or operate the bauxite mines and alumina refineries within the Company's Bauxite and Alumina segments (except for the Poços de Caldas mine and refinery, portions of the São Luís refinery and investment in Mineração Rio do Norte S.A. (MRN) until its sale in April 2022, all in Brazil) and a portion (55%) of the Portland smelter (Australia) within the Company's Aluminum segment. Alcoa Corporation owns 60% and Alumina Limited owns 40% of these individual entities, which are consolidated by the Company for financial reporting purposes and include Alcoa of Australia Limited (AofA), Alcoa World Alumina LLC (AWA), Alcoa World Alumina Brasil Ltda. (AWAB), and Alúmina Española, S.A. (Española). Alumina Limited's interest in the equity of such entities is reflected as Noncontrolling interest on the accompanying Consolidated Balance Sheet.

Management evaluates whether an Alcoa Corporation entity or interest is a variable interest entity and whether the Company is the primary beneficiary. Consolidation is required if both of these criteria are met. Alcoa Corporation does not have any variable interest entities requiring consolidation.

Related Party Transactions. Alcoa Corporation buys products from and sells products to various related companies, consisting of entities in which the Company retains a 50% or less equity interest, at negotiated prices between the two parties. These transactions were not material to the financial position or results of operations of Alcoa Corporation for all periods presented.

B. Summary of Significant Accounting Policies

Cash Equivalents. Cash equivalents are highly liquid investments purchased with an original maturity of three months or less.

Restricted Cash. Restricted cash is included with Cash and cash equivalents when reconciling the Cash and cash equivalents and restricted cash at beginning of year and Cash and cash equivalents and restricted cash at end of year on the accompanying Statement of Consolidated Cash Flows. Current restricted cash amounts are reported in Prepaid expenses and other current assets on the accompanying Consolidated Balance Sheet. Noncurrent restricted cash amounts are reported in Other noncurrent assets on the accompanying Consolidated Balance Sheet (see Note U for a reconciliation of Cash and cash equivalents and restricted cash).

Inventory Valuation. Inventories are carried at the lower of cost or net realizable value, with the cost of inventories principally determined under the average cost method.

Properties, Plants, and Equipment. Properties, plants, and equipment are recorded at cost. Interest related to the construction of qualifying assets is capitalized as part of the construction costs. Depreciation is recorded principally on the straight-line method over the estimated useful lives of the assets. Depreciation is recorded on temporarily idled facilities until such time management approves a permanent closure. The following table details the weighted average useful lives of structures and machinery and equipment by type of operation (numbers in years):

	Structures	Machinery and equipment
Bauxite mining	33	17
Alumina refining	29	29
Aluminum smelting and casting	37	22
Energy generation	33	24

Repairs and maintenance are charged to expense as incurred while costs for significant improvements that add productive capacity or that extend the useful life are capitalized. Gains or losses from the sale of assets are generally recorded in Other (income) expenses, net.

Properties, plants, and equipment are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of such assets (asset group) may not be recoverable. Recoverability of assets is determined by comparing the estimated undiscounted net cash flows of the operations related to the assets (asset group) to their carrying amount. An impairment loss would be recognized when the carrying amount of the assets (asset group) exceeds the fair value. The amount of the impairment loss to be recorded is calculated as the excess of the carrying value of the assets (asset group) over their fair value, with fair value determined using the best information available, which generally is a discounted cash flow (DCF) model. The determination of what constitutes an asset group, the associated estimated undiscounted net cash flows, and the estimated useful lives of assets also require significant judgments.

Leases. The Company determines whether an arrangement is a lease at the inception of the arrangement based on the terms and conditions in the contract. A contract contains a lease if there is an identified asset which the Company has the right to control. Lease right-of-use (ROU) assets are included in Properties, plants, and equipment with the corresponding operating lease liabilities included within Other current liabilities and Other noncurrent liabilities and deferred credits.

Operating lease ROU assets and liabilities are recognized at the lease commencement date based on the present value of lease payments over the lease term. The Company uses its incremental borrowing rate at the commencement date in determining the present value of lease payments unless a rate is implicit in the lease. Lease terms include options to extend the lease when it is reasonably certain that those options will be exercised. Leases with an initial term of 12 months or less, including anticipated renewals, are not recorded on the Consolidated Balance Sheet.

The Company made a policy election not to record any non-lease components of a lease agreement in the lease liability. Variable lease payments are not presented as part of the ROU asset or liability recorded at the inception of a contract. Lease expense for operating lease payments is recognized on a straight-line basis over the lease term.

Equity Investments. Alcoa invests in a number of privately-held companies, primarily through joint ventures and consortia, which are accounted for using the equity method. The equity method is applied in situations where the Company has the ability to exercise significant influence, but not control, over the investee. Management reviews equity investments for impairment whenever certain indicators are present suggesting that the carrying value of an investment is not recoverable.

Deferred Mining Costs. Alcoa incurs deferred mining costs during the development stage of a mine life cycle. Such costs include the construction of access and haul roads, detailed drilling and geological analysis to further define the grade and quality of the known bauxite, and overburden removal costs. These costs relate to sections of the related mines where the Company is currently extracting bauxite or preparing for production in the near term. These sections are outlined and planned incrementally and generally are mined over periods ranging from one to five years, depending on specific mine plans. The amount of geological drilling and testing necessary to determine the economic viability of the bauxite deposit being mined is such that the reserves are considered to be proven. Deferred mining costs are amortized on a units-of-production basis and included in Other noncurrent assets on the accompanying Consolidated Balance Sheet.

Goodwill and Other Intangible Assets. Goodwill is not amortized but is reviewed for impairment annually (in the fourth quarter) or more frequently if indicators of impairment exist or if a decision is made to sell or exit a business.

Goodwill is allocated among and evaluated for impairment at the reporting unit level, which is defined as an operating segment or one level below an operating segment. The Company has four reporting units, of which two are included in the Aluminum segment (smelting/casting and energy generation). The remaining two reporting units are the Bauxite and Alumina segments. Of these four reporting units, only Bauxite and Alumina contain goodwill (see Note L).

Goodwill is tested for impairment by assessing qualitative factors to determine whether it is more likely than not (greater than 50%) that the fair value of the reporting unit is less than its carrying amount or performing a quantitative assessment using a discounted cash flow model. If the qualitative assessment indicates a possible impairment, then a quantitative impairment test is performed to determine the fair value of the reporting unit using a discounted cash flow method. Otherwise, no further analysis is required.

Under the quantitative assessment, the evaluation of impairment involves comparing the current fair value of each reporting unit to its carrying value, including goodwill. In the event the estimated fair value of a reporting unit is less than the carrying value, an impairment loss equal to the excess of the reporting unit's carrying value over its fair value not to exceed the total amount of goodwill applicable to that reporting unit would be recognized.

Alcoa's policy for its annual review of goodwill is to perform the quantitative impairment test for each of its two reporting units that contain goodwill at least once during every three-year period.

Intangible assets with finite useful lives are amortized generally on a straight-line basis over the periods benefited. The following table details the weighted average useful lives of software and other intangible assets by type of operation (numbers in years):

	Software	Other intangible assets
Bauxite mining	3	—
Alumina refining	7	25
Aluminum smelting and casting	3	40
Energy generation	3	29

Asset Retirement Obligations. Alcoa recognizes asset retirement obligations (AROs) related to legal obligations associated with the standard operation of bauxite mines, alumina refineries, and aluminum smelters. These AROs consist primarily of costs associated with mine reclamation, closure of bauxite residue areas, spent pot lining and regulated waste materials disposal, and landfill closure. Additionally, costs are recorded as AROs upon management's decision to permanently close and demolish certain structures and for any significant lease restoration obligations. The fair values of these AROs are recorded on a discounted basis at the time the obligation is incurred and accreted over time for the change in present value; related accretion is recorded as a component of Cost of goods sold. Additionally, the Company capitalizes asset retirement costs by increasing the carrying amount of the related long-lived assets and depreciating these assets over their remaining useful life. Certain conditional asset retirement obligations related to alumina refineries, aluminum smelters, and energy generation facilities have not been recorded in the Consolidated Financial Statements due to uncertainties surrounding the ultimate settlement date. The fair value of these asset retirement obligations will be recorded when a reasonable estimate of the ultimate settlement date can be made. Subsequent adjustments to estimates of previously established AROs for current operations are capitalized by increasing the carrying amount of the related long-lived assets and depreciating these assets over their remaining useful life. Adjustments to estimates of AROs for closed locations are charged to Restructuring and other charges, net on the accompanying Statement of Consolidated Operations (see Note R).

Environmental Matters. Environmental related expenditures for current operations are expensed as a component of Cost of goods sold or capitalized, as appropriate. Expenditures relating to existing conditions caused by past operations, generally for closed locations which will not contribute to future revenues, are charged to Restructuring and other charges, net. Liabilities are recorded when remediation costs are probable and can be reasonably estimated. In instances where the Company has ongoing monitoring and maintenance responsibilities, it is Alcoa's policy to maintain a reserve equal to five years of expected costs. The liability is continuously reviewed and adjusted to reflect current remediation progress, rate and pricing changes, actual volumes of material requiring management, changes to the original assumptions regarding how the site was to be remediated, and other factors that may be relevant, including changes in technology or regulations. The estimates may also include costs related to other potentially responsible parties to the extent that Alcoa has reason to believe such parties will not fully pay their proportionate share.

Litigation Matters. For asserted claims and assessments, liabilities are recorded when an unfavorable outcome of a matter is deemed to be probable and the loss is reasonably estimable. With respect to unasserted claims or assessments, liabilities are recorded when the probability that an assertion will be made is likely, an unfavorable outcome of the matter is deemed to be probable, and the loss is reasonably estimable. Legal matters are reviewed on a continuous basis to determine if there has been a change in management's judgment regarding the likelihood of an unfavorable outcome or the estimate of a potential loss. Legal costs, which are primarily for general litigation, environmental compliance, tax disputes, and general corporate matters, are expensed as incurred.

Revenue Recognition. The Company recognizes revenue when it satisfies a performance obligation(s) in accordance with the provisions of a customer order or contract. This is achieved when control of the product has been transferred to the customer, which is generally determined when title, ownership, and risk of loss pass to the customer, all of which occurs upon shipment or delivery of the product. The shipping terms vary across all businesses and depend on the product, the country of origin, and the type of transportation. Accordingly, the sale of Alcoa's products to its customers represent single performance obligations for which revenue is recognized at a point in time, except for the Company's Energy product division in which the customer simultaneously receives and consumes electricity (see Note E). Revenue is based on the consideration the Company expects to receive in exchange for its products. Returns and other adjustments have not been material. Based on the foregoing, no significant judgment is required to determine when control of a product has been transferred to a customer.

The Company considers shipping and handling activities as costs to fulfill the promise to transfer the related products. As a result, customer payments of shipping and handling costs are recorded as a component of revenue. Taxes collected (e.g., sales, use, value added, excise) from its customers related to the sale of its products are remitted to governmental authorities and excluded from Sales.

Cost of goods sold. The Company includes the following in Cost of goods sold: operating costs of our three segments, excluding depreciation, depletion, and amortization, but including all production related costs: raw materials consumed; purchases of metal for consumption or trade; conversion costs, such as labor, materials, and utilities; equity earnings of certain investments integral to the Company's supply chain; and plant administrative expenses. Also included in Cost of goods sold are: costs related to the Transformation function, which focuses on the management of expenses and obligations of previously closed operations; pension and other postretirement benefit service cost for employees maintaining closed locations; and other costs not included in the operating costs of the segments.

Selling, general administrative, and other expenses. The Company includes the costs of corporate-wide functional support in Selling, general administrative, and other expenses. Such costs include: executive; sales; marketing; strategy; operations administration; finance; information technology; legal; human resources; and government affairs and communications.

Stock-Based Compensation. Compensation expense for employee equity grants is recognized using the non-substantive vesting period approach, in which the expense is recognized ratably over the requisite service period based on the grant date fair value. Forfeitures are accounted for as they occur. The fair value of performance stock units containing a market condition is valued using a Monte Carlo valuation model. There were no stock options granted in 2022 or 2021. In 2020, the fair value of stock options was estimated on the date of grant using a lattice pricing model. Determining the fair value at the grant date requires judgment, including estimates for the average risk-free interest rate, dividend yield, volatility, annual forfeiture rate, and exercise behavior. These assumptions may differ significantly between grant dates because of changes in the actual results of these inputs that occur over time.

Refer to Note N for more information regarding stock-based compensation.

Pension and Other Postretirement Benefits. Alcoa sponsors several defined benefit pension plans and health care postretirement benefit plans. The Company recognizes on a plan-by-plan basis the net funded status of these pension and postretirement benefit plans as either an asset or a liability on its Consolidated Balance Sheet. The net funded status represents the difference between the fair value of each plan's assets and the benefit obligation of the respective plan. The benefit obligation represents the present value of the estimated future benefits the Company currently expects to pay to plan participants based on past service. Unrecognized gains and losses related to the plans are deferred in Accumulated other comprehensive loss on the Consolidated Balance Sheet until amortized into net income.

The plan assets and benefit obligations are measured at the end of each year or more frequently, upon the occurrence of certain events such as a significant plan amendment, settlement, or curtailment. For interim plan remeasurements, it is the Company's policy to record the related accounting impacts within the same quarter as the triggering event.

Liabilities and expenses for pension and other postretirement benefits are determined using actuarial methodologies and incorporate significant assumptions, including the interest rate used to discount the future estimated liability, the expected long-term rate of return on plan assets, and several assumptions relating to the employee workforce (salary increases, health care cost trend rates, retirement age, and mortality).

The yield curve model used to develop the discount rate parallels the plans' projected cash flows and has a weighted average duration of 11 years. The underlying cash flows of the high-quality corporate bonds included in the model exceed the cash flows needed to satisfy the Company's plan obligations multiple times. If a deep market of high-quality corporate bonds does not exist in a country, then the yield on government bonds plus a corporate bond yield spread is used.

The expected long-term rate of return on plan assets is generally applied to a five-year market-related value of plan assets (a four-year average or the fair value at the plan measurement date is used for certain non-U.S. plans). The process used by management to develop this assumption is one that relies on forward-looking investment returns by asset class. Management incorporates expected future investment returns on current and planned asset allocations using information from various external investment managers and consultants, as well as management's own judgment.

Mortality rate assumptions are based on mortality tables and future improvement scales published by third parties, such as the Society of Actuaries, and consider other available information including historical data as well as studies and publications from reputable sources.

A change in one or a combination of these assumptions, or the effects of actual results differing from assumptions, could have a material impact on Alcoa's projected benefit obligation. These changes or differences are recorded in Accumulated other comprehensive loss and are amortized into net income as a component of the net periodic benefit cost (income) over the average future working lifetime or average remaining life expectancy, as appropriate, of the plan's participants.

One-time accounting impacts, such as curtailment and settlement losses (gains), are recognized immediately and are reclassified from Accumulated other comprehensive loss to Restructuring and other charges, net on the accompanying Statement of Consolidated Operations.

Refer to Note O for more information regarding pension and other postretirement benefits including accounting impacts of current year actions.

Derivatives and Hedging. Derivatives are held for purposes other than trading and are part of a formally documented risk management program.

Alcoa accounts for hedges of firm customer commitments for aluminum as fair value hedges. The fair values of the derivatives and changes in the fair values of the underlying hedged items are reported as assets and liabilities in the Consolidated Balance Sheet. Changes in the fair values of these derivatives and underlying hedged items generally offset and are recorded each period in Sales, consistent with the underlying hedged item.

The Company accounts for hedges of foreign currency exposures and certain forecasted transactions as cash flow hedges. The fair values of the derivatives are recorded as assets and liabilities in the Consolidated Balance Sheet. The changes in the fair values of these derivatives are recorded in Other comprehensive income (loss) and are reclassified to Sales, Cost of goods sold, or Other (income) expenses, net in the period in which earnings are impacted by the hedged items or in the period that the transaction no longer qualifies as a cash flow hedge. These contracts cover the same periods as known or expected exposures, generally not exceeding five years.

If no hedging relationship is designated, the derivative is marked to market through Other (income) expenses, net.

Cash flows from derivatives are recognized in the Statement of Consolidated Cash Flows in a manner consistent with the underlying transactions.

Income Taxes. The provision for income taxes is determined using the asset and liability approach of accounting for income taxes. Under this approach, the provision for income taxes represents income taxes paid or payable (or received or receivable) for the current year plus the change in deferred taxes during the year. Deferred taxes represent the future tax consequences expected to occur when the reported amounts of assets and liabilities are recovered or paid, result from differences between the financial and tax bases of Alcoa's assets and liabilities and are adjusted for changes in tax rates and tax laws when enacted.

Valuation allowances are recorded to reduce deferred tax assets when it is more likely than not (greater than 50%) that a tax benefit will not be realized. In evaluating the need for a valuation allowance, management applies judgement in assessing all available positive and negative evidence and considers all potential sources of taxable income. Deferred tax assets for which no valuation allowance is recorded may not be realized upon changes in facts and circumstances, resulting in a future charge to establish a valuation allowance. Existing valuation allowances are re-examined under the same standards of positive and negative evidence. If it is determined that it is more likely than not that a deferred tax asset will be realized, the appropriate amount of the valuation allowance, if any, is released. Deferred tax assets and liabilities are also re-measured to reflect changes in underlying tax rates due to law changes and the granting and lapse of tax holidays.

Tax benefits related to uncertain tax positions taken or expected to be taken on a tax return are recorded when such benefits meet a more likely than not threshold. Otherwise, these tax benefits are recorded when a tax position has been effectively settled, which means that the statute of limitation has expired or the appropriate taxing authority has completed their examination even though the statute of limitations remains open. Interest and penalties related to uncertain tax positions are recognized as part of the provision for income taxes and are accrued in the period that such interest and penalties would be applicable under relevant tax law until such time that the related tax benefits are recognized.

Foreign Currency. The local currency is the functional currency for Alcoa's significant operations outside the United States, except for certain operations in Canada and Iceland, and a holding and trading company in the Netherlands, where the U.S. dollar is used as the functional currency. The determination of the functional currency for Alcoa's operations is made based on the appropriate economic and management indicators. Where local currency is the functional currency, assets and liabilities are translated into U.S. dollars using year-end exchange rates and income and expenses are translated using the average exchange rates for the reporting period. Unrealized foreign currency translation gains and losses are deferred in Accumulated other comprehensive loss on the Consolidated Balance Sheet.

Recently Adopted Accounting Guidance. In March 2020 and January 2021, the FASB issued ASU No. 2020-04 and ASU No. 2021-01, respectively. Together, the ASUs provide temporary optional expedients and exceptions to the U.S. GAAP guidance on contract modifications and hedge accounting to ease the financial reporting burdens related to the expected market transition from the London Interbank Offered Rate (LIBOR) and other interbank offered rates to alternative reference rates. The Company adopted this guidance in 2022, and there was no material impact on the Company's financial statements.

Recently Issued Accounting Guidance. In September 2022, the FASB issued ASU 2022-04 which requires a buyer in a supplier finance program to disclose qualitative and quantitative information about its supplier finance programs, including the key terms of the program, the amount of obligations outstanding at the end of the reporting period, a description of where those obligations are presented in the balance sheet, and a roll-forward of such amounts during the annual period. The new guidance is effective for fiscal years beginning after December 15, 2022, including interim periods within those fiscal years, except for roll-forward information, which is effective for fiscal years beginning after December 15, 2023. Early adoption is permitted. The adoption of this guidance will provide enhanced disclosures regarding these programs and will not have a material impact on the Company's financial statements.

C. Divestitures

Rockdale Site

During the fourth quarter of 2021, the Company completed the sale of land and industrial assets at the previously closed Rockdale smelter site in the state of Texas in a transaction valued at $240. Upon closing of the transaction, the Company received $230 in cash and recorded a net gain of $202 in Other (income) expenses, net (pre- and after-tax; see Note U) on the Statement of Consolidated Operations.

Eastalco Site

During the second quarter of 2021, the Company completed the sale of land at the previously closed Eastalco smelter site in the state of Maryland in a transaction valued at $100. Upon closing of the transaction, the Company received $94 in cash and recorded a gain of $90 in Other (income) expenses, net ($90 pre- and $89 after-tax; see Note U) on the Statement of Consolidated Operations.

Warrick Rolling Mill

In November 2020, Alcoa entered into an agreement to sell its rolling mill located at Warrick Operations (Warrick Rolling Mill), an integrated aluminum manufacturing site near Evansville, Indiana (Warrick Operations), to Kaiser Aluminum Corporation (Kaiser).

In March 2021, Alcoa completed the sale for total consideration of approximately $670, which included the assumption of $69 in other postretirement benefit liabilities. The Company recorded a net gain of $30 in Other (income) expenses, net (pre- and after-tax, see Note U) on the Statement of Consolidated Operations. Upon the closing of the transaction, the Company recorded estimated liabilities for future site separation commitments and remaining transaction costs associated with the sales agreement. The Company recorded a charge of $8 in 2022 in Other (income) expenses, net related to additional costs of existing site separation commitments. In 2022, the Company spent $37 against the reserve. The remaining balance of $46 at December 31, 2022 is expected to be spent in 2023.

In connection with the transaction, Alcoa and Kaiser entered into a market-based metal supply agreement. The remaining Warrick Operations results are included within the Aluminum segment.

Gum Springs Waste Treatment Business

During the first quarter of 2020, the Company sold Elemental Environmental Solutions LLC (EES), a wholly-owned Alcoa subsidiary that operated the waste processing facility in Gum Springs, Arkansas, to a global environmental firm in a transaction valued at $250. Related to this transaction, the Company received $200 in cash and recorded a gain of $181 (pre- and after-tax; see Note U). Further, an additional $50 is held in escrow to be paid to Alcoa if certain post-closing conditions are satisfied, which would result in additional gain being recorded.

D. Restructuring and Other Charges, Net

Restructuring and other charges, net were comprised of the following:

	2022	2021	2020
Settlements and/or curtailments related to retirement benefits (O)	$ 632	$ 977	$ 58
Severance and employee termination costs	1	1	16
Loss on divestitures	79	—	—
Asset impairments	58	75	2
Asset retirement obligations (R)	34	23	2
Environmental remediation (S)	21	15	1
Other	(7)	82	36
Reversals of previously recorded charges	(122)	(45)	(11)
Restructuring and other charges, net	$ 696	$ 1,128	$ 104

Severance and employee termination costs were recorded based on approved detailed action plans submitted by the operating locations that specified positions to be eliminated, benefits to be paid under existing severance plans, union contracts or statutory requirements, and the expected timetable for completion of the plans.

2022 Actions. In 2022 Alcoa Corporation recorded Restructuring and other charges, net, of $696 which were primarily comprised of the following components**:**

- Non-cash settlement charges related to pension benefits (see Note O):
  - $635 related to the purchase of group annuity contracts to transfer approximately $1,000 of pension obligations and assets associated with defined benefit pension plans for approximately 4,400 United States retirees and beneficiaries, as well as lump sum settlements;
- Charges related to portfolio actions:
  - $79 for the agreement reached with the workers of the divested Avilés and La Coruña facilities to settle various legal disputes related to the 2019 divestiture (see Note S);
  - $58 for an asset impairment related to the sale of the Company's interest in MRN (see Note H);
  - $29 related to the closure of the previously curtailed magnesium smelter facility in Addy (Washington) (see below);
- Other charges and credits:
  - $26 to record additional environmental and asset retirement related reserves at previously closed sites (see Note R and Note S);
  - $7 net credit for revaluation of adjustments to take-or-pay contract reserves related to the closed Wenatchee (Washington) and curtailed Intalco (Washington) smelters;
- Reversals:
  - $83 for the release of a valuation allowance on Brazil value added taxes (VAT) (see Note Q); and,
  - $34 due to lower costs for demolition and remediation at previously closed sites (see Note S).

In July 2022, Alcoa made the decision to permanently close the previously curtailed magnesium smelter in Addy (Washington). The facility has been fully curtailed since 2001. The Company recorded a charge of $29 to establish reserves for environmental and demolition obligations in Restructuring and other charges, net on the Statement of Consolidated Operations in the third quarter of 2022. Associated cash outlays are expected to be paid over the next three to five years.

2021 Actions. In 2021 Alcoa Corporation recorded Restructuring and other charges, net, of $1,128 which were comprised of the following components**:**

- Non-cash settlement charges related to pension and certain other postretirement benefits (see Note O):
  - $858 related to the purchase of group annuity contracts to transfer approximately $1,500 of pension obligations and assets associated with defined benefit pension plans for approximately 14,000 United States retirees and beneficiaries, as well as lump sum settlements;
  - $63 related to the purchase of a group annuity contract to transfer approximately $55 of pension obligations and assets associated with a Suriname pension plan for approximately 800 retirees and beneficiaries;
  - $47 related to lump sum settlements;
  - Net $9 related to the settlement and curtailment of certain other postretirement benefits resulting from the sale of the Warrick Rolling Mill;
- Charges related to portfolio actions taken as part of the Company's ongoing strategic review (see details below):
  - $80 related to the closure of the previously curtailed aluminum smelter facility in Wenatchee (Washington);
  - $62 related to the agreement reached with the workers at the San Ciprián (Spain) aluminum smelter to curtail smelting capacity;
  - $27 related to the closure of the previously curtailed anode facility in Lake Charles (Louisiana);
- Other charges:
  - $13 for additional take-or-pay contract costs related to the curtailed Wenatchee (Washington) and Intalco (Washington) smelters;
  - $11 to record additional environmental and asset retirement related reserves (see Note R and Note S);
  - $3 for several other insignificant items;
- Reversals:
  - $6 for a take-or-pay energy-related obligation at the Alumar smelter no longer required due to the announced restart;
  - $17 related to the divestiture of the Avilés and La Coruña entities (see below); and,
  - $22 due to lower costs for demolition and remediation related to previously established reserves (see Note R and Note S).

In December 2021, the Company announced the two-year curtailment of 228 kmt of smelting capacity at the San Ciprián (Spain) aluminum smelter. The temporary curtailment, which began at the end of January 2022, was the result of an agreement reached with the workers at the site to suspend production due to exorbitant energy prices in Spain. Under the terms of the agreement, the Company is responsible for certain employee and contractual obligations during the curtailment period. As a result, the Company recorded charges of $62 in the fourth quarter of 2021 in Restructuring and other charges, net on the Statement of Consolidated Operations to establish the related reserve. In 2022, cash payments of $26 were made to reduce the reserve. Additionally, in connection with the agreement, the Company committed to restart the smelter beginning in January of 2024 and has restricted cash of $103 to be made available in the future to cover $68 in capital improvements at the site and $35 in smelter restart costs. Restricted cash is included in Prepaid expenses and other current assets and Other noncurrent assets on the Consolidated Balance Sheet (see Note U). The San Ciprián smelter continues to incur operating costs for the casthouse as well as resources to maintain and improve the smelter for restart.

During the fourth quarter of 2021, as part of the Company's ongoing strategic portfolio review, the Company announced the permanent closure of the Wenatchee (Washington) aluminum smelter. The smelter has been fully curtailed since 2015. Charges related to the closure totaled $90 in the fourth quarter of 2021 and included a charge of $10 for the write down of remaining inventories to net realizable value recorded in Cost of goods sold on the Statement of Consolidated Operations and a charge of $80 recorded in Restructuring and other charges, net on the Statement of Consolidated Operations. The restructuring charges were comprised of: $30 to write-off the remaining net book value of various assets; $23 of asset impairments; $21 to establish reserves related to environmental and demolition obligations; $5 related to take-or-pay contractual obligations; and $1 of severance and employee termination costs from the separation of approximately 10 employees. Cash outlays related to demolition and environmental related activities are expected to be spread over approximately 5 years.

During the third quarter of 2021, as part of the Company's ongoing strategic portfolio review, the Company announced the decision to permanently close the previously curtailed anode facility in Lake Charles (Louisiana). The anode facility within the Lake Charles site has been fully curtailed since 2015. The Company recorded charges of $27 in the third quarter of 2021, which were recorded in Restructuring and other charges, net on the Statement of Consolidated Operations, comprised of asset impairments of $22 and cash-based charges for closure and asset retirement obligations of $5. The closure was completed in September 2022. The decision to permanently close the facility was made as part of the Company's on-going portfolio review. The Company's petroleum coke calciner located at the same site in Lake Charles remains in operation, unaffected by the closure of the anode facility.

2020 Actions. In 2020, Alcoa Corporation recorded Restructuring and other charges, net, of $104 which were comprised of the following components: $59 related to settlements and curtailments of certain pension and other postretirement benefits (see Note O); $28 (net) for costs related to the curtailment of the Intalco (Washington) smelter; $20 for additional contract costs related to the then curtailed Wenatchee (Washington) smelter; and several other insignificant items.

In April 2020, as part of the Company's portfolio review, Alcoa Corporation announced the curtailment of the remaining 230 kmt of uncompetitive smelting capacity at the Intalco (Washington) smelter amid declining market conditions. The full curtailment, which included 49 kmt of earlier-curtailed capacity, was completed during the third quarter of 2020. The $28 net restructuring charge recorded during 2020 was comprised of $13 for severance and employee termination costs from the separation of approximately 685 employees, $16 for contract termination costs, and a net curtailment gain of $1 related to the U.S. hourly defined benefit pension and retiree life plans (see Note O). Additional contract termination costs related to take-or-pay agreements may recur during the curtailment period.

Alcoa Corporation does not include Restructuring and other charges, net in the results of its reportable segments. The impact of allocating such charges to segment results would have been as follows:

	2022	2021	2020
Bauxite	$ 58	$ —	$ 1
Alumina	(85)	1	5
Aluminum	82	184	53
Segment total	55	185	59
Corporate	641	943	45
Total Restructuring and other charges, net	$ 696	$ 1,128	$ 104

Activity and reserve balances for restructuring charges were as follows:

	Severance and employee termination costs	Other costs	Total
Balances at December 31, 2019	$ 35	$ 102	137
Restructuring charges, net	16	36	52
Cash payments	(41)	(79)	(120)
Reversals and other	(4)	(2)	(6)
Balances at December 31, 2020	6	57	63
Restructuring charges, net	1	80	81
Cash payments	(4)	(25)	(29)
Reversals and other	—	(22)	(22)
Balances at December 31, 2021	3	90	93
Restructuring charges, net	1	73	74
Cash payments	(2)	(37)	(39)
Reversals and other	(1)	(10)	(11)
Balances at December 31, 2022	$ 1	$ 116	$ 117

The activity and reserve balances include only Restructuring and other charges, net that impact the reserves for Severance and employee termination costs and Other costs. Restructuring and other charges, net that affected other liability accounts such as Environmental remediation (see Note S), Asset retirement obligations (see Note R), and Accrued pension benefits and Accrued other postretirement benefits (see Note O) are excluded from the above activity and balances. Reversals and other include reversals of previously recorded liabilities and foreign currency translation impacts.

The current portion of the reserve balance is reflected in Other current liabilities on the Consolidated Balance Sheet and the noncurrent portion of the reserve balance is reflect in Other noncurrent liabilities and deferred credits on the Consolidated Balance Sheet. The noncurrent portion of the reserve was $3 and $43 at December 31, 2022 and 2021, respectively.

E. Segment and Related Information

Segment Information

Alcoa Corporation is a producer of bauxite, alumina, and aluminum products. The Company has three operating and reportable segments, which are organized by product on a global basis: Bauxite, Alumina, and Aluminum. Segment performance under Alcoa Corporation's management reporting system is evaluated based on a number of factors; however, the primary measure of performance is the Adjusted EBITDA (Earnings before interest, taxes, depreciation, and amortization) of each segment. The Company calculates Segment Adjusted EBITDA as Total sales (third-party and intersegment) minus the following items: Cost of goods sold; Selling, general administrative, and other expenses; and Research and development expenses. Alcoa Corporation's Adjusted EBITDA may not be comparable to similarly titled measures of other companies. The chief operating decision maker function regularly reviews the financial information, including Sales and Adjusted EBITDA, of these three operating segments to assess performance and allocate resources. Beginning in January 2023, the Company changed its operating segments by combining the Bauxite and Alumina segments, and will report its financial results in the following two segments: (i) Alumina, and (ii) Aluminum (see Note V).

Segment assets include, among others, customer receivables (third-party and intersegment), inventories, properties, plants, and equipment, and equity investments. The accounting policies of the segments are the same as those described in the Summary of Significant Accounting Policies (see Note B). Transactions among segments are established based on negotiation among the parties. Differences between segment totals and Alcoa Corporation's consolidated totals for line items not reconciled are in Corporate.

The following are detailed descriptions of Alcoa Corporation's reportable segments:

Bauxite. This segment represents the Company's global bauxite mining operations. A portion of this segment's production represents the offtake from equity method investments in Brazil (prior to the MRN sale in April 2022) and Guinea, as well as AWAC's share of bauxite production related to an equity investment in Saudi Arabia. The bauxite mined by this segment is sold primarily to internal customers within the Alumina segment; a portion of the bauxite is sold to external customers. Bauxite mined by this segment and used internally is transferred to the Alumina segment at negotiated terms that are intended to approximate market prices; sales to third-parties are conducted on a contract basis. Generally, this segment's sales are transacted in U.S. dollars while costs and expenses are transacted in the local currency of the respective operations, which are the Australian dollar and the Brazilian real. Most of the operations that comprise the Bauxite segment are part of AWAC (see Principles of Consolidation in Note A).

Alumina. This segment represents the Company's worldwide refining system, which processes bauxite into alumina. The alumina produced by this segment is sold primarily to internal and external aluminum smelter customers; a portion of the alumina is sold to external customers who process it into industrial chemical products. Approximately two-thirds of Alumina's production is sold under supply contracts to third parties worldwide, while the remainder is used internally by the Aluminum segment. Alumina produced by this segment and used internally is transferred to the Aluminum segment at prevailing market prices. A portion of this segment's third-party sales are completed through the use of alumina traders. Generally, this segment's sales are transacted in U.S. dollars while costs and expenses are transacted in the local currency of the respective operations, which are the Australian dollar, the Brazilian real, and the euro. Most of the operations that comprise the Alumina segment are part of AWAC (see Principles of Consolidation in Note A). This segment also includes AWAC's 25.1% ownership interest in a mining and refining joint venture company in Saudi Arabia (see Note H).

Aluminum. This segment consists of the Company's (i) worldwide smelting and casthouse system, which processes alumina into primary aluminum, and (ii) portfolio of energy assets in Brazil, Canada, and the United States.

Aluminum's combined smelting and casting operations produce primary aluminum products, nearly all of which are sold to external customers and traders. The smelting operations produce molten primary aluminum, which is then formed by the casting operations into either common alloy ingot (e.g., t-bar, sow, standard ingot) or into value-add ingot products (e.g., foundry, billet, rod, and slab). A variety of external customers purchase the primary aluminum products for use in fabrication operations, which produce products primarily for the transportation, building and construction, packaging, wire, and other industrial markets. Results from the sale of aluminum powder and scrap are also included in this segment, as well as the impacts of embedded aluminum derivatives (see Note P) related to energy supply contracts.

The energy assets supply power to external customers in Brazil and the United States, as well as internal customers in the Aluminum segment (Canadian smelters and Warrick (Indiana) smelter) and, to a lesser extent, the Alumina segment (Brazilian refineries).

On March 31, 2021, Alcoa completed the sale of its rolling mill located at Warrick Operations (Warrick Rolling Mill) an integrated aluminum manufacturing site near Evansville, Indiana (Warrick Operations), to Kaiser Aluminum Corporation (Kaiser) (see Note C). Results from the Warrick Rolling Mill are included in this segment through the first quarter of 2021. Alcoa continues to own and operate the site's aluminum smelter and the power plant. On July 1, 2022, Alcoa curtailed one of the three operating smelting potlines (54 kmt) at its Warrick Operations site due to operational challenges stemming from labor shortages in the region.

Generally, this segment's aluminum sales are transacted in U.S. dollars while costs and expenses of this segment are transacted in the local currency of the respective operations, which are the U.S. dollar, the euro, the Norwegian krone, the Icelandic króna, the Canadian dollar, the Brazilian real, and the Australian dollar.

This segment also includes Alcoa Corporation's 25.1% ownership interest in a smelting joint venture company in Saudi Arabia (see Note H).

The operating results, capital expenditures, and assets of Alcoa Corporation's reportable segments were as follows:

	Bauxite	Alumina	Aluminum	Total
2022				
Sales:				
Third-party sales	$ 204	$ 3,520	$ 8,735	$ 12,459
Intersegment sales	680	1,754	27	2,461
Total sales	$ 884	$ 5,274	$ 8,762	$ 14,920
Segment Adjusted EBITDA	$ 82	$ 701	$ 1,492	$ 2,275
Supplemental information:				
Depreciation, depletion, and amortization	$ 130	$ 182	$ 283	$ 595
Equity (loss) income	—	(39)	48	9
2021				
Sales:				
Third-party sales	$ 236	$ 3,139	$ 8,766	$ 12,141
Intersegment sales	711	1,586	18	2,315
Total sales	$ 947	$ 4,725	$ 8,784	$ 14,456
Segment Adjusted EBITDA	$ 172	$ 1,002	$ 1,879	$ 3,053
Supplemental information:				
Depreciation, depletion, and amortization	$ 153	$ 198	$ 289	$ 640
Equity loss	—	4	116	120
2020				
Sales:				
Third-party sales	$ 272	$ 2,627	$ 6,365	$ 9,264
Intersegment sales	941	1,268	12	2,221
Total sales	$ 1,213	$ 3,895	$ 6,377	$ 11,485
Segment Adjusted EBITDA	$ 495	$ 497	$ 325	$ 1,317
Supplemental information:				
Depreciation, depletion, and amortization	$ 135	$ 172	$ 322	$ 629
Equity loss	—	(23)	(7)	(30)

	Bauxite	Alumina	Aluminum	Total
2022				
Assets:				
Capital expenditures	$ 104	$ 216	$ 153	$ 473
Equity investments	188	234	685	1,107
Total assets	1,474	4,447	6,358	12,279
2021				
Assets:				
Capital expenditures	$ 95	$ 178	$ 107	$ 380
Equity investments	234	270	678	1,182
Total assets	1,430	4,385	6,251	12,066

The following tables reconcile certain segment information to consolidated totals:

	2022	2021	2020
Sales:			
Total segment sales	$ 14,920	$ 14,456	$ 11,485
Elimination of intersegment sales	(2,461)	(2,315)	(2,221)
Other	(8)	11	22
Consolidated sales	$ 12,451	$ 12,152	$ 9,286

	2022	2021	2020
Net (loss) income attributable to Alcoa Corporation:			
Total Segment Adjusted EBITDA	$ 2,275	$ 3,053	$ 1,317
Unallocated amounts:			
Transformation[1]	(66)	(44)	(45)
Intersegment eliminations	143	(101)	(8)
Corporate expenses[2]	(128)	(129)	(102)
Provision for depreciation, depletion, and amortization	(617)	(664)	(653)
Restructuring and other charges, net (D)	(696)	(1,128)	(104)
Interest expense (U)	(106)	(195)	(146)
Other income (expenses), net (U)	118	445	(8)
Other[3]	(221)	(38)	(78)
Consolidated income before income taxes	702	1,199	173
Provision for income taxes (Q)	(664)	(629)	(187)
Net income attributable to noncontrolling interest	(161)	(141)	(156)
Consolidated net (loss) income attributable to Alcoa Corporation	$ (123)	$ 429	$ (170)

(1) Transformation includes, among other items, the Adjusted EBITDA of previously closed operations.
(2) Corporate expenses are composed of general administrative and other expenses of operating the corporate headquarters and other global administrative facilities, as well as research and development expenses of the corporate technical center.
(3) Other includes certain items that are not included in the Adjusted EBITDA of the reportable segments.

December 31,	2022	2021
Assets:		
Total segment assets	$ 12,279	$ 12,066
Elimination of intersegment receivables	(197)	(261)
Unallocated amounts:		
Cash and cash equivalents	1,363	1,814
Corporate fixed assets, net	364	374
Corporate goodwill	141	140
Deferred income taxes	296	506
Pension assets	146	164
Other	364	222
Consolidated assets	$ 14,756	$ 15,025

Product Information

Alcoa Corporation has four product divisions and one divested product division as follows:

Bauxite—Bauxite is a reddish clay rock that is mined from the surface of the earth's terrain. This ore is the basic raw material used to produce alumina and is the primary source of aluminum.

Alumina—Alumina is an oxide that is extracted from bauxite and is the basic raw material used to produce primary aluminum. This product can also be consumed for non-metallurgical purposes, such as industrial chemical products.

Primary aluminum—Primary aluminum is metal in the form of a common alloy ingot or a value-add ingot (e.g., foundry, billet, rod, and slab). These products are sold primarily to customers, that produce products for the transportation, building and construction, packaging, wire, and other industrial markets, and traders.

Energy—Energy is the generation of electricity, which is sold in the wholesale market to traders, large industrial consumers, distribution companies, and other generation companies.

Flat-rolled aluminum—Flat-rolled aluminum is metal in the form of sheet, which is sold primarily to customers that produce beverage and food cans, including body, tab, and end stock. As noted above, the Company sold the Warrick Rolling Mill in the first quarter of 2021 which represented the Company's only Flat-rolled aluminum asset. The results of the Warrick Rolling Mill are included in this product division through the first quarter of 2021.

The following table represents the general commercial profile of the Company's Bauxite, Alumina, and Primary aluminum product divisions (see text below table for Energy):

Product division	Pricing components	Shipping terms[3]	Payment terms[4]
Bauxite	Negotiated	FOB/CIF	LC Sight
Alumina:			
Smelter-grade	API[1]/spot/fixed	FOB/CIF	LC Sight/CAD/Net 30 days
Non-metallurgical	Negotiated	FOB/CIF	Net 30 days
Primary aluminum:			
Common alloy ingot	LME + Regional premium[2]	DAP/CIF	Net 30 to 45 days
Value-add ingot	LME + Regional premium + Product premium[2]	DAP/CIF	Net 30 to 45 days

(1) API (Alumina Price Index) is a pricing mechanism that is calculated by the Company based on the weighted average of a prior month's daily spot prices published by the following three indices: CRU Metallurgical Grade Alumina Price, Platts Metals Daily Alumina PAX Price, and FastMarkets Metal Bulletin Non-Ferrous Metals Alumina Index.

(2) LME (London Metal Exchange) is a globally recognized exchange for commodity trading, including aluminum. The LME pricing component represents the underlying base metal component, based on quoted prices for aluminum on the exchange. The regional premium represents the incremental price over the base LME component that is associated with the physical delivery of metal to a particular region (e.g., the Midwest premium for metal sold in the United States). The product premium represents the incremental price for receiving physical metal in a particular shape or alloy.

(3) CIF (cost, insurance, and freight) means that the Company pays for these items until the product reaches the buyer's designated destination point related to transportation by vessel. DAP (delivered at place) means the same as CIF related to all methods of transportation. FOB (free on board) means that the Company pays for costs, insurance, and freight until the product reaches the seller's designated shipping point.

(4) The net number of days means that the customer is required to remit payment to the Company for the invoice amount within the designated number of days. LC Sight is a letter of credit that is payable immediately (usually within five to ten business days) after a seller meets the requirements of the letter of credit (i.e. shipping documents that evidence the seller performed its obligations as agreed to with a buyer). CAD (cash against documents) is a payment arrangement in which a seller instructs a bank to provide shipping and title documents to the buyer at the time the buyer pays in full the accompanying bill of exchange.

For the Company's Energy product division, sales of electricity are based on current market prices. Electricity is provided to customers on demand through a national or regional power grid; the customer simultaneously receives and consumes the electricity. Payment terms are generally within 10 days related to the previous 30 days of electricity consumption.

The following table details Alcoa Corporation's Third-party sales by product division:

	2022	2021	2020
Sales:			
Primary aluminum	$ 8,887	$ 8,420	$ 5,190
Alumina	3,478	3,125	2,624
Flat-rolled aluminum[1]	—	320	1,115
Energy	201	286	141
Bauxite	168	207	238
Other[2]	(283)	(206)	(22)
	$ 12,451	$ 12,152	$ 9,286

(1) Flat-rolled aluminum represented sales of the Warrick Rolling Mill through the sale of the facility on March 31, 2021 (see Note C).

(2) Other includes realized gains and losses related to embedded derivative instruments designated as cash flow hedges of forward sales of aluminum (see Note P).

Geographic Area Information

Geographic information for Third-party sales was as follows (based upon the country where the point of sale originated):

	2022	2021	2020
Sales:			
United States[1]	$ 5,462	$ 5,290	$ 4,246
Netherlands[2]	3,031	2,644	—
Australia	2,742	2,092	1,884
Spain[3]	618	1,465	2,766
Brazil	527	610	346
Canada	1	11	31
Other	70	40	13
	$ 12,451	$ 12,152	$ 9,286

(1) Sales of a portion of the alumina from refineries in Australia and Brazil and most of the aluminum from smelters in Canada occurred in the United States. Additionally, sales of aluminum off-take related to an interest in the Saudi Arabia joint venture (see Note H) occurred in the United States beginning at the end of the third quarter of 2021.

(2) Sales of the aluminum produced from smelters in Iceland and Norway occurred in the Netherlands beginning at the end of the first quarter of 2021.

(3) Sales of the aluminum produced from smelters in Iceland and Norway occurred in Spain through most of the first quarter of 2021 and in the Netherlands thereafter. Sales of aluminum off-take related to an interest in the Saudi Arabia joint venture (see Note H), occurred in Spain through most of the third quarter of 2021 and in the United States thereafter.

Geographic information for long-lived assets was as follows (based upon the physical location of the assets):

December 31,	2022	2021
Long-lived assets:		
Australia	$ 1,944	$ 2,091
Brazil	1,298	1,118
Iceland	1,002	1,048
Canada	919	958
United States	830	874
Norway	304	338
Spain	194	193
Other	2	3
	$ 6,493	$ 6,623

F. Earnings Per Share

Basic earnings per share (EPS) amounts are computed by dividing Net (loss) income attributable to Alcoa Corporation by the average number of common shares outstanding. Diluted EPS amounts assume the issuance of common stock for all potentially dilutive share equivalents outstanding.

The share information used to compute basic and diluted EPS attributable to Alcoa Corporation common shareholders was as follows (shares in millions):

	2022	2021	2020
Average shares outstanding—basic	181	186	186
Effect of dilutive securities:			
Stock options	—	—	—
Stock units	—	4	—
Average shares outstanding—diluted	181	190	186

In 2022, basic average shares outstanding and diluted average shares outstanding were the same because the effect of potential shares of common stock was anti-dilutive. Had Alcoa generated net income in 2022, three million common share equivalents related to five million outstanding stock units and stock options combined would have been included in diluted average shares outstanding for the period.

In 2021, options to purchase less than two hundred thousand shares of common stock outstanding as of December 31, 2021 at a weighted average exercise price of $38.67 per share were not included in the computation of diluted EPS because the exercise prices of these options were greater than the annual average market price of Alcoa Corporation's common stock.

In 2020, basic average shares outstanding and diluted average shares outstanding were the same because the effect of potential shares of common stock was anti-dilutive. Had Alcoa generated net income in 2020, one million common share equivalents related to five million outstanding stock units and stock options combined would have been included in diluted average shares outstanding for the respective period. Options to purchase two million shares of common stock outstanding at December 31, 2020 had a weighted average exercise price of $26.85 per share which was greater than the annual average market price per share of Alcoa Corporation's common stock.

G. Accumulated Other Comprehensive Loss

The following table details the activity of the three components that comprise Accumulated other comprehensive loss for both Alcoa Corporation's shareholders and noncontrolling interest:

	Alcoa Corporation			Noncontrolling interest		
	2022	2021	2020	2022	2021	2020
Pension and other postretirement benefits (O)						
Balance at beginning of period	$ (882)	$ (2,536)	$ (2,282)	$ (13)	$ (67)	$ (56)
Other comprehensive income (loss):						
Unrecognized net actuarial gain (loss) and prior service cost/benefit	263	550	(545)	7	30	(19)
Tax (expense) benefit	(42)	(37)	31	—	(6)	3
Total Other comprehensive income (loss) before reclassifications, net of tax	221	513	(514)	7	24	(16)
Amortization of net actuarial loss and prior service cost/benefit(1)	723	1,144	269	1	30	6
Tax expense(2)	—	(3)	(9)	—	—	(1)
Total amount reclassified from Accumulated other comprehensive loss, net of tax(6)	723	1,141	260	1	30	5
Total Other comprehensive income (loss)	944	1,654	(254)	8	54	(11)
Balance at end of period	$ 62	$ (882)	$ (2,536)	$ (5)	$ (13)	$ (67)
Foreign currency translation						
Balance at beginning of period	$ (2,614)	$ (2,385)	$ (2,160)	$ (937)	$ (844)	$ (834)
Other comprehensive loss	(71)	(229)	(225)	(103)	(93)	(10)
Balance at end of period	$ (2,685)	$ (2,614)	$ (2,385)	$ (1,040)	$ (937)	$ (844)
Cash flow hedges (P)						
Balance at beginning of period	$ (1,096)	$ (708)	$ (532)	$ (1)	$ (1)	$ 20
Other comprehensive loss:						
Net change from periodic revaluations	(119)	(782)	(345)	2	(2)	(36)
Tax benefit	43	140	74	—	1	10
Total Other comprehensive (loss) income before reclassifications, net of tax	(76)	(642)	(271)	2	(1)	(26)
Net amount reclassified to earnings:						
Aluminum contracts(3)	316	288	66	—	—	—
Financial contracts(4)	—	2	15	—	1	6
Foreign exchange contracts(3)	(5)	(3)	20	—	—	—
Interest rate contracts(5)	5	8	5	—	1	—
Sub-total	316	295	106	—	2	6
Tax expense(2)	(60)	(41)	(11)	—	(1)	(1)
Total amount reclassified from Accumulated other comprehensive loss, net of tax(6)	256	254	95	—	1	5
Total Other comprehensive income (loss)	180	(388)	(176)	2	—	(21)
Balance at end of period	$ (916)	$ (1,096)	$ (708)	$ 1	$ (1)	$ (1)
Total Accumulated other comprehensive loss	$ (3,539)	$ (4,592)	$ (5,629)	$ (1,044)	$ (951)	$ (912)

(1) These amounts were included in the computation of net periodic benefit cost for pension and other postretirement benefits. The amounts related to settlements and/or curtailments of certain pension and other postretirement benefits for Alcoa Corporation include $633, $952, and $55 for the years ended December 31, 2022, 2021, and 2020, respectively. The amounts related to settlements and/or curtailments of certain pension and other postretirement benefits for Noncontrolling interest include ($1), $25, and $3 for the years ended December 31, 2022, 2021, and 2020, respectively (see Note O).

(2) These amounts were reported in Provision for income taxes on the accompanying Statement of Consolidated Operations.

(3) These amounts were reported in Sales on the accompanying Statement of Consolidated Operations.

(4) These amounts were reported in Cost of goods sold on the accompanying Statement of Consolidated Operations.

(5) These amounts were included in Other (income) expenses, net on the accompanying Statement of Consolidated Operations.

(6) A positive amount indicates a corresponding charge to earnings and a negative amount indicates a corresponding benefit to earnings.

H. Investments

December 31,	2022	2021
Equity investments	$ 1,112	$ 1,189
Other investments	10	10
	$ 1,122	$ 1,199

Equity Investments. The following table summarizes information of Alcoa Corporation's equity investments as of December 31, 2022 and 2021. In 2022, 2021, and 2020, Alcoa Corporation received $127, $50, and $44, respectively, in dividends from these equity investments. Each of the investees either owns the facility listed or has an ownership interest in an entity that owns the facility listed:

Investee	Country	Nature of investment	Income Statement Location of Equity Earnings	Ownership interest
Ma'aden Aluminum Company	Saudi Arabia	Aluminum smelter and casthouse	Other (income) expenses, net	25.1%
Ma'aden Bauxite and Alumina Company	Saudi Arabia	Bauxite mine and alumina refinery	Other (income) expenses, net	25.1%
Halco Mining, Inc.	Guinea	Bauxite mine	Cost of goods sold	45%
Energética Barra Grande S.A.	Brazil	Hydroelectric generation facility	Cost of goods sold	42.18%
Pechiney Reynolds Quebec, Inc.	Canada	Aluminum smelter	Cost of goods sold	50%
Consorcio Serra do Facão	Brazil	Hydroelectric generation facility	Cost of goods sold	34.97%
Mineração Rio do Norte S.A. (1)	Brazil	Bauxite mine	Cost of goods sold	18.2%
Manicouagan Power Limited Partnership	Canada	Hydroelectric generation facility	Cost of goods sold	40%
Elysis™ Limited Partnership	Canada	Aluminum smelting technology	Other (income) expenses, net	48.235%

(1) On April 30, 2022, Alcoa completed the sale of its 18.2% interest in Mineração Rio do Norte S.A. to South32 Minerals S.A.

Saudi Arabia Joint Venture—Alcoa Corporation and Ma'aden have a 30-year (from December 2009) joint venture shareholders agreement (automatic extension for an additional 20 years, unless the parties agree otherwise or unless earlier terminated) setting forth the terms for the development, construction, ownership, and operation of an integrated aluminum complex in Saudi Arabia. The project developed by the joint venture consists of a bauxite mine from the Al Ba'itha bauxite deposit in the northern part of Saudi Arabia, an alumina refinery, a primary aluminum smelter, and an aluminum rolling mill.

The joint venture is owned 74.9% by Ma'aden and 25.1% by Alcoa Corporation and originally consisted of three separate companies as follows: the bauxite mine and alumina refinery (MBAC), the smelter (MAC), and the rolling mill (MRC). In June 2019, Alcoa Corporation and Ma'aden amended the joint venture agreement that governs the operations of each of the three companies that comprise the joint venture. Under the terms of the agreement, Alcoa Corporation transferred its 25.1% interest in MRC to Ma'aden and, as a result, has no further direct or indirect equity interest in MRC. In accordance with the June 2019 amended joint venture agreement, Ma'aden's put option and Alcoa Corporation's call option, relating to additional interests in the joint venture, were exercisable for a period of six months after October 1, 2021. On March 31, 2022, Ma'aden's and Alcoa's put and call options, respectively, expired with neither party exercising their options.

The results for the joint venture for the year ended December 31, 2022 include a charge related to a dispute with an industrial utility for periods in 2021 and 2022 that progressed in early 2023. Alcoa's share of this charge is $21 which is included in Other (income) expenses, net on the Statement of Consolidated Operations for the year ended December 31, 2022. As of December 31, 2022 and 2021, the carrying value of Alcoa's investment in this joint venture was $710 and $687, respectively.

ELYSIS Limited Partnership—In June 2018, Alcoa Corporation, Rio Tinto Alcan Inc. (Rio Tinto), and Investissement Québec, a company wholly-owned by the Government of Québec, Canada, launched the ELYSIS Limited Partnership (ELYSIS). The purpose of this partnership is to advance larger scale development and commercialization of its patent-protected technology that produces oxygen and eliminates all direct greenhouse gas emissions from the traditional aluminum smelting process. Alcoa and Rio Tinto plc, as general partners, each own a 48.235% stake in ELYSIS, and the Québec provincial government, as a limited partner, owns a 3.53% stake. The federal government of Canada and Apple Inc., as well as the Québec provincial government, are providing initial financing to the partnership.

Through December 31, 2022, the Company has contributed $55 (C$71) toward its investment commitment in ELYSIS. The Company's basis in the investment has been reduced to zero for its share of losses incurred to date. As a result, the Company has $69 in unrecognized losses as of December 31, 2022 that will be recognized upon additional contributions into the partnership.

The following table summarizes the profit and loss data for the respective periods ended December 31, as it relates to Alcoa Corporation's equity investments. Information shown for the Saudi Arabia Joint Venture for all periods presented includes the combined balances for MAC and MBAC. The investments are grouped based on the nature of the investment. The Mining investments are part of the Bauxite segment, while the Energy and Other investments are primarily part of the Aluminum segment.

	Saudi Arabia Joint Venture	Mining	Energy	Other
2022				
Sales	$ 3,317	$ 763	$ 252	$ 488
Cost of goods sold	2,696	488	120	445
Net income (loss)	42	110	109	(75)
Equity in net income (loss) of affiliated companies, before reconciling adjustments	11	39	41	(36)
Other	(7)	(2)	(3)	15
Alcoa Corporation's equity in net income (loss) of affiliated companies	4	37	38	(21)
2021				
Sales	$ 3,127	$ 794	$ 264	$ 404
Cost of goods sold	2,083	571	135	365
Net income (loss)	495	30	114	(42)
Equity in net income (loss) of affiliated companies, before reconciling adjustments	124	18	45	(20)
Other	(8)	5	(1)	25
Alcoa Corporation's equity in net income of affiliated companies	116	23	44	5
2020				
Sales	$ 2,279	$ 841	$ 238	$ 316
Cost of goods sold	1,829	543	107	283
Net (loss) income	(108)	46	74	(24)
Equity in net (loss) income of affiliated companies, before reconciling adjustments	(27)	23	31	(11)
Other	(7)	(1)	2	14
Alcoa Corporation's equity in net (loss) income of affiliated companies	(34)	22	33	3

The following table summarizes the balance sheet data for the respective periods ended December 31, as it relates to Alcoa Corporation's equity investments.

	Saudi Arabia Joint Venture	Mining [1]	Energy	Other
2022				
Current assets	$ 1,769	$ 5	$ 114	$ 134
Noncurrent assets	6,993	363	301	757
Current liabilities	1,255	3	13	114
Noncurrent liabilities	4,314	24	26	84
2021				
Current assets	$ 1,748	$ 142	$ 96	$ 246
Noncurrent assets	7,330	852	316	755
Current liabilities	956	158	17	95
Noncurrent liabilities	5,018	331	27	73

(1) The assets and liabilities of MRN were excluded from the December 31, 2022 balances in the table above due to the sale of Alcoa's interest in the investment.

On February 15, 2022, the Company signed an agreement to sell its share of its investment in MRN in Brazil for $10 to South32 Minerals S.A. Related to this transaction, the Company recorded an asset impairment of $58 in the first quarter of 2022 in Restructuring and other charges, net on the Statement of Consolidated Operations. On April 30, 2022, Alcoa completed the sale of its investment in MRN. An additional $30 in cash could be paid to the Company in the future if certain post-closing conditions related to future MRN mine development are satisfied.

I. Receivables

On October 25, 2019, a wholly-owned subsidiary of the Company entered into a $120 three-year revolving credit facility agreement secured by certain customer receivables. Alcoa Corporation guaranteed the performance obligations of the wholly-owned subsidiary under the facility; however no assets (other than the receivables) were pledged as collateral.

On April 20, 2020, the Company amended this agreement converting it to a Receivables Purchase Agreement to sell up to $120 of the receivables previously secured by the credit facility without recourse on a revolving basis. The unsold portion of the specified receivable pool is pledged as collateral to the purchasing bank to secure the sold receivables.

On November 8, 2021, the Company terminated the Receivables Purchase Agreement. No receivables were sold under this agreement.

On January 31, 2023, a wholly-owned subsidiary of the Company entered into a one-year Receivables Purchase Agreement to sell up to $150 of certain customer receivables without recourse on a revolving basis. The unsold portion of the specified receivable pool is pledged as collateral to the purchasing bank to secure the sold receivables. Alcoa Corporation will guarantee the performance obligations of the wholly-owned subsidiary under the facility; however no assets (other than the receivables) will be pledged as collateral.

J. Inventories

December 31,	2022	2021
Finished goods	$ 385	$ 529
Work-in-process	350	257
Bauxite and alumina	584	376
Purchased raw materials	923	619
Operating supplies	185	175
	$ 2,427	$ 1,956

The Finished goods, Work-in-process and Bauxite and alumina balances as of December 31, 2021 reported above reflect an adjustment related to a misclassification of an intercompany profit reserve previously presented in Work-in-process. This resulted in an increase in Work-in-process of $172 and reductions of $9 and $163 in Finished goods and Bauxite and alumina, respectively. This adjustment had no impact on the total Inventories balance as of December 31, 2021.

K. Properties, Plants, and Equipment, Net

December 31,	2022	2021
Land and land rights, including mines	$ 253	$ 264
Structures (by type of operation):		
Bauxite mining	1,234	1,148
Alumina refining	2,281	2,400
Aluminum smelting and casting	3,265	3,298
Energy generation	354	339
Other	346	340
	7,480	7,525
Machinery and equipment (by type of operation):		
Bauxite mining	569	565
Alumina refining	3,658	3,946
Aluminum smelting and casting	5,813	5,877
Energy generation	851	836
Other	461	452
	11,352	11,676
	19,085	19,465
Less: accumulated depreciation, depletion, and amortization	13,112	13,130
	5,973	6,335
Construction work-in-progress	520	288
	$ 6,493	$ 6,623

L. Goodwill and Other Intangible Assets

Goodwill, which is included in Other noncurrent assets on the accompanying Consolidated Balance Sheet, was as follows:

December 31,	2022	2021
Bauxite	$ 2	$ 2
Alumina	2	2
Aluminum	—	—
Corporate[1]	141	140
	$ 145	$ 144

(1) The carrying value of Corporate's goodwill is net of accumulated impairment losses of $742 as of both December 31, 2022 and 2021. As of December 31, 2022, the $141 of goodwill reflected in Corporate is allocated to two of Alcoa Corporation's three reportable segments ($48 to Bauxite and $93 to Alumina) for purposes of impairment testing (see Note B). This goodwill is reflected in Corporate for segment reporting purposes because it is not included in management's assessment of performance by the two reportable segments. Changes in the carrying amount of goodwill were attributable to foreign currency translation as of December 31, 2022 and 2021.

Management performed a quantitative assessment for the Bauxite and Alumina reporting units in 2022. The estimated fair values of the Bauxite and Alumina reporting units in both assessments were substantially in excess of the reporting units' carrying values, resulting in no impairment.

Other intangible assets, which are included in Other noncurrent assets on the accompanying Consolidated Balance Sheet, were as follows:

	2022			2021		
December 31,	Gross carrying amount	Accumulated amortization	Net carrying amount	Gross carrying amount	Accumulated amortization	Net carrying amount
Computer software	$ 206	$ (202)	$ 4	$ 214	$ (204)	$ 10
Patents and licenses	25	(9)	16	25	(9)	16
Other intangibles	20	(11)	9	19	(10)	9
Total other intangible assets	$ 251	$ (222)	$ 29	$ 258	$ (223)	$ 35

Computer software consists primarily of software costs associated with the enterprise business solution within Alcoa to drive common systems among all businesses.

Amortization expense related to the intangible assets in the table above for the years ended December 31, 2022, 2021, and 2020 was $7, $11, and $9, respectively, and is expected to be approximately $10 annually from 2023 to 2027.

M. Debt

Short-term borrowings.

December 31,	2022	2021
Short-term borrowings	$ —	$ 75

Short-term borrowings are reported in Other current liabilities on the accompanying Consolidated Balance Sheet.

Long-Term Debt.

December 31,	2022	2021
5.500% Notes, due 2027	750	$ 750
6.125% Notes, due 2028	500	500
4.125% Notes, due 2029	500	500
Other	84	5
Unamortized discounts and deferred financing costs	(27)	(28)
Total	1,807	1,727
Less: amount due within one year	1	1
Long-term debt, less amount due within one year	$ 1,806	$ 1,726

The principal amount of long-term debt maturing in each of the next five years is: $1 in 2023, $80 in 2024, $1 in each of 2025 and 2026, and $750 in 2027. At December 31, 2022, Other includes $79 related to a term loan that was extended to 2024.

144A Debt.

2029 Notes. In March 2021, Alcoa Nederland Holding B.V. (ANHBV), a wholly-owned subsidiary of Alcoa Corporation, completed a Rule 144A (U.S. Securities Act of 1933, as amended) debt issuance for $500 aggregate principal amount of 4.125% Senior Notes due 2029 (the 2029 Notes) with the following terms:

- Net proceeds were approximately $493, reflecting a discount to the initial purchasers as well as issuance costs. The discount, as well as costs to complete the financing, were deferred and are being amortized to interest expense over the term;
- Interest is paid semi-annually in March and September, which commenced September 30, 2021;

- Indenture contains customary affirmative and negative covenants, see below;
- Option to redeem on at least 10 days, but not more than 60 days, prior notice to the holders under multiple scenarios, including, in whole or in part, at any time, or from time to time after March 31, 2024, at a redemption price up to 102.063% of the principal amount, plus any accrued and unpaid interest; and,
- Subject to repurchase upon the occurrence of a change in control repurchase event (as defined in the indenture) at a repurchase price in cash equal to 101% of the aggregate principal amount of the notes repurchased, plus any accrued and unpaid interest.

The Company used the net proceeds of the 2029 Notes, together with cash on hand, to contribute $500 to its U.S. defined benefit pension plans applicable to salaried and hourly employees on April 1, 2021 (see Note O), to redeem in full $750 aggregate principal amount of the Company's outstanding 6.75% Senior Notes due 2024 (the 2024 Notes) on April 7, 2021, and to pay transaction-related fees and expenses.

2027 Notes. In July 2020, ANHBV completed a Rule 144A debt issuance for $750 aggregate principal amount of 5.500% Senior Notes due 2027 (the 2027 Notes) with the following terms:

- Net proceeds were approximately $736, reflecting a discount to the initial purchasers as well as issuance costs. The discount, as well as costs to complete the financing, were deferred and are being amortized to interest expense over the term;
- Interest is paid semi-annually in June and December, which commenced on December 15, 2020;

- Indenture contains customary affirmative and negative covenants, see below;
- Option to redeem on at least 15 days, but not more than 60 days, prior notice to the holders under multiple scenarios, including, in whole or in part, at any time, or from time to time after June 15, 2023, at a redemption price up to 102.750% of the principal amount, plus any accrued and unpaid interest; and,
- Subject to repurchase upon the occurrence of a change in control repurchase event (as defined in the indenture) at a repurchase price in cash equal to 101% of the aggregate principal amount of the notes repurchased, plus any accrued and unpaid interest.

The Company used the net proceeds of the 2027 Notes for general corporate purposes, including adding cash to its balance sheet.

2028 Notes. In May 2018, ANHBV completed a Rule 144A debt issuance for $500 aggregate principal amount of 6.125% Senior Notes due 2028 (the 2028 Notes) with the following terms:

- Net proceeds were approximately $492, reflecting a discount to the initial purchasers as well as issuance costs. The discount, as well as costs to complete the financing, were deferred and are being amortized to interest expense over the term;
- Interest is paid semi-annually in November and May, which commenced November 15, 2018;

- Indenture contains customary affirmative and negative covenants, see below;
- Option to redeem on at least 30 days, but not more than 60 days, prior notice to the holders under multiple scenarios, including, in whole or in part, at any time, or from time to time after May 2023, at a redemption price up to 103.063% of the principal amount, plus any accrued and unpaid interest; and,
- Subject to repurchase upon the occurrence of a change in control repurchase event (as defined in the indenture) at a repurchase price in cash equal to 101% of the aggregate principal amount of the notes repurchased, plus any accrued and unpaid interest.

The Company used the net proceeds of the 2028 Notes, together with cash on hand, to make discretionary contributions to certain U.S. defined benefit pension plans.

The indentures of the 2027 Notes, 2028 Notes, and 2029 Notes contain customary affirmative and negative covenants, such as limitations on liens, limitations on sale and leaseback transactions, and a prohibition on a reduction in the ownership of AWAC entities below an agreed level. The negative covenants in the indentures are less extensive than those in the Revolving Credit Facility (see below). For example, the indentures do not include a limitation on restricted payments, such as repurchases of common stock and dividends to stockholders.

The 2027 Notes, the 2028 Notes, and the 2029 Notes are senior unsecured obligations of ANHBV and do not entitle the holders to any registration rights pursuant to a registration rights agreement. ANHBV does not intend to file a registration statement with respect to resales of or an exchange offer for the notes. The notes are guaranteed on a senior unsecured basis by Alcoa Corporation and its subsidiaries that are guarantors under the Facility (the "subsidiary guarantors" and, together with Alcoa Corporation, the "guarantors"). Each of the subsidiary guarantors will be released from their guarantees upon the occurrence of certain events, including the release of such guarantor from its obligations as a guarantor under the Facility.

The 2027 Notes, the 2028 Notes, and the 2029 Notes rank equally in right of payment with each other and with all of ANHBV'S existing and future senior unsecured indebtedness; rank senior in right of payment to any future subordinated obligations of ANHBV; and are effectively subordinated to ANHBV's existing and future secured indebtedness, including under the Facility, to the extent of the value of property and assets securing such indebtedness. The guarantees of the notes rank equally in right of payment with each other and with all the guarantors' existing and future senior unsecured indebtedness; rank senior in right of payment to any future subordinated obligations of the guarantors; and are effectively subordinated to the guarantors' existing and future secured indebtedness, including under the Facility, to the extent of the value of property and assets securing such indebtedness.

Redemption events. On April 7, 2021, the Company redeemed in full $750 aggregate principal amount notes due in 2024 at a redemption price equal to 103.375% of the principal amount, plus accrued and unpaid interest. The issuance of the 2029 Notes and this redemption were determined to be an issuance of new debt and an extinguishment of existing debt. As a result, the Company recorded a loss of $32 on the extinguishment of debt in the second quarter of 2021 in Interest expense, which was comprised of the redemption premium and the write-off of deferred financing fees and unamortized debt issuance costs. The cash flows related to the transaction were classified as financing cash flows.

On September 30, 2021, the Company redeemed in full $500 aggregate principal amount notes due in 2026 at a redemption price equal to 103.5% of the principal amount, plus accrued and unpaid interest. As a result, the Company recorded a loss of $22 on the extinguishment of debt in the third quarter of 2021 in Interest expense, which was comprised of the redemption premium and the write-off of deferred financing fees and unamortized debt issuance costs. The cash flows related to the transaction were classified as financing cash flows.

Credit Facilities.

Revolving Credit Facility

On June 27, 2022, Alcoa Corporation and Alcoa Nederland Holding B.V. (ANHBV), a wholly owned subsidiary of Alcoa Corporation and the borrower, entered into an amendment and restatement agreement (the Third Amendment and Restatement) (as amended and restated, the Revolving Credit Facility) that provides additional flexibility to the Company and ANHBV by (i) extending the maturity date of the Revolving Credit Facility from November 2023 to June 2027, (ii) reducing the aggregate commitments under the facility from $1,500 to $1,250, (iii) releasing the collateral package that had previously secured the Revolving Credit Facility, which will continue so long as certain credit ratings are maintained, (iv) increasing the maximum leverage ratio from 2.75 to 1.00 to 3.25 to 1.00, which increases following material acquisitions for four consecutive fiscal quarters following an acquisition, (v) providing a debt to capitalization ratio not to exceed .60 to 1.00 to replace the maximum leverage ratio upon a ratings upgrade to investment grade by Moody's Investor Service (Moody's) or Standard and Poor's Global Ratings (S&P), and (vi) providing flexibility for dividends and other restricted payments, to make investments, and to incur additional indebtedness. The Revolving Credit Facility implements a sustainability adjustment to the applicable margin and commitment fee that may result in a positive or negative adjustment based on two of the Company's existing sustainability metrics.

If Alcoa Corporation or ANHBV, as applicable, fails to have a rating of at least Ba1 from Moody's and BB+ from S&P, then the Company would be required to execute all security documents to re-secure collateral under the Revolving Credit Facility.

On July 26, 2022, Moody's upgraded the rating of ANHBV's senior unsecured notes to Baa3 (investment grade) from Ba1 and set the current outlook to stable.

In addition to the financial covenants, the Revolving Credit Facility includes several customary affirmative and negative covenants (applicable to Alcoa Corporation and certain subsidiaries described as restricted), that, subject to certain exceptions, include limitations on (among other things): indebtedness, liens, investments, sales of assets, restricted payments, entering into restrictive agreements, a covenant prohibiting reductions in the ownership of AWAC entities, and certain other specified restricted subsidiaries of Alcoa Corporation, below an agreed level. The Revolving Credit Facility also contains customary events of default, including failure to make payments under the Revolving Credit Facility, cross-default and cross-judgment default, and certain bankruptcy and insolvency events.

As of December 31, 2022, the Company was in compliance with all financial covenants. There were no borrowings outstanding at December 31, 2022 and 2021, and no amounts were borrowed during 2022 and 2021 under the Revolving Credit Facility.

Alcoa Norway ANS

On October 2, 2019, Alcoa Norway ANS, a wholly-owned subsidiary of Alcoa Corporation, entered into a one-year, multicurrency revolving credit facility agreement for NOK 1.3 billion (approximately $149) which was fully and unconditionally guaranteed on an unsecured basis by Alcoa Corporation. The maturity date of the facility was subsequently extended by one year.

On April 8, 2020, Alcoa Norway ANS drew $100 against this facility. Repayment of the drawn amount, including interest accrued at 2.93%, occurred upon maturity on June 29, 2020.

In September 2021, Alcoa Norway ANS made the decision not to extend the maturity of the facility allowing it to expire, effective October 4, 2021. During 2021, no amounts were drawn related to this credit facility. In all periods, Alcoa Norway ANS was in compliance with related covenants.

N. Preferred and Common Stock

Preferred Stock. Alcoa Corporation is authorized to issue 100,000,000 shares of preferred stock at a par value of $0.01 per share. At December 31, 2022 and 2021, the Company had no issued preferred stock.

Common Stock. Alcoa Corporation is authorized to issue 750,000,000 shares of common stock at a par value of $0.01 per share. As of December 31, 2022 and 2021, Alcoa Corporation had 176,969,091 and 184,099,748, respectively, issued and outstanding shares of common stock.

Under its employee stock-based compensation plan, the Company issued shares of 1,434,543 in 2022, 1,305,979 in 2021, and 397,903 in 2020. The Company issues new shares to satisfy the exercise of stock options and the conversion of stock units. As of December 31, 2022, 22,028,804 shares of common stock were available for issuance.

Share Repurchase

In October 2021, Alcoa Corporation’s Board of Directors approved a common stock repurchase program under which the Company may purchase shares of its outstanding common stock up to an aggregate transactional value of $500, depending on cash availability, market conditions, and other factors.

In July 2022, Alcoa Corporation announced that its Board of Directors approved an additional common stock repurchase program under which the Company may purchase shares of its outstanding common stock up to an aggregate transactional value of $500, depending on the Company’s continuing analysis of market, financial, and other factors (the New Repurchase Program).

In 2022, the Company repurchased 8,565,200 shares of its common stock for $500, which fully exhausted the October 2021 authorization; the shares were immediately retired. As of the date of this report, the Company is currently authorized to repurchase up to a total of $500, in the aggregate, of its outstanding shares of common stock under the New Repurchase Program. Repurchases under this program may be made using a variety of methods, which may include open market purchases, privately negotiated transactions, or pursuant to a Rule 10b5-1 plan. This program may be suspended or discontinued at any time and does not have a predetermined expiration date. Alcoa Corporation intends to retire repurchased shares of common stock.

In 2021, the Company repurchased 3,184,300 shares of its common stock for $150; the shares were immediately retired.

No shares were repurchased in 2020.

Dividend

Dividends on common stock are subject to authorization by Alcoa Corporation’s Board of Directors.

In October 2021, the Company announced the initiation of a quarterly cash dividend on its common stock and the Board of Directors declared the first quarterly cash dividend of $0.10 per share of the Company’s common stock. Dividends paid totaled $19 in 2021.

Quarterly dividends paid were $0.10 per share in 2022, totaling $72.

The Company did not declare any dividends in 2020.

The details of any future cash dividend declaration, including the amount of such dividend and the timing and establishment of the record and payment dates, will be determined by the Board of Directors. The decision of whether to pay future cash dividends and the amount of any such dividends will be based on the Company's financial position, results of operations, cash flows, capital requirements, business conditions, the requirements of applicable law, and any other factors the Board of Directors may deem relevant.

Stock-based Compensation

Restricted stock units are generally granted in either January or February each calendar year to eligible employees (the Company's Board of Directors also receive certain stock units; however, these amounts are not material). Time-based restricted stock units (RSUs) generally cliff vest on the third anniversary of the award grant date. The Company also grants performance restricted stock units (PRSUs), which are subject to performance conditions. Prior to 2021, stock options were historically granted at the closing market price of Alcoa Corporation's common stock on the date of grant and grade vested over a three-year service period (1/3 each year) with a ten-year contractual term. As of January 1, 2021, the Company no longer grants stock options.

The final number of PRSUs earned is dependent on Alcoa Corporation's achievement of certain targets over a three-year measurement period for grants. For PRSUs granted in 2020, the award was earned after the end of the measurement period of January 1, 2020 through December 31, 2022 based on performance against four measures: (1) the Company's total shareholder return measured against the ranked total shareholder return of the Standard & Poor's Metals and Mining Select Industry Index components; (2) a pre-established return-on-equity target; (3) an improvement in proportional net debt; and (4) a reduction in carbon intensity in both refining (through reduced carbon dioxide emissions) and smelting (through increased production from renewable energy) operations. For PRSUs granted in 2021, the award will be earned after the end of the measurement period of January 1, 2021 through December 31, 2023 based on performance against four measures: (1) the Company's total shareholder return measured against the ranked total shareholder return of the Standard & Poor's Metals and Mining Select Industry Index components; (2) a pre-established return-on-equity target; (3) an improvement in proportional net debt; and (4) a reduction in carbon intensity in both refining (through reduced carbon dioxide emissions) and smelting (through increased production from renewable energy) operations. For PRSUs granted in 2022, the award will be earned after the end of the measurement period of January 1, 2022 through December 31, 2024 based on performance against three measures: (1) the Company's total shareholder return measured against the ranked total shareholder return of the Standard & Poor's Metals and Mining Select Industry Index components; (2) a pre-established return-on-equity target; and (3) a reduction in carbon intensity in both refining (through reduced carbon dioxide emissions) and smelting (through increased production from renewable energy) operations.

In 2022, 2021, and 2020, Alcoa Corporation recognized stock-based compensation expense of $40, $39, and $25, respectively, of which approximately 85% to 100% was related to stock units in each period. There was no stock-based compensation expense capitalized in 2022, 2021, or 2020.

Stock-based compensation expense is based on the grant date fair value of the applicable equity grant. For both RSUs and PRSUs, the fair value was equivalent to the closing market price per share of Alcoa Corporation's common stock on the date of grant in the respective periods. For stock units with a market condition, the fair value was estimated on the date of grant using a Monte Carlo simulation model, which generated a result of $126.86, $39.88, and $21.43 per unit in 2022, 2021, and 2020, respectively. The Monte Carlo simulation model uses certain assumptions to estimate the fair value of a market-based stock unit, including volatility (65.25%, 60.19%, and 41.65% in 2022, 2021, and 2020, respectively, for the Company) and a risk-free interest rate (1.71%, 0.22%, and 1.38% in 2022, 2021, and 2020, respectively), to estimate the probability of satisfying market conditions. For stock options, the fair value was estimated on the date of grant using a lattice pricing model, which generated a result of $6.12 per option in 2020. There were no stock options granted in 2022 and 2021. The lattice pricing model uses several assumptions to estimate the fair value of a stock option, including an average risk-free interest rate, dividend yield, volatility, annual forfeiture rate, exercise behavior, and contractual life.

The activity for stock units and stock options during 2022 was as follows:

	Stock units		Stock options	
	Number of units	Weighted average FMV per unit	Number of options	Weighted average exercise price
Outstanding, January 1, 2022	4,702,546	$ 22.23	910,420	$ 29.61
Granted	624,441	67.50	—	—
Exercised	—	—	(686,097)	31.50
Converted	(1,056,571)	30.07	—	—
Expired or forfeited	(100,726)	26.63	(3,727)	21.13
Performance share adjustment	436,525	18.00	—	—
Outstanding, December 31, 2022	4,606,215	26.08	220,596	23.88

The number of Converted units includes 308,125 shares withheld to meet the Company's statutory tax withholding requirements related to the income earned by the employees as a result of vesting in the units.

As of December 31, 2022, the 220,596 outstanding stock options had a weighted average remaining contractual life of 5.23 years and a total intrinsic value of $5. Additionally, 131,546 of the total outstanding stock options were fully vested and exercisable and had a weighted average remaining contractual life of 4.75 years, a weighted average exercise price of $29.02, and a total intrinsic value of $2 as of December 31, 2022. Cash received from stock option exercises was $22, $25, and $1 in 2022, 2021, and 2020, respectively. The total intrinsic value of stock options exercised during 2022, 2021, and 2020 was $22, $17, and $0, respectively. The total fair value of stock units converted during 2022, 2021 and 2020 was $32, $19 and $17, respectively.

At December 31, 2022, there was $34 (pretax) of combined unrecognized compensation expense related to non-vested grants of both stock units and stock options. This expense is expected to be recognized over a weighted average period of 1.77 years.

O. Pension and Other Postretirement Benefits

Defined Benefit Plans

Alcoa sponsors several defined benefit pension plans covering certain employees in the U.S. and foreign locations. Pension benefits generally depend on length of service, job grade, and remuneration. Substantially all benefits are paid through pension trusts that are sufficiently funded to ensure that all plans can pay benefits to retirees as they become due. Most salaried and non-bargaining hourly U.S. employees hired after March 1, 2006 and most bargaining hourly U.S. employees hired after January 1, 2020 participate in a defined contribution plan instead of a defined benefit plan.

The Company also maintains health care postretirement benefit plans covering certain eligible U.S. retired employees and certain retirees from foreign locations. Generally, the medical plans are unfunded and pay a percentage of medical expenses, reduced by deductibles and other coverage. The Company retains the right, subject to existing agreements, to change or eliminate these benefits. All salaried and certain non-bargaining hourly U.S. employees hired after January 1, 2002 and certain bargaining hourly U.S. employees hired after July 1, 2010 are not eligible for postretirement health care benefits.

As of January 1, 2022, the pension benefit plans and the other postretirement benefit plans covered an aggregate of approximately 22,000 and approximately 22,000 participants, respectively.

2022 Plan Actions. In 2022, management initiated the following actions to certain pension plans:

Action #1 – In the third quarter of 2022, settlement accounting and related plan remeasurements were triggered within Alcoa's U.S. pension plans as a result of the Company's purchase of group annuity contracts to transfer the obligation to pay the remaining retirement benefits of approximately 4,400 retirees and beneficiaries from its U.S. defined benefit pension plans. The transfer of approximately $1,000 in both plan obligations and plan assets was completed in August 2022. As a result, Alcoa recorded a $5 increase to Accrued pension benefits and a $27 increase to Other noncurrent assets and recognized a non-cash settlement loss of $617 (pre- and after-tax) in Restructuring and other charges, net on the Statement of Consolidated Operations.

Action #2 – In the third quarter of 2022, settlement accounting and related plan remeasurements were triggered within Alcoa's U.S. pension plans as a result of participants electing lump sum payments. Alcoa recognized a non-cash settlement loss of $11 (pre- and after-tax) in Restructuring and other charges, net on the Statement of Consolidated Operations.

Action #3 – In the third quarter of 2022, settlement accounting and a related plan remeasurement was triggered within Alcoa's U.S. salaried pension plan as a result of participants electing lump sum payments. Alcoa recorded a $23 increase to Accrued pension benefits and a $12 decrease to Other noncurrent assets and recognized a non-cash settlement loss of $1 (pre- and after-tax) in Restructuring and other charges, net on the Statement of Consolidated Operations.

Action #4 – In the third quarter of 2022, settlement accounting and a related plan remeasurement was triggered within Alcoa's Australian pension plan as a result of participants electing lump sum payments. Alcoa recorded a $21 increase to Other noncurrent assets and recognized a non-cash settlement gain of $3 (pre- and after-tax) in Restructuring and other charges, net on the Statement of Consolidated Operations.

Action #5 – In the fourth quarter of 2022, settlement accounting was triggered within Alcoa's U.S. pension plans as a result of participants electing lump sum payments. Alcoa recorded a $3 increase to Accrued pension benefits and recognized a non-cash settlement loss of $6 (pre- and after-tax) in Restructuring and other charges, net on the Statement of Consolidated Operations.

The following table presents certain information and the financial impacts of these actions on the accompanying Consolidated Financial Statements:

Action #	Number of affected plan participants	Weighted average discount rate as of prior plan remeasurement date	Plan remeasurement date	Weighted average discount rate as of plan remeasurement date	Increase to accrued pension benefits liability(1)	Increase (decrease) to other noncurrent assets(1)	Settlement loss (gain)(2)
1	~4,400	2.90%	July 31, 2022	4.63%	$ 5	$ 27	$ 617
2	~45	2.90%	July 31, 2022	4.63%	—	—	11
3	~5	4.57%	September 30, 2022	5.71%	23	(12)	1
4	~25	2.46%	September 30, 2022	4.99%	—	21	(3)
5	~20	N/A	December 31, 2022	N/A	3	—	6
	~4,495				$ 31	$ 36	$ 632

(1) Actions 1-4 caused interim plan remeasurements, including an update to the discount rates used to determine the benefit obligations of the affected plans. These amounts include impacts due to interim plan remeasurements.

(2) These amounts represent the net actuarial loss (gain) and were reclassified from Accumulated other comprehensive loss to Restructuring and other charges, net (see Note D) on the accompanying Statement of Consolidated Operations.

2021 Plan Actions. In 2021, management initiated the following actions to certain pension and other postretirement benefit plans:

Action #1 – On March 31, 2021, Alcoa completed the sale of the Warrick Rolling Mill to Kaiser Aluminum Corporation for total consideration of $670, which included the assumption of $69 in other postretirement benefit liabilities. Approximately 1,150 employees at the rolling operations, which includes the casthouse, hot mill, cold mills, and coating and slitting lines, became employees of Kaiser. As a result, the affected plan was remeasured, including an update to the discount rate used to determine the benefit obligation of the plan. Accrued other postretirement benefits reflects a decrease of $40 related to the remeasurement in addition to the $69 assumed by Kaiser. Further, Alcoa recognized a curtailment gain of $17 (pre- and after-tax) and a settlement loss of $26 (pre- and after-tax).

Action #2 – In the second quarter of 2021, settlement accounting and a related plan remeasurement was triggered within Alcoa's U.S. salaried pension plan as a result of a high number of participants electing lump sum payments. This includes former employees of the Warrick Rolling Mill, as well as other Alcoa employees making this election at retirement. Alcoa recorded a $90 decrease to Accrued pension benefits related to this remeasurement and recognized a settlement loss of $39 (pre- and after-tax).

Action #3 – In the third quarter of 2021, settlement accounting and a related plan remeasurement was triggered within Alcoa's U.S. salaried pension plan as a result of participants electing lump sum payments. Alcoa recorded a $7 increase to Accrued pension benefits related to this remeasurement and recognized a settlement loss of $7 (pre- and after-tax).

Action #4 – In the third quarter of 2021, settlement accounting and a related plan remeasurement was triggered within Alcoa's Australian pension plan as a result of participants electing lump sum payments. Alcoa recorded a $38 decrease to Accrued pension benefits related to this remeasurement and recognized a settlement loss of $1 (pre- and after-tax).

Action #5 – In the fourth quarter of 2021, the Company purchased a group annuity contract to transfer the obligation to pay the remaining retirement benefits of approximately 800 retirees and deferred vested participants from one of its Suriname pension plans to an insurance company. The transfer of $55 in both plan obligations and plan assets were completed on October 19, 2021. As a result, the Company recorded a settlement loss of $63 (pre- and after-tax) in Restructuring and other charges, net on the Statement of Consolidated Operations in the fourth quarter of 2021.

Action #6 – In the fourth quarter of 2021, settlement accounting and related plan remeasurements were triggered within Alcoa's U.S. pension plans as a result of the Company purchasing group annuity contracts to transfer the obligation to pay remaining retirement benefits of approximately 14,000 retirees and beneficiaries from its U.S. defined benefit pension plans and transferred approximately $1,540 in both plan obligations and plan assets. The transfers were completed on November 23, 2021 and December 16, 2021. As a result, the Company recorded a $84 decrease to Accrued pension benefits related to this remeasurement and recognized a non-cash settlement loss of $848 (pre- and after-tax) in Restructuring and other charges, net on the Statement of Consolidated Operations in the fourth quarter of 2021.

Action #7 – In the fourth quarter of 2021, settlement accounting and related plan remeasurements were triggered within Alcoa's U.S. pension plans as a result of participants electing lump sum payments (and the group annuity contracts discussed in Action 6 above). Alcoa recorded a $1 decrease to Accrued pension benefits related to this remeasurement and recognized a settlement loss of $10 (pre- and after-tax).

The following table presents certain information and the financial impacts of these actions on the accompanying Consolidated Financial Statements:

Action #	Number of affected plan participants	Weighted average discount rate as of prior plan remeasurement date	Plan remeasurement date	Weighted average discount rate as of plan remeasurement date	Increase (decrease) to accrued pension benefits liability	Decrease to accrued other postretirement benefits liability	Curtailment gain(1)	Settlement loss(1)
1	~840	2.45%	March 31, 2021	3.06%	$ —	$ (106)	$ (17)	$ 26
2	~120	2.38%	June 30, 2021	2.71%	(90)	—	—	39
3	~20	2.71%	September 30, 2021	2.74%	7	—	—	7
4	~20	1.34%	September 30, 2021	1.53%	(38)	—	—	1
5	~800	N/A	N/A	N/A	N/A	—	—	63
6	~14,000	2.59%	November 30, 2021	2.79%	(84)	—	—	848
7	~60	2.59%	November 30, 2021	2.79%	(1)	—	—	10
					$ (206)	$ (106)	$ (17)	$ 994

(1) These amounts primarily represent the accelerated amortization of a portion of the existing prior service benefit for curtailments and net actuarial loss for settlements and were reclassified from Accumulated other comprehensive loss to Restructuring and other charges, net (see Note D) on the accompanying Statement of Consolidated Operations.

2020 Plan Actions. In 2020, management initiated the following actions to certain pension and other postretirement benefit plans:

Action #1 – In February 2020, the Company entered into a new, six-year collective bargaining agreement with the Union of Professional and Office Workers of the Alcoa Smelter of Baie-Comeau in Canada. Under the agreement, all unionized office employees that are participants in one of the Company's defined benefit pension plans ceased accruing retirement benefits for future service effective January 1, 2021. This change affected approximately 20 employees, who were transitioned to a target benefit plan, where the funding risk is assumed by the employees. The Company will contribute approximately 12% of these participants' eligible earnings to the new plan on an annual basis. Participants already collecting benefits or who terminated with a vested benefit under the defined benefit pension plan were not affected by these changes**.**

Action #2 – In February 2020, the Company notified all non-unionized hourly employees of Aluminerie de Deschambault, who are participants in one of the Company's defined benefit pension plans, that they will cease accruing retirement benefits for future service effective January 1, 2021. This change affected approximately 430 employees, who were transitioned to a to a member-funded pension plan, where the funding risk is assumed by the employees. The Company will contribute approximately 12% of these participants' eligible earnings to the new plan on an annual basis. Participants already collecting benefits or who terminated with a vested benefit under the defined benefit pension plan were not affected by these changes.

Action #3 – In April 2020**,** as part of the Company's portfolio review, Alcoa announced that it will curtail the remaining capacity at its Intalco smelter in Ferndale, Washington amid declining market conditions. The full curtailment was completed during the third quarter of 2020, and the workforce was reduced by approximately 685 people. As a result, curtailment accounting was triggered in the U.S. hourly defined benefit pension and retiree life plans (3a and 3b in the below table, respectively).

Action #4 – In September 2020, the Company and the United Steelworkers jointly notified certain U.S. retirees that their medical and prescription drug coverage will be provided through an insured group Medicare Advantage and Prescription Drug plan and will include an increase to participant contributions, effective January 1, 2021. These changes affected approximately 8,600 participants. Although the plan change and related remeasurement increased the other postretirement benefit liability by $74, the plan change lowered the Company's expected cash requirements for the program over the next five years.

Action #5 – In October 2020, the Company offered lump sum buyouts to specific participants in its U.S. defined benefit pension plans. As a result, the Company paid approximately $33 from plan assets on December 31, 2020 to approximately 430 participants, was relieved of the corresponding pension obligation of $35, and recognized a settlement loss of $44 (pre- and after-tax).

Action #6 – On November 30, 2020, Alcoa announced an agreement to sell the Warrick Rolling Mill to Kaiser. The sale closed on March 31, 2021. Approximately 1,170 employees at the rolling operations, which includes the casthouse, hot mill, cold mills, and coating and slitting lines, will become employees of Kaiser once the transaction is complete. As a result, Alcoa recognized a pension curtailment loss of $5 (pre- and after-tax) in the fourth quarter of 2020.

The following table presents certain information and the financial impacts of these actions on the accompanying Consolidated Financial Statements:

Action #	Number of affected plan participants	Weighted average discount rate as of December 31, 2019	Plan remeasurement date	Weighted average discount rate as of plan remeasurement date	Increase (decrease) to accrued pension benefits liability(1)	Increase to accrued other postretirement benefits liability(1)	Curtailment loss (gain)(2)	Settlement loss(2)
1	~20	3.15%	January 31, 2020	2.75%	$ 18	$ —	$ 1	$ —
2	~430	3.20%	January 31, 2020	2.75%	28	—	2	—
3a	~300	3.25%	April 30, 2020	2.92%	156	—	1	—
3b	~600	3.75%	April 30, 2020	3.44%	—	—	(2)	—
4	~8,600	3.11%	August 31, 2020	2.65%	—	74	—	—
5	~430	N/A	December 31, 2020	N/A	(2)	—	—	44
6	~900	N/A	December 31, 2020	N/A	5	—	5	—
	~11,280				$ 205	$ 74	$ 7	$ 44

(1) Actions 1-4 caused interim plan remeasurements, including an update to the discount rates used to determine the benefit obligations of the affected plans. These amounts include impacts due to interim plan remeasurements

(2) These amounts primarily represent the accelerated amortization of a portion of the existing prior service benefit for curtailments and net actuarial loss for settlements and were reclassified from Accumulated other comprehensive loss to Restructuring and other charges, net (see Note D) on the accompanying Statement of Consolidated Operations.

Obligations and Funded Status

December 31,	Pension benefits 2022	Pension benefits 2021	Other postretirement benefits 2022	Other postretirement benefits 2021
Change in benefit obligation				
Benefit obligation at beginning of year	$ 4,594	$ 6,904	$ 710	$ 892
Service cost	13	22	4	4
Interest cost	107	120	15	15
Actuarial gains	(803)	(305)	(140)	(78)
Settlements	(1,090)	(1,763)	—	—
Benefits paid, net of participants' contributions	(211)	(362)	(53)	(56)
Medicare Part D subsidy receipts	—	—	—	2
Divestitures	—	—	—	(69)
Foreign currency translation impact	(92)	(22)	—	—
Benefit obligation at end of year	$ 2,518	$ 4,594	$ 536	$ 710
Change in plan assets				
Fair value of plan assets at beginning of year	$ 4,306	$ 5,356	$ —	$ —
Actual return on plan assets	(528)	513	—	—
Employer contributions	18	581	—	—
Participant contributions	4	5	—	—
Benefits paid	(204)	(356)	—	—
Administrative expenses	(6)	(4)	—	—
Settlements	(1,090)	(1,763)	—	—
Annuity purchase premium refund	22	—	—	—
Foreign currency translation impact	(88)	(26)	—	—
Fair value of plan assets at end of year	$ 2,434	$ 4,306	$ —	$ —
Funded status	$ (84)	$ (288)	$ (536)	$ (710)
Less: Amounts attributed to joint venture partners	(6)	(25)	—	—
Net funded status	$ (78)	$ (263)	$ (536)	$ (710)
Amounts recognized in the Consolidated Balance Sheet consist of:				
Noncurrent assets	$ 146	$ 164	$ —	$ —
Current liabilities	(11)	(10)	(55)	(60)
Noncurrent liabilities	(213)	(417)	(481)	(650)
Net amount recognized	$ (78)	$ (263)	$ (536)	$ (710)
Amounts recognized in Accumulated Other Comprehensive Loss consist of:				
Net actuarial loss	$ 1,016	$ 1,877	$ 95	$ 253
Prior service cost (benefit)	2	2	(111)	(125)
Total, before tax effect	1,018	1,879	(16)	128
Less: Amounts attributed to joint venture partners	27	38	—	—
Net amount recognized, before tax effect	$ 991	$ 1,841	$ (16)	$ 128
Other Changes in Plan Assets and Benefit Obligations Recognized in Other Comprehensive Income (Loss) consist of:				
Net actuarial benefit	$ (141)	$ (527)	$ (140)	$ (74)
Amortization of accumulated net actuarial loss	(720)	(1,159)	(18)	(47)
Amortization of prior service benefit	—	—	14	31
Total, before tax effect	(861)	(1,686)	(144)	(90)
Less: Amounts attributed to joint venture partners	(11)	(19)	—	—
Net amount recognized, before tax effect	$ (850)	$ (1,667)	$ (144)	$ (90)

At December 31, 2022, the benefit obligation, fair value of plan assets, and funded status for U.S. pension plans were $1,113, $1,064, and ($49), respectively. At December 31, 2021, the benefit obligation, fair value of plan assets, and funded status for U.S. pension plans were $2,712, $2,681, and ($31), respectively.

Pension Plan Benefit Obligations

	Pension benefits	
	2022	2021
The aggregate projected benefit obligation and accumulated benefit obligation for all defined benefit pension plans was as follows:		
Projected benefit obligation	$ 2,518	$ 4,594
Accumulated benefit obligation	2,453	4,438
The aggregate projected benefit obligation and fair value of plan assets for pension plans with projected benefit obligations in excess of plan assets was as follows:		
Projected benefit obligation	1,465	3,031
Fair value of plan assets	1,232	2,579
The aggregate accumulated benefit obligation and fair value of plan assets for pension plans with accumulated benefit obligations in excess of plan assets was as follows:		
Accumulated benefit obligation	1,458	2,918
Fair value of plan assets	1,232	2,579

Components of Net Periodic Benefit Cost

	Pension benefits[1]			Other postretirement benefits		
	2022	2021	2020	2022	2021	2020
Service cost	$ 13	$ 22	$ 54	$ 4	$ 4	$ 5
Interest cost[2]	104	116	164	15	15	19
Expected return on plan assets[2]	(151)	(281)	(292)	—	—	—
Recognized net actuarial loss[2]	88	190	212	18	21	20
Amortization of prior service cost (benefit)[2]	—	—	—	(14)	(14)	(15)
Settlements[3]	632	968	51	—	26	—
Curtailments[4]	—	—	9	—	(17)	(2)
Net periodic benefit cost[5]	$ 686	$ 1,015	$ 198	$ 23	$ 35	$ 27

(1) In 2022, 2021, and 2020, net periodic benefit cost for U.S pension plans was $698, $962, and $154, respectively.

(2) These amounts were reported in Other (income) expenses, net on the accompanying Statement of Consolidated Operations.

(3) These amounts were reported in Restructuring and other charges, net on the accompanying Statement of Consolidated Operations (see Note D). In 2022 and 2021, settlements were due to management actions (see Plan Actions above). In 2020, settlements were due to management actions ($44) (see Plan Actions above) and payment of additional lump sum benefits ($7).

(4) These amounts were reported in Restructuring and other charges, net on the accompanying Statement of Consolidated Operations (see Note D). In 2021 and 2020, curtailments were due to management actions (see Plan Actions above).

(5) Amounts attributed to joint venture partners are not included.

Assumptions. Liabilities and expenses for pension and other postretirement benefits are determined using actuarial methodologies and incorporate significant assumptions, including the interest rate used to discount the future estimated liability, the expected long-term rate of return on plan assets, and several assumptions relating to the employee workforce (salary increases, health care cost trend rates, retirement age, and mortality).

Weighted average assumptions used to determine benefit obligations for pension and other postretirement benefit plans were as follows:

December 31,	2022	2021
Discount rate—pension plans	5.41%	2.99%
Discount rate—other postretirement benefit plans	5.54	2.82
Rate of compensation increase—pension plans	3.21	3.11

The yield curve model used to develop the discount rate parallels the plans' projected cash flows and has a weighted average duration of 11 years. The underlying cash flows of the high-quality corporate bonds included in the model exceed the cash flows needed to satisfy the Company's plan obligations multiple times. If a deep market of high-quality corporate bonds does not exist in a country, then the yield on government bonds plus a corporate bond yield spread is used.

Weighted average assumptions used to determine net periodic benefit cost for pension and other postretirement benefit plans were as follows:

	2022	2021	2020
Discount rate—pension plans	2.66%	1.91%	3.02%
Discount rate—other postretirement benefit plans	2.46	1.99	2.84
Expected long-term rate of return on plan assets—pension plans	4.94	5.66	6.28
Rate of compensation increase—pension plans	3.11	2.58	3.25

For 2022, 2021, and 2020, the expected long-term rate of return used by management was based on the prevailing and planned strategic asset allocations, as well as estimates of future returns by asset class. For 2023, management anticipates that 6.21% will be the weighted average expected long-term rate of return.

Assumed health care cost trend rates for U.S. other postretirement benefit plans were as follows (non-U.S. plans are not material):

	2022	2021	2020
Health care cost trend rate assumed for next year	7.0%	5.5%	5.5%
Rate to which the cost trend rate gradually declines	5.0%	4.5%	4.5%
Year that the rate reaches the rate at which it is assumed to remain	2028	2026	2026

The assumed health care cost trend rate is used to measure the expected cost of gross eligible charges covered by the Company's other postretirement benefit plans. For 2023, a 7.0% trend rate will be used, reflecting management's best estimate of the change in future health care costs covered by the plans.

Plan Assets. Alcoa's pension plan weighted average target and actual asset allocations at December 31, 2022 and 2021, by asset class, were as follows:

	Target asset allocation		Plan assets at December 31,	
Asset class	**2022**	**2021**	**2022**	**2021**
Equities	20%	25%	29%	28%
Fixed income	65	65	57	64
Other investments	15	10	14	8
Total	100%	100%	100%	100%

The principal objectives underlying the investment of the pension plan assets are to ensure that the Company can properly fund benefit obligations as they become due under a broad range of potential economic and financial scenarios, maximize the long-term investment return with an acceptable level of risk based on such obligations, and broadly diversify investments across and within various asset classes to protect asset values against adverse movements. Investment risk is controlled by rebalancing to target allocations on a periodic basis and ongoing monitoring of investment manager performance.

The portfolio includes an allocation to investments in long-duration corporate credit and government debt, public and private market equities, intermediate duration corporate credit and government debt, global-listed infrastructure, high-yield bonds and bank loans, real estate, and securitized credit.

In late 2022, management began restructuring the asset portfolios of certain non-U.S. pension plans. The new strategy will increase the amount and duration of the fixed income asset portfolios to reduce exposure to interest rates and will be substantially implemented by the end of the first quarter in 2023.

Investment practices comply with the requirements of applicable laws and regulations in the respective jurisdictions, including the Employee Retirement Income Security Act of 1974 (ERISA) in the United States.

The following section describes the valuation methodologies used by the trustees to measure the fair value of pension plan assets. For plan assets measured at net asset value, this refers to the net asset value of the investment on a per share basis (or its equivalent) as a practical expedient. Otherwise, an indication of the level in the fair value hierarchy in which each type of asset is generally classified is provided (see Note P for the definition of fair value and a description of the fair value hierarchy).

Equities—These securities consist of: (i) direct investments in the stock of publicly traded U.S. and non-U.S. companies and are valued based on the closing price reported in an active market on which the individual securities are traded (generally classified in Level 1); (ii) the plans' share of commingled funds that are invested in the stock of publicly traded companies and are valued at net asset value; and (iii) direct investments in long/short equity hedge funds and private equity (limited partnerships and venture capital partnerships) and are valued at net asset value.

Fixed income—These securities consist of: (i) U.S. government debt and are generally valued using quoted prices (included in Level 1); (ii) cash and cash equivalents invested in publicly-traded funds and are valued based on the closing price reported in an active market on which the individual securities are traded (generally classified in Level 1); (iii) publicly traded U.S. and non-U.S. fixed interest obligations (principally corporate bonds and debentures) and are valued through consultation and evaluation with brokers in the institutional market using quoted prices and other observable market data (included in Level 2); and (iv) cash and cash equivalents invested in institutional funds and are valued at net asset value.

Other investments—These investments include, among others: (i) real estate investment trusts valued based on the closing price reported in an active market on which the investments are traded (included in Level 1); (ii) the plans' share of commingled funds that are invested in real estate partnerships and are valued at net asset value; (iii) direct investments in private real estate (includes limited partnerships) and are valued at net asset value; and (iv) absolute return strategy funds and are valued at net asset value.

The fair value methods described above may not be indicative of net realizable value or reflective of future fair values. Additionally, while Alcoa believes the valuation methods used by the plans' trustees are appropriate and consistent with other market participants, the use of different methodologies or assumptions to determine the fair value of certain financial instruments could result in a different fair value measurement at the reporting date.

The following table presents the fair value of pension plan assets classified under either the appropriate level of the fair value hierarchy or net asset value:

December 31, 2022	Level 1	Level 2	Level 3	Net Asset Value	Total
Equities:					
Equity securities	$ 71	$ —	$ —	$ 480	$ 551
Long/short equity hedge funds	—	—	—	8	8
Private equity	—	—	—	145	145
	$ 71	$ —	$ —	$ 633	$ 704
Fixed income:					
Intermediate and long-duration government/credit	$ 390	$ 426	$ —	$ 420	$ 1,236
Cash and cash equivalent funds	38	—	—	118	156
Other	—	—	—	—	-
	$ 428	$ 426	$ —	$ 538	$ 1,392
Other investments:					
Real estate	$ 20	$ —	$ —	$ 282	$ 302
Other	—	—	—	28	28
	$ 20	$ —	$ —	$ 310	$ 330
Total[1]	$ 519	$ 426	$ —	$ 1,481	$ 2,426

December 31, 2021	Level 1	Level 2	Level 3	Net Asset Value	Total
Equities:					
Equity securities	$ 210	$ —	$ —	$ 671	$ 881
Long/short equity hedge funds	—	—	—	4	4
Private equity	—	—	—	281	281
	$ 210	$ —	$ —	$ 956	$ 1,166
Fixed income:					
Intermediate and long-duration government/credit	$ 827	$ 1,027	$ —	$ 651	$ 2,505
Cash and cash equivalent funds	64	—	—	172	236
Other	—	—	—	—	-
	$ 891	$ 1,027	$ —	$ 823	$ 2,741
Other investments:					
Real estate	$ 63	$ —	$ —	$ 263	$ 326
Other	—	—	—	31	31
	$ 63	$ —	$ —	$ 294	$ 357
Total[2]	$ 1,164	$ 1,027	$ —	$ 2,073	$ 4,264

(1) As of December 31, 2022, the total fair value of pension plan assets excludes a net receivable of $8, which primarily represents securities not yet settled plus interest and dividends earned on various investments.

(2) As of December 31, 2021, the total fair value of pension plan assets excludes a net receivable of $42, which primarily represents securities not yet settled plus interest and dividends earned on various investments.

Funding and Cash Flows. It is Alcoa's policy to fund amounts for defined benefit pension plans sufficient to meet the minimum requirements set forth in applicable country benefits laws and tax laws, including ERISA for U.S. plans. From time to time, the Company contributes additional amounts as deemed appropriate.

In 2022, 2021, and 2020, cash contributions to Alcoa's defined benefit pension plans were $17, $579, and $343.

During 2020, the Company initially deferred approximately $200 in pension contributions under provisions in the U.S. Government's Coronavirus Aid, Relief, and Economic Security (CARES) Act. With ample cash on hand and having achieved its objective to hold cash during uncertain times in 2020, the Company made a $250 pension contribution to its U.S. pension plans in late December to cover both the deferred contributions due on January 4, 2021 and a discretionary prepayment. During 2021, Alcoa made $500 in unscheduled contributions to certain U.S. defined benefit pension plans. The additional contributions were discretionary in nature and were funded with net proceeds from a March 2021 debt issuance (see Note M) plus available cash on hand. There were no discretionary contributions made in 2022.

Alcoa's minimum required contribution to defined benefit pension plans in 2023 is estimated to be $75, of which approximately $55 is for U.S. plans. Under ERISA regulations, a plan sponsor that establishes a pre-funding balance by making discretionary contributions to a U.S. defined benefit pension plan may elect to apply all or a portion of this balance toward its minimum required contribution obligations to the related plan in future years. In 2023, management intends to make such election related to the Company's U.S. plans.

Benefit payments expected to be paid to pension and other postretirement benefit plan participants are as follows:

Year ending December 31,	Pension benefits	Other postretirement benefits
2023	$ 195	$ 55
2024	190	55
2025	190	50
2026	190	50
2027	195	45
2028 through 2032	915	210
	$ 1,875	$ 465

Defined Contribution Plans

The Company sponsors savings and investment plans in several countries, primarily in Australia and the United States. In the United States, employees may contribute a portion of their compensation to the plans, and Alcoa matches a specified percentage of these contributions in equivalent form of the investments elected by the employee. Also, the Company makes contributions to a retirement savings account based on a percentage of eligible compensation for certain U.S. employees that are not able to participate in Alcoa's defined benefit pension plans. The Company's expenses related to all defined contribution plans were $71 in 2022, $72 in 2021, and $73 in 2020.

Member-funded Pension Plans

The Company contributes to member-funded pension plans for the employees of Aluminerie de Bécancour Inc. and Aluminerie de Deschambault in Canada. Alcoa makes contributions to the plans based on a percentage of the employees' eligible compensation. The Company's expenses related to the member-funded pension plans were $17 in 2022, $17 in 2021, and $10 in 2020.

Target Benefit Plan

The Company contributes to a target benefit plan for the employees of Baie-Comeau in Canada. Alcoa makes contributions to the plan based on a percentage of the employees' eligible compensation. The Company's expenses related to the target benefit plan were $9 in 2022, and $9 in 2021.

P. Derivatives and Other Financial Instruments

Fair Value. The Company follows a fair value hierarchy to measure its assets and liabilities. As of December 31, 2022 and 2021, respectively, the assets and liabilities measured at fair value on a recurring basis were primarily derivative instruments. In addition, the Company measures its pension plan assets at fair value (see Note O). Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. The fair value hierarchy distinguishes between (i) market participant assumptions developed based on market data obtained from independent sources (observable inputs) and (ii) an entity's own assumptions about market participant assumptions developed based on the best information available in the circumstances (unobservable inputs). The fair value hierarchy consists of three broad levels, which gives the highest priority to unadjusted quoted prices in active markets for identical assets or liabilities (Level 1) and the lowest priority to unobservable inputs (Level 3). The three levels of the fair value hierarchy are described below:

- Level 1—Unadjusted quoted prices in active markets that are accessible at the measurement date for identical, unrestricted assets or liabilities;
- Level 2—Inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly, including quoted prices for similar assets or liabilities in active markets; quoted prices for identical or similar assets or liabilities in markets that are not active; inputs other than quoted prices that are observable for the asset or liability (e.g., interest rates); and inputs that are derived principally from or corroborated by observable market data by correlation or other means; and,
- Level 3—Inputs that are both significant to the fair value measurement and unobservable.

Derivatives. Alcoa Corporation is exposed to certain risks relating to its ongoing business operations, including the risks of changing commodity prices, foreign currency exchange rates and interest rates. Alcoa Corporation's commodity and derivative activities include aluminum, energy, foreign exchange, and interest rate contracts, which are held for purposes other than trading. They are used to mitigate uncertainty and volatility, and to cover underlying exposures. While Alcoa does not generally enter into derivative contracts to mitigate the risk associated with changes in aluminum price, the Company may do so in isolated cases to address discrete commercial or operational conditions. Alcoa is not involved in trading activities for energy, weather derivatives, or other nonexchange commodities.

Alcoa Corporation's commodity and derivative activities are subject to the management, direction, and control of the Strategic Risk Management Committee (SRMC), which consists of at least three members, including the chief executive officer, the chief financial officer, and the chief commercial officer. The remaining member(s) are other officers and/or employees of the Company as the chief executive officer may designate from time to time. The SRMC meets on a periodic basis to review derivative positions and strategy and reports to the Audit Committee of Alcoa Corporation's Board of Directors on the scope of its activities.

Alcoa Corporation's aluminum and foreign exchange contracts are predominately classified as Level 1 under the fair value hierarchy. All of the Level 1 contracts are designated as either fair value or cash flow hedging instruments (except as described below). Alcoa Corporation also has several derivative instruments classified as Level 3 under the fair value hierarchy, which are either designated as cash flow hedges or undesignated. Alcoa includes the changes in its equity method investee's Level 2 derivatives in Accumulated other comprehensive loss.

The following tables present the detail for Level 1 and 3 derivatives (see additional Level 3 information in further tables below):

	2022		2021	
Balance at December 31,	**Assets**	**Liabilities**	**Assets**	**Liabilities**
Level 1 derivative instruments	$ 84	$ 14	$ 19	$ 29
Level 3 derivative instruments	52	1,212	2	1,293
Total	$ 136	$ 1,226	$ 21	$ 1,322
Less: Current	134	200	14	274
Noncurrent	$ 2	$ 1,026	$ 7	$ 1,048

	2022		2021	
Year ended December 31,	**Unrealized loss recognized in Other comprehensive loss**	**Realized loss reclassed from Other comprehensive loss to earnings**	**Unrealized loss recognized in Other comprehensive loss**	**Realized loss reclassed from Other comprehensive loss**
Level 1 derivative instruments	$ 116	$ 35	$ (28)	$ (10)
Level 3 derivative instruments	(247)	(345)	(759)	(279)
Noncontrolling and equity interest (Level 2)	12	(6)	5	(6)
Total	$ (119)	$ (316)	$ (782)	$ (295)

The 2022 realized gain of $35 on Level 1 cash flow hedges was comprised of a $40 gain recognized in Sales and a $5 loss recognized in Cost of goods sold. The 2021 realized loss of $10 on Level 1 cash flow hedges was comprised of a $7 loss recognized in Sales and a $3 loss recognized in Cost of goods sold.

The following table presents the outstanding quantities of derivative instruments classified as Level 1:

	Classification	December 31, 2022	December 31, 2021
Aluminum (in kmt)	Commodity buy forwards	176	166
Aluminum (in kmt)	Commodity sell forwards	337	485
Foreign currency (in millions of euro)	Foreign exchange buy forwards	60	92
Foreign currency (in millions of Norwegian krone)	Foreign exchange buy forwards	302	—
Foreign currency (in millions of Brazilian real)	Foreign exchange buy forwards	1,008	1,318
Foreign currency (in millions of Brazilian real)	Foreign exchange sell forwards	7	—

Alcoa routinely uses Level 1 aluminum derivative instruments to manage exposures to changes in the fair value of firm commitments for the purchases or sales of aluminum. Additionally, Alcoa uses Level 1 aluminum derivative instruments to manage exposures to changes in the LME associated with the Alumar (Brazil) restart (April 2022 through December 2023) and the San Ciprián (Spain) strike (expired October 2022). As a result of a delay with the Alumar restart, it became probable that certain of the original forecasted transactions would not occur by the end of the originally specified time period and Alcoa dedesignated certain aluminum sell forwards. The Company reclassified the related unrealized gain of $20 included in Accumulated other comprehensive loss to Sales during the year ended December 31, 2022. In conjunction with the dedesignations, the Company entered into aluminum buy forwards in 2022 for the same volume and periods which were also not designated. The unrealized and realized gains and losses on the aluminum buy and sell forwards that are not designated will offset resulting in no impact to Alcoa's earnings.

Alcoa Corporation uses Level 1 foreign exchange forward contracts to mitigate the risk of foreign exchange exposure related to euro power purchases in Norway (expires December 2026), krone capital expenditures in Norway (expires June 2025), and U.S. dollar alumina and aluminum sales in Brazil (expires December 2024).

Derivative instruments classified as Level 3 in the fair value hierarchy represent those in which management has used at least one significant unobservable input in the valuation model. Alcoa Corporation uses a discounted cash flow model to fair value all Level 3 derivative instruments. Inputs in the valuation models for Level 3 derivative instruments are composed of the following: (i) quoted market prices (e.g., aluminum prices on the 10-year LME forward curve and energy prices), (ii) significant other observable inputs (e.g., information concerning time premiums and volatilities for certain option type embedded derivatives and regional premiums for aluminum contracts), and (iii) unobservable inputs (e.g., aluminum and energy prices beyond those quoted in the market, and estimated credit spread between Alcoa and the counterparty). For periods beyond the term of quoted market prices for aluminum, Alcoa Corporation estimates the price of aluminum by extrapolating the 10-year LME forward curve. For periods beyond the term of quoted market prices for the Midwest premium, management estimates the Midwest premium based on recent transactions. Where appropriate, valuations are adjusted for various factors such as liquidity, bid/offer spreads, and credit considerations. Such adjustments are generally based on available market evidence (Level 2). In the absence of such evidence, management's best estimate is used (Level 3). If a significant input that is unobservable in one period becomes observable in a subsequent period, the related asset or liability would be transferred to the appropriate classification (Level 1 or 2) in the period of such change (there were no such transfers in the periods presented). There were no sales or settlements of Level 3 derivative instruments in the periods presented.

Level 3 derivative instruments outstanding as of December 31, 2022 are described in the table below:

Description	Designation	Contract Termination	Unobservable Inputs Impacting Valuation	Sensitivity to Inputs
Power contracts				
Embedded derivative that indexes the price of power to the LME price of aluminum plus the Midwest premium	Cash flow hedge of forward sales of aluminum	March 2026 December 2029 February 2036	LME price, Midwest premium and MWh per year	Increase in LME price and/or the Midwest premium results in a higher cost of power and an increase to the derivative liability
Embedded derivative that indexes the price of power to the LME price of aluminum	Cash flow hedge of forward sales of aluminum	September 2027	LME price and MWh per year	Increase in LME price results in a higher cost of power and an increase to the derivative liability
Embedded derivative that indexes the price of power to the credit spread between the Company and the counterparty	Not designated	October 2028	Estimated credit spread	Wider credit spread results in a higher cost of power and increase in the derivative liability
Financial contracts				
Hedge power prices	Not designated	June 2026	LME price and power price	Lower prices in the power market or higher LME prices result in an increase in the derivative liability
Hedge power prices	Cash flow hedge of forward sales of power	March 2023	Power price	Higher prices in the power market results in an increase in the derivative liability

In December 2022, Alcoa entered into a financial contract (Financial contract, below) with a counterparty to hedge power price exposure through March 31, 2023. The Financial contract is designated as a cash flow hedge of future sales of power. Unrealized gains and losses are recognized in Accumulated other comprehensive loss on the accompanying Consolidated Balance Sheet, and realized gains and losses are recognized in Cost of goods sold on the accompanying Statement of Consolidated Operations.

In addition to the instruments presented above, Alcoa had a financial contract that expired in July 2021 that hedged the anticipated power requirements at one of its smelters and was designated as a cash flow hedge of future purchases of electricity. In March 2021, Alcoa entered into four financial contracts (Financial contracts (undesignated), below) with three counterparties to hedge the anticipated power requirements at this smelter for the period from August 1, 2021 through June 30, 2026. A fifth financial contract (undesignated) was entered into in November 2021, with an effective date of September 30, 2022 through June 30, 2026. Two of these financial contracts include LME-linked pricing components and do not qualify for hedge accounting treatment. Management elected not to apply hedge accounting treatment for the other three financial contracts. Unrealized and realized gains and losses on these financial contracts are included in Other (income) expenses, net on the accompanying Statement of Consolidated Operations.

At December 31, 2022, the outstanding Level 3 instruments are associated with eight smelters. At December 31, 2022 and 2021, the power contracts with embedded derivatives designated as cash flow hedges hedge forecasted aluminum sales of 1,683 kmt and 1,905 kmt, respectively.

The following table presents quantitative information related to the significant unobservable inputs described above for Level 3 derivative instruments (megawatt hours in MWh):

	December 31, 2022	Unobservable input	Unobservable input range	
Asset Derivatives				
Financial contracts (undesignated)	$ 32	Interrelationship of forward energy price, LME forward price and the Consumer Price Index	Electricity (per MWh)	2023: $56.79 2023: $75.71
			LME (per mt)	2023: $2,350 2023: $2,406
Financial contract	20	Interrelationship of forward energy price and the contract price	Electricity (per MWh)	2023: $196.85
Total asset derivatives	$ 52			
Liability Derivatives				
Power contract	$ 237	MWh of energy needed to produce the forecasted mt of aluminum	LME (per mt)	2023: $2,350 2027: $2,791
			Electricity	Rate of 4 million MWh per year
Power contracts	975	MWh of energy needed to produce the forecasted mt of aluminum	LME (per mt)	2023: $2,350 2029: $2,886 2036: $3,182
			Midwest premium (per pound)	2023: $0.240 2029: $0.265 2036: $0.265
			Electricity	Rate of 18 million MWh per year
Power contract	—	MWh of energy needed to produce the forecasted mt of aluminum	LME	2023: $2,350 2023: $2,372
			Midwest premium	2023: $0.240 2023: $0.253
			Electricity	Rate of 2 million megawatt hours per year
Power contract (undesignated)	—	Estimated spread between the 30-year debt yield of Alcoa and the counterparty	Credit spread	1.10%: 30-year debt yield spread 6.63%: Alcoa (estimated) 5.53%: counterparty
Total liability derivatives	$ 1,212			

The fair values of Level 3 derivative instruments recorded in the accompanying Consolidated Balance Sheet were as follows:

Asset Derivatives	December 31, 2022	December 31, 2021
Derivatives designated as hedging instruments:		
Current—financial contract	$ 20	$ —
Total derivatives designated as hedging instruments	$ 20	$ —
Derivatives not designated as hedging instruments:		
Current—financial contracts	$ 32	$ 2
Total derivatives not designated as hedging instruments	$ 32	$ 2
Total asset derivatives	$ 52	$ 2
Liability Derivatives		
Derivatives designated as hedging instruments:		
Current—power contracts	$ 195	$ 262
Noncurrent—power contracts	1,017	1,028
Total derivatives designated as hedging instruments	$ 1,212	$ 1,290
Derivatives not designated as hedging instruments:		
Current—embedded credit derivative	$ —	$ 1
Noncurrent—embedded credit derivative	—	2
Total derivatives not designated as hedging instruments	$ —	$ 3
Total liability derivatives	$ 1,212	$ 1,293

The following table shows the net fair values of the Level 3 derivative instruments at December 31, 2022 and the effect on these amounts of a hypothetical change (increase or decrease of 10%) in the market prices or rates that existed as of December 31, 2022:

	Fair value asset (liability)	Index change of + / -10%
Power contracts	$ (1,212)	$ 329
Embedded credit derivative	-	-
Financial contracts	52	6

The following tables present a reconciliation of activity for Level 3 derivative instruments:

	Assets	Liabilities	
2022	Financial contracts	Power contracts	Embedded credit derivative
January 1, 2022	$ 2	$ 1,290	$ 3
Total gains or losses included in:			
Sales (realized)	—	(345)	—
Other income, net (unrealized)	171	—	(3)
Other comprehensive (income) loss (unrealized)	20	267	—
Settlements and other	(141)	—	—
December 31, 2022	$ 52	$ 1,212	$ —
Change in unrealized gains or losses included in earnings for derivative instruments held at December 31, 2022:			
Other income, net	$ 171	$ —	$ (3)

	Assets	Liabilities		
2021	Financial contract	Power contracts	Financial contract	Embedded credit derivative
January 1, 2021	$ —	$ 814	$ 1	$ 23
Total gains or losses included in:				
Sales (realized)	—	(277)	—	—
Cost of goods sold (realized)	(6)	—	(8)	—
Other (income) expenses, net (unrealized/realized)	7	—	—	(20)
Other comprehensive loss (unrealized)	—	753	6	—
Other	1	—	1	—
December 31, 2021	$ 2	$ 1,290	$ —	$ 3
Change in unrealized gains or losses included in earnings for derivative instruments held at December 31, 2021:				
Other (income) expenses, net	$ 5	$ —	$ (1)	$ (19)

Derivatives Designated As Hedging Instruments—Cash Flow Hedges

Assuming market rates remain constant with the rates at December 31, 2022, a realized loss of $195 related to power contracts is expected to be recognized in Sales over the next 12 months.

Material Limitations

The disclosures with respect to commodity prices and foreign currency exchange risk do not consider the underlying commitments or anticipated transactions. If the underlying items were included in the analysis, the gains or losses on the futures contracts may be offset. Actual results will be determined by several factors that are not under Alcoa Corporation's control and could vary significantly from those factors disclosed.

Alcoa Corporation is exposed to credit loss in the event of nonperformance by counterparties on the above instruments, as well as credit or performance risk with respect to its hedged customers' commitments. Alcoa Corporation does not anticipate nonperformance by any of these parties. Contracts are with creditworthy counterparties and are further supported by cash, treasury bills, or irrevocable letters of credit issued by carefully chosen banks. In addition, various master netting arrangements are in place with counterparties to facilitate settlement of gains and losses on these contracts.

Other Financial Instruments. The carrying values and fair values of Alcoa Corporation's other financial instruments were as follows:

	2022		2021	
December 31,	Carrying value	Fair value	Carrying value	Fair value
Cash and cash equivalents	$ 1,363	$ 1,363	$ 1,814	$ 1,814
Restricted cash	111	111	110	110
Short-term borrowings	—	—	75	75
Long-term debt due within one year	1	1	1	1
Long-term debt, less amount due within one year	1,806	1,744	1,726	1,865

Cash and cash equivalents and Restricted cash. The carrying amounts approximate fair value because of the short maturity of the instruments. The fair value amounts for Cash and cash equivalents and Restricted cash were classified in Level 1 of the fair value hierarchy.

Short-term borrowings and Long-term debt, including amounts due within one year. The fair value of Long-term debt, less amount due within one year was based on quoted market prices for public debt and on interest rates that are currently available to Alcoa Corporation for issuance of debt with similar terms and maturities for non-public debt. The fair value amounts for all Short-term borrowings and Long-term debt were classified in Level 2 of the fair value hierarchy.

Q. Income Taxes

Provision for income taxes. The components of Income before income taxes were as follows:

	2022	2021	2020
Domestic	$ (652)	$ (663)	$ (328)
Foreign	1,354	1,862	501
Total	$ 702	$ 1,199	$ 173

Provision for income taxes consisted of the following:

	2022	2021	2020
Current:			
Federal	$ —	$ 8	$ 2
Foreign	445	473	211
State and local	—	1	—
	$ 445	$ 482	$ 213
Deferred:			
Federal	(3)	6	—
Foreign	222	141	(26)
State and local	—	—	—
	$ 219	$ 147	$ (26)
Total	$ 664	$ 629	$ 187

Federal includes U.S. income taxes related to foreign income.

A reconciliation of the U.S. federal statutory rate to Alcoa's effective tax rate was as follows:

	2022	2021	2020
U.S. federal statutory rate	21.0%	21.0%	21.0%
Changes in valuation allowances	76.7	23.4	168.3
Taxes on foreign operations—rate differential	9.9	10.8	34.5
Tax on foreign operations—other	1.3	1.7	(0.7)
Noncontrolling interest	0.8	0.5	1.6
Uncertain tax positions	0.4	—	(21.5)
Impacts of the TCJA	—	2.0	(88.8)
Adjustment of prior year income taxes	—	—	(2.5)
Equity (loss) income	(2.0)	(2.5)	2.0
Tax holidays	(5.2)	(2.8)	(1.9)
Internal legal entity reorganizations	(9.0)	—	—
Other	0.7	(1.6)	(3.9)
Effective tax rate	94.6%	52.5%	108.1%

In the fourth quarter of 2020, the Supreme Court of Spain ruled in favor of Alcoa regarding the 2006 through 2009 tax year assessment. As a result, the reserve for Uncertain tax positions that was established in 2018 was released in 2020.

On December 22, 2017, U.S. tax legislation known as the U.S. Tax Cuts and Jobs Act of 2017 (the TCJA) was enacted. In 2018, the Company made an accounting policy election to include as a period cost the tax impact generated by including Global Intangible Low-Taxed Income provisions (GILTI) in U.S. taxable income. During 2020, the U.S. Treasury Department finalized regulations implementing the GILTI provisions of the TCJA. Included in these regulations is an exclusion from GILTI for income subject to a high rate of foreign tax, which permits taxpayers to elect to apply the exception to previously filed tax returns. During 2020, an amended tax return was filed for 2018 to make this election. As a result, the Company recorded a tax benefit of ($138) in 2020 to reflect the re-establishment of certain U.S. Federal net operating loss carryforwards and a corresponding tax charge of $138 to record a full valuation allowance against the increased deferred tax asset.

Certain income earned by AWAB is eligible for a tax holiday, which decreases the tax rate on this income from 34% to 15.25%, which will result in future cash tax savings. The holiday related to production at the Alumar refinery will end on December 31, 2027, and the holiday related to the operation of the Juruti (Brazil) bauxite mine will end on December 31, 2026. In 2020, deferred tax assets expected to reverse in the holiday period were revalued at the holiday rate. This resulted in a discrete income tax charge of $15 in 2020. In 2021, it was determined that the deferred taxes associated with the tax holiday would be fully exhausted within the holiday period and the amounts were therefore maintained on the balance sheet at the holiday tax rate. In 2022, the Company's projection of the reversal of deferred tax assets during the holiday tax period was lowered, and as a result, the remainder was revalued at the statutory rate of 34%, resulting in a discrete income tax benefit of $33, which is included in Tax holidays, above.

In October 2022, Alcoa completed the liquidation of Alcoa Saudi Rolling Inversiones S.L. (ASRI), a wholly owned subsidiary that previously held the Company's investment in the Ma'aden Rolling Company. This liquidation resulted in a deductible loss in the Netherlands and a tax benefit of $94 was recognized in 2022, however, this tax benefit was substantially offset by a valuation allowance.

In December 2022, Alcoa commenced an internal reorganization to reduce its number of legal entities in Norway from four to one to simplify accounting and treasury functions and reduce external costs. As a result of the simplification, the Company recorded a deferred tax expense of $30 in 2022.

Deferred income taxes. The components of deferred tax assets and liabilities based on the underlying attributes without regard to jurisdiction were as follows:

	2022		2021	
December 31,	Deferred tax assets	Deferred tax liabilities	Deferred tax assets	Deferred tax liabilities
Tax loss carryforwards	$ 1,781	$ —	$ 1,554	$ —
Employee benefits	297	—	409	—
Derivatives and hedging activities	283	24	345	—
Loss provisions	174	—	214	—
Depreciation	128	336	128	425
Interest	127	2	105	1
Investment basis differences	75	—	117	—
Lease assets and liabilities	24	23	26	22
Tax credit carryforwards	23	—	26	—
Deferred income/expense	10	153	2	135
Other	36	—	38	—
	$ 2,958	$ 538	$ 2,964	$ 583
Valuation allowance	(2,333)	—	(2,062)	—
Total	$ 625	$ 538	$ 902	$ 583

The following table details the expiration periods of the deferred tax assets presented above:

December 31, 2022	Expires within 10 years	Expires within 11-20 years	No expiration	Other	Total
Tax loss carryforwards	$ 298	$ 364	$ 1,119	$ —	$ 1,781
Tax credit carryforwards	23	—	—	—	23
Other	—	—	142	1,012	1,154
Valuation allowance	(321)	(363)	(1,141)	(508)	(2,333)
Total	$ —	$ 1	$ 120	$ 504	$ 625

Deferred tax assets with no expiration may still have annual limitations on utilization. Other represents deferred tax assets whose expiration is dependent upon the reversal of the underlying temporary difference.

The total deferred tax asset (net of valuation allowance) is supported by projections of future taxable income exclusive of reversing temporary differences and taxable temporary differences that reverse within the carryforward period. The composition of Alcoa's net deferred tax asset by jurisdiction as of December 31, 2022 was as follows:

	Domestic	Foreign	Total
Deferred tax assets	$ 964	$ 1,994	$ 2,958
Valuation allowance	(897)	(1,436)	(2,333)
Deferred tax liabilities	(67)	(471)	(538)
Total	$ —	$ 87	$ 87

The Company has several income tax filers in various foreign countries. Of the $87 net deferred tax asset included under the Foreign column in the table above, approximately 85% relates to five of Alcoa's income tax filers (the "Foreign Filers") as follows: a $108 net deferred tax asset for Alcoa Canada Company in Canada; a $96 net deferred tax asset for AWAB in Brazil; a $43 net deferred tax asset for Alcoa Lauralco Management Company in Canada; a $33 net deferred tax asset for Alcoa Wolinbec Company in Canada; and, a $207 net deferred tax liability for AofA in Australia.

The future realization of the net deferred tax asset for each of the Foreign Filers was based on projections of the respective future taxable income (defined as the sum of pretax income, other comprehensive income, and permanent tax differences), exclusive of reversing temporary differences and carryforwards. The realization of the net deferred tax assets of the Foreign Filers is not dependent on any future tax planning strategies.

The Foreign Filers do not have a history of tax loss carryforwards expiring unused. Additionally, tax loss carryforwards have an infinite life under the income tax code in Brazil. However, utilization of an existing tax loss carryforward is limited to 30% of taxable income in a particular year in Brazil.

Accordingly, management concluded that the net deferred tax assets of the Foreign Filers referenced above will more likely than not be realized in future periods, resulting in no need for a partial or full valuation allowance as of December 31, 2022.

In December 2022, Alcoa recorded a valuation allowance of $217 against the net deferred tax assets of Alumínio, of which $150 related to the balance as of December 31, 2021. The 2022 full valuation allowance for Alumínio was a result of Alumínio's three-year cumulative loss position for the period ended December 31, 2022. Although the Company entered into aluminum contracts to manage exposures associated with the restart, these contracts were held by another legal entity, and the associated realized gains are not available to Alumínio to offset the restart losses. While management believes Alumínio will return to profitability in the future with the restart of the Alumar smelter, current volatility in the market does not provide a reliable basis for concluding that it is more likely than not that Alumínio's net deferred tax assets, which consist primarily of tax loss carryforwards with indefinite life, will be realized. Alumar smelter profitability in future periods could prompt the Company to evaluate the realizability of the deferred tax asset and assess the possibility of a reversal of the valuation allowance, which could have a significant impact on net income in the quarter the valuation allowance is reversed.

The Company's subsidiaries in Iceland have a full valuation allowance recorded against deferred tax assets, which was established in 2015 and 2017, as the Company believed it was more likely than not that these tax benefits would not be realized. Strong market conditions in the first half of 2022 prompted management to reevaluate the realizability of the deferred tax asset and assess the possibility of a reversal of the valuation allowance. However, after weighing all available positive and negative evidence as of December 31, 2022, management's position continues to be that it is more likely than not that Alcoa Corporation would not realize the benefit of these deferred tax assets and continues to have a full valuation allowance recorded against Iceland deferred tax assets.

In 2021, Alcoa recorded a valuation allowance of $103 against the net deferred tax assets of Alúmina Española, S.A. (Española). Management concluded that it was more likely than not that Española's net deferred tax assets, which consisted primarily of tax loss carryforwards, would not be realized as the entity's sole operating asset, the San Ciprián refinery, was in a three-year cumulative loss position for the period ended December 31, 2021. This cumulative loss position was the result of recent operating losses due to the high energy costs in Spain and the impact of the refinery workers' strike on the fourth quarter of 2021. After weighing all available positive and negative evidence as of December 31, 2022, management's position continues to be that it is more likely than not that Alcoa Corporation would not realize the benefit of these deferred tax assets and continues to have a full valuation allowance recorded against the deferred tax assets.

The following table details the changes in the valuation allowance:

December 31,	2022	2021	2020
Balance at beginning of year	$ (2,062)	$ (2,127)	$ (1,778)
Establishment of new allowances[1]	(150)	(103)	—
Net change to existing allowances[2]	(151)	139	(315)
Foreign currency translation	30	29	(34)
Balance at end of year	$ (2,333)	$ (2,062)	$ (2,127)

(1) This line item reflects valuation allowances initially established as a result of a change in management's judgment regarding the realizability of deferred tax assets.

(2) This line item reflects movements in previously established valuation allowances, which increase or decrease as the related deferred tax assets increase or decrease. Such movements occur as a result of remeasurement due to a tax rate change and changes in the underlying attributes of the deferred tax assets, including expiration of the attribute and reversal of the temporary difference that gave rise to the deferred tax asset.

Undistributed net earnings. Certain earnings of Alcoa's foreign subsidiaries are deemed to be permanently reinvested outside the United States. The cumulative amount of Alcoa's foreign undistributed net earnings deemed to be permanently reinvested was approximately $2,794 as of December 31, 2022. Alcoa Corporation has several commitments and obligations related to the Company's operations in various foreign jurisdictions; therefore, management has no plans to distribute such earnings in the foreseeable future. Alcoa Corporation continuously evaluates its local and global cash needs for future business operations and anticipated debt facilities, which may influence future repatriation decisions. If these earnings were distributed in the form of dividends or otherwise, we could be subject to foreign income or withholding taxes and state income taxes. Due to the uncertainty of the manner in which the undistributed earnings would be brought back to the United States and the tax laws in effect at that time, it is not practicable to estimate the tax liability that might be incurred if such earnings were remitted to the U.S.

Unrecognized tax benefits. Alcoa and its subsidiaries file income tax returns in the U.S. federal jurisdiction and various foreign and U.S. state jurisdictions. With few exceptions, the Company is not subject to income tax examinations by tax authorities for years prior to 2014. The U.S. federal income tax filings of the Company's U.S. consolidated tax group have been examined through the 2018 tax year. Foreign jurisdiction tax authorities are in the process of examining income tax returns of several of Alcoa's subsidiaries for various tax years. Excluding the Australia tax matter discussed in Note S, the period under foreign examination includes the income tax years from 2012 through 2021. For U.S. state income tax purposes, the Company and its subsidiaries remain subject to income tax examinations for the 2017 tax year and forward.

In the third quarter of 2020, AofA paid approximately $74 (A$107) to the ATO related to the tax dispute described in Note S. Upon payment, AofA recorded a noncurrent prepaid tax asset, as the Company continues to believe it is more likely than not that AofA's tax position will be sustained and therefore is not recognizing any tax expense in relation to this matter. In accordance with Australian tax laws, the initial interest assessment and additional interest are deductible against AofA's taxable income resulting in approximately $169 (A$219) in 2020, $14 (A$19) in 2021, and $15 (A$22) in 2022 in lower cash tax payments. Interest compounded in future years is also deductible against AofA's income in the respective periods. If AofA is ultimately successful, the interest deduction would become taxable as income in the year the dispute is resolved. In addition, should the ATO decide in the interim to reduce any interest already assessed, the reduction would be taxable as income at that point in time. During 2022, AofA continued to record its tax provision and tax liability without effect of the ATO assessment, since it expects to prevail. The tax payable will remain on AofA's balance sheet as a noncurrent liability, increased by the tax effect of subsequent periods' interest deductions, until dispute resolution, which is expected to take several years. The noncurrent liability resulting from the cumulative interest deductions was approximately $174 (A$260) and $174 (A$238) at December 31, 2022 and 2021, respectively.

The reserve balance for unrecognized tax benefits is included in Noncurrent income taxes on the Consolidated Balance Sheet. A reconciliation of the beginning and ending amount of unrecognized tax benefits (excluding interest and penalties) was as follows:

December 31,	2022	2021	2020
Balance at beginning of year	$ 4	$ 4	$ 29
Additions for tax positions of prior years	2	—	—
Reductions for tax positions of prior years	—	—	(26)
Expiration of the statute of limitations	(1)	—	—
Foreign currency translation	—	—	1
Balance at end of year	$ 5	$ 4	$ 4

For all periods presented, a portion of the balance at end of year pertains to state tax liabilities, which are presented before any offset for federal tax benefits. The effect of unrecognized tax benefits, if recorded, that would impact the annual effective tax rate for 2022, 2021, and 2020 would be 1%, 0%, and 3%, respectively, of Income before income taxes. In 2018, the Company recorded a charge of $30 (€26), including $10 (€9) for interest, in Provision for income taxes on the accompanying Statement of Consolidated Operations to establish a liability for its 49% share of the estimated loss on a disputed income tax matter (see Spain in the Tax section of Note S). In 2020, the Company received a favorable final ruling in the Supreme Court of Spain on the Spain tax matter and recorded income of $32 (€26) from the reversal of the 2018 entry and the interest expense accrued through 2019. This change is reflected in the above table as Reductions for tax positions of prior years in the amount of $21 (€17), which is exclusive of interest previously charged to expense. The remainder of the change in Reductions for tax positions of prior years is primarily related to changes in Brazil income tax positions. There were no material changes in Reductions for tax positions of prior years in 2021 or 2022. Alcoa does not anticipate that changes in its unrecognized tax benefits will have a material impact on the Statement of Consolidated Operations during 2023.

It is the Company's policy to recognize interest and penalties related to income taxes as a component of the Provision for income taxes on the accompanying Statement of Consolidated Operations. In 2022, 2021, and 2020 Alcoa recognized $1, $0, and $0, in interest and penalties, respectively. Due to the expiration of the statute of limitations, settlements with tax authorities, and refunded overpayments, the Company also recognized interest income of $1, $0, and $13 in 2022, 2021, and 2020, respectively. As of December 31, 2022 and 2021, the amount accrued for the payment of interest and penalties was $3 and $2, respectively.

On August 16, 2022, the U.S. enacted the Inflation Reduction Act of 2022, which includes a 15% minimum tax on book income of certain large corporations, a 1% excise tax on net stock repurchases after December 31, 2022, and several tax incentives to promote clean energy. This legislation did not have a material impact on the Company's Consolidated Financial Statements as of December 31, 2022.

R. Asset Retirement Obligations

Alcoa records AROs related to legal obligations associated with the standard operation of bauxite mines, alumina refineries, and aluminum smelters. These AROs consist primarily of costs associated with mine reclamation, closure of bauxite residue areas, spent pot lining disposal, and landfill closures. The Company also recognizes AROs for the disposal of regulated waste materials related to the demolition of facilities and for any significant lease restoration obligations, if required by a lease agreement.

The following table details the carrying value of recorded AROs by major category, of which $117 and $116 was classified as a current liability as of December 31, 2022 and 2021, respectively:

December 31,	2022	2021
Closure of bauxite residue areas	$ 342	$ 274
Mine reclamation	279	255
Spent pot lining disposal	115	107
Demolition	61	72
Landfill closure	31	30
Balance at end of year	$ 828	$ 738

The following table details the changes in the total carrying value of recorded AROs:

December 31,	2022	2021
Balance at beginning of year	$ 738	$ 753
Accretion expense	20	20
Liabilities incurred	224	101
Payments	(114)	(101)
Reversals of previously recorded liabilities	(12)	(6)
Foreign currency translation and other	(28)	(29)
Balance at end of year	$ 828	$ 738

Liabilities incurred in 2022 include:

- $81 related to improvements required on both operating and non-operating bauxite residue areas at the Poços de Caldas and Alumar (Brazil) refineries for changes in closure estimates and to comply with updated impoundment regulations in the regions;
- $79 for new mining areas opened during the year and higher estimated mine reclamation costs;
- $28 related to spent pot lining treatment and disposal;
- $18 for bauxite residue areas related to water management at non-operating bauxite residue areas and changes in engineering designs for closure of operating bauxite residue areas;
- $15 related to the closure of the previously curtailed magnesium smelter in Addy (Washington). The facility has been fully curtailed since 2001; and,
- $3 related to accruals for demolition projects at closed sites.

The additional accruals were primarily recorded with corresponding capitalized asset retirement costs (see Note B) except for $72 related to non-operating bauxite reside areas which were recorded to Cost of Goods Sold at Poços de Caldas and Alumar and $34 related to the closure of the smelter in Addy (Washington) and adjustments to other previously closed sites which were recorded to Restructuring and other charges, net on the accompanying Statement of Consolidated Operations (see Note D).

Liabilities incurred in 2021 include:

- $30 for new mine areas opened during the year and higher estimated mine reclamation costs, partially driven by increased complexity of reclamation areas due to steeper mine pits and grades;
- $28 for bauxite residue areas, including new bauxite residue areas as well as changes in engineering designs for both operating and non-operating bauxite residue areas;
- $17 related to spent pot lining treatment and disposal;
- $16 related to the closure of the Wenatchee smelter announced in the fourth quarter of 2021;
- $5 related to the closure of the Lake Charles anode facility announced in the third quarter of 2021; and,
- $5 related to changes in scope for landfill closures.

The additional accruals were primarily recorded with corresponding capitalized asset retirement costs (see Note B) except for $23 related to closed sites which were recorded to Restructuring and other charges, net on the accompanying Statement of Consolidated Operations (see Note D).

In 2022, reversals of previously recorded liabilities included a reversal of $12 due to the completion of demolition projects at numerous permanently closed sites. In 2021, reversals of previously recorded liabilities included a reversal of $5 due to the determination that previously estimated demolition costs were not required at the previously closed Tennessee site.

S. Contingencies and Commitments

Contingencies

Environmental Matters

Alcoa Corporation participates in environmental assessments and cleanups at several locations. These include currently or previously owned or operated facilities and adjoining properties, and waste sites, including Superfund (Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)) sites.

Alcoa Corporation's environmental remediation reserve balance reflects the most probable costs to remediate identified environmental conditions for which costs can be reasonably estimated. The following table details the changes in the carrying value of recorded environmental remediation reserves:

Balance at December 31, 2019	$	335
Liabilities incurred		7
Cash payments		(19)
Reversals of previously recorded liabilities		(1)
Balance at December 31, 2020		322
Liabilities incurred		21
Cash payments		(23)
Reversals of previously recorded liabilities		(17)
Foreign currency translation and other		6
Balance at December 31, 2021		309
Liabilities incurred		32
Cash payments		(26)
Reversals of previously recorded liabilities		(30)
Foreign currency translation and other		(1)
Balance at December 31, 2022	$	284

At December 31, 2022 and 2021, the current portion of the remediation reserve balance was $58 and $44, respectively.

In 2022, the Company incurred liabilities of $32 primarily related to $14 for the closure of the previously curtailed magnesium smelter in Addy (Washington), $6 for estimates for environmental remediation at the Point Henry site, $4 for a new phase of work at the former East St. Louis site and $9 for environmental activities at various sites. These charges are recorded in Cost of goods sold and Restructuring and other charges, net (see Note D) on the accompanying Statement of Consolidated Operations. Payments related to remediation expenses applied against the reserve were $26 in 2022. These amounts include mandated expenditures as well as those not required by any regulatory authority or third party. Further, the Company recorded a reversals of reserves of $30 during 2022, primarily related to changes in estimates for site remediation at Massena East of $18 and Suralco of $5, and completion of remediation at a previously closed site in Brazil of $6.

In 2021, the Company incurred liabilities of $21 primarily related to remediation design considerations at the Longview site in Washington, closure of the Wenatchee aluminum smelter in Washington, environmental activities at the Point Comfort site in Texas, closure of the anode plant at the Lake Charles site in Louisiana, and wetlands mitigation at the Longview site in Washington, as well as other increases for ongoing monitoring and maintenance at various sites. These charges are primarily recorded in Cost of goods sold and Restructuring and other charges, net on the accompanying Statement of Consolidated Operations. These amounts include mandated expenditures as well as those not required by any regulatory authority or third-party. Further, the Company recorded reversals of reserves of $17 related to:

- $7 due to the determination that previously estimated site remediation is not required at the previously closed Tennessee site;
- $5 due to lower costs for waste treatment at a previously closed Suriname site; and,
- $5 due to lower costs for site remediation related to a previously closed site in Brazil.

In 2020, the Company incurred liabilities of $7 which were primarily related to ongoing remediation work at various sites. The additional accruals were recorded to Cost of goods sold except for $1 which was recorded to Restructuring and other charges, net on the accompanying Statement of Consolidated Operations (see Note D).

The estimated timing of cash outflows from the environmental remediation reserve at December 31, 2022 is as follows:

2023	$	58
2024 - 2027		169
Thereafter		57
Total	$	284

Reserve balances at December 31, 2022 and 2021, associated with significant sites with active remediation underway or for future remediation were $234 and $247, respectively. In management's judgment, the Company's reserves are sufficient to satisfy the provisions of the respective action plans. Upon changes in facts or circumstances, a change to the reserve may be required. The Company's significant sites include:

Poços de Caldas, Brazil—The reserve associated with the 2015 closure of the Alcoa Alumínio S.A. smelter in Poços de Caldas, Brazil, is for remediation of historic smelting operations, spent potlining storage and disposal areas.

Fusina and Portovesme, Italy—Alcoa Corporation's subsidiary Alcoa Trasformazioni S.r.l. has remediation projects underway for its closed smelter sites at Fusina and Portovesme which have been approved by the Italian Ministry for Ecologic Transition (MET). Soil remediation at the Fusina site was mostly completed in the first half of 2022, however, the scope of the project was changed to include the northwest area of the site; approval of the change is expected in the second half of 2023 with completion by the end of 2024. Soil remediation at the Portovesme site was completed in the first half of 2022.

Suriname—The reserve associated with the 2017 closure of the Suralco refinery and bauxite mine is for treatment and disposal of refinery waste and soil remediation. The work began in 2017 and is expected to be completed at the end of 2025.

Hurricane Creek, Arkansas—The reserve associated with the 1990 closure of two mining areas and refineries near Hurricane Creek, Arkansas is for ongoing monitoring and maintenance for water quality surrounding the mine areas and residue disposal areas.

Massena, New York—The reserve associated with the 2015 closure of the Massena East smelter by the Company's subsidiary, Reynolds Metals Company, is for subsurface soil remediation to be performed after demolition of the structures. Remediation work commenced in 2021 and will take four to eight years to complete.

Point Comfort, Texas—The reserve associated with the 2019 closure of the Point Comfort alumina refinery is for disposal of industrial wastes contained at the site, subsurface remediation, and post-closure monitoring and maintenance. The final remediation plan is currently under review, which may result in a change to the existing reserve.

Sherwin, Texas—In connection with the 2018 settlement of a dispute related to the previously-owned Sherwin alumina refinery, the Company's subsidiary, Copano Enterprises LLC, accepted responsibility for the final closure of four bauxite residue waste disposal areas (known as the Copano facility). Work commenced on the first residue disposal area in 2018 and will take up to three additional years to complete, depending on the nature of its potential re-use. Other than ongoing maintenance and repair activities, work on the next three areas has not commenced but is expected to be completed by 2048, depending on its potential re-use.

Longview, Washington— In connection with a 2018 Consent Decree and Cleanup Action Plan with the State of Washington Department of Ecology, the Company's subsidiary, Northwest Alloys as landowner, accepted certain responsibilities for future remediation of contaminated soil and sediments at the site located near Longview, Washington. In December 2020, the lessee of the land, who was a partner in the remediation of the site, filed for bankruptcy and exited the site in January 2021. Remediation design changes for consolidation and remediation of the onsite industrial waste landfills, groundwater remediation, and post-closure monitoring and maintenance at the site was completed in 2021.

Addy, Washington—The reserve associated with the 2022 closure of the Addy magnesium smelter facility is for site-wide remediation and investigation and post-closure monitoring and maintenance. Remediation work is not expected to begin until 2024 and will take three to five years to complete. The final remediation plan is currently being developed, which may result in a change to the existing reserve.

Other Sites—The Company is in the process of decommissioning various other plants and remediating sites in several countries for potential redevelopment or to return the land to a natural state. In aggregate, there are approximately 30 remediation projects at these other sites that are planned or underway. These activities will be completed at various times in the future with the latest expected to be in 2026, after which ongoing monitoring and other activities may be required. At December 31, 2022 and 2021, the reserve balance associated with these activities was $50 and $62, respectively.

Tax

Brazil (AWAB)— In March 2013, AWAB was notified by the Brazilian Federal Revenue Office (RFB) that approximately $110 (R$220) of value added tax credits previously claimed were being disallowed and a penalty of 50% was assessed. Of this amount, AWAB received $41 (R$82) in cash in May 2012. The value added tax credits were claimed by AWAB for both fixed assets and export sales related to the Juruti bauxite mine and São Luís refinery expansion for tax years 2009 through 2011. The RFB has disallowed credits they allege belong to the consortium in which AWAB owns an interest and should not have been claimed by AWAB. Credits have also been disallowed as a result of challenges to apportionment methods used, questions about the use of the credits, and an alleged lack of documented proof. AWAB presented defense of its claim to the RFB on April 8, 2013. In February 2022, the RFB notified AWAB that it had inspected the value added tax credits claimed for 2012 and disallowed $4 (R$19). In its decision, the RFB allowed credits of $14 (R$65) that were similar to those previously disallowed for 2009 through 2011. In July 2022, the RFB notified AWAB that it had inspected the value added tax credits claimed for 2013 and disallowed $13 (R$70). In its decision, the RFB allowed credits of $16 (R$84) that were similar to those previously disallowed for 2009 through 2011. The decisions on the 2012 and 2013 credits provide positive evidence to support management's opinion that there is no basis for these credits to be disallowed. AWAB received the 2012 allowed credits with interest of $9 (R$44) in March 2022 and the 2013 allowed credits with interest of $6 (R$31) in August 2022. AWAB will continue to dispute the credits that were disallowed for 2012 and 2013. If AWAB is successful in this administrative process, the RFB would have no further recourse. If unsuccessful in this process, AWAB has the option to litigate at a judicial level. Separately from AWAB's administrative appeal, in June 2015, a new tax law was enacted repealing the provisions in the tax code that were the basis for the RFB assessing a 50% penalty in this matter. As such, the estimated range of reasonably possible loss for these matters is $0 to $45 (R$239). It is management's opinion that the allegations have no basis; however, at this time, the Company is unable to reasonably predict an outcome for this matter.

Australia (AofA)— In December 2019, AofA received a statement of audit position (SOAP) from the Australian Taxation Office (ATO) related to the pricing of certain historic third-party alumina sales. The SOAP proposed adjustments that would result in additional income tax payable by AofA. During 2020, the SOAP was the subject of an independent review process within the ATO. At the conclusion of this process, the ATO determined to continue with the proposed adjustments and issued Notices of Assessment (the Notices) that were received by AofA on July 7, 2020. The Notices asserted claims for income tax payable by AofA of approximately $143 (A$214). The Notices also included claims for compounded interest on the tax amount totaling approximately $474 (A$707).

On September 17, 2020, the ATO issued a position paper with its preliminary view on the imposition of administrative penalties related to the tax assessment issued to AofA. This paper proposed penalties of approximately $86 (A$128).

AofA disagreed with the Notices and with the ATO's proposed position on penalties. In September 2020, AofA lodged formal objections to the Notices. In the fourth quarter of 2020, AofA provided a submission on the ATO's imposition of interest and also submitted a response to the ATO's position paper on penalties. After the ATO completes its review of AofA's response to the penalties position paper, the ATO could issue a penalty assessment.

To date, AofA has not received a response to its submission on the ATO's imposition of interest or its response to the ATO's position paper on penalties.

Through February 1, 2022, AofA did not receive a response from the ATO on AofA's formal objections to the Notices and, on that date, AofA submitted statutory notices to the ATO requiring the ATO to make decisions on AofA's objections within a 60-day period. On April 1, 2022, the ATO issued its decision disallowing the Company's objections related to the income tax assessment, while the position on penalties and interest remains outstanding.

On April 29, 2022, AofA filed proceedings in the Australian Administrative Appeals Tribunal (AAT) against the ATO to contest the Notices, a process which could last several years. The AAT held the first directions hearing on July 25, 2022 ordering AofA to file its evidence and related materials by November 4, 2022, ATO to file its materials by April 14, 2023 and AofA to file reply materials by May 26, 2023. AofA filed its evidence and related materials on November 4, 2022. The Company maintains that the sales subject to the ATO's review, which were ultimately sold to Aluminium Bahrain B.S.C., were the result of arm's length transactions by AofA over two decades and were made at arm's length prices consistent with the prices paid by other third-party alumina customers.

In accordance with the ATO's dispute resolution practices, AofA paid 50% of the assessed income tax amount exclusive of interest and any penalties, or approximately $74 (A$107), during the third quarter 2020, and the ATO is not expected to seek further payment prior to final resolution of the matter. If AofA is ultimately successful, any amounts paid to the ATO as part of the 50% payment would be refunded. AofA funded the payment with cash on hand and recorded the payment within Other noncurrent assets as a noncurrent prepaid tax asset; the related December 31, 2022 balance is $72 (A$107).

Further interest on the unpaid tax will continue to accrue during the dispute. The initial interest assessment and the additional interest accrued are deductible against taxable income by AofA but would be taxable as income in the year the dispute is resolved if AofA is ultimately successful. AofA applied this deduction beginning in the third quarter of 2020 which reduced cash tax payments by approximately $169 (A$219) in 2020, $14 (A$19) in 2021, and $15 (A$22) in 2022. This amount has been reflected within Other noncurrent liabilities and deferred credits as a noncurrent accrued tax liability; the related December 31, 2022 balance is $174 (A$260).

The Company continues to believe it is more likely than not that AofA's tax position will be sustained and therefore is not recognizing any tax expense in relation to this matter. However, because the ultimate resolution of this matter is uncertain at this time, the Company cannot predict the potential loss or range of loss associated with the outcome, which may materially affect its results of operations and financial condition. References to any assessed U.S. dollar amounts presented in connection with this matter have been converted into U.S. dollars from Australian dollars based on the exchange rate in the respective period.

AofA is part of the Company's joint venture with Alumina Limited, an Australian public company listed on the Australian Securities Exchange. The Company and Alumina Limited own 60% and 40%, respectively, of the joint venture entities, including AofA.

Other

Spain— In July 2019, the Company completed the divestiture of the Avilés and La Coruña (Spain) aluminum facilities to PARTER Capital Group AG (PARTER) in a sale process endorsed by the Spanish government and supported by the workers' representatives following a collective dismissal process.

In connection with the divestiture, Alcoa committed to make financial contributions to the divested entities of up to $95; a total of $78 was paid through December 31, 2021.

In early 2020, PARTER sold a majority stake in the facilities to an unrelated party. Alcoa had no knowledge of the subsequent transaction prior to its announcement and on August 28, 2020, Alcoa filed a lawsuit with the Court of First Instance in Madrid, Spain asserting that the sale was in breach of the sale agreement between Alcoa and PARTER.

Related to this subsequent sale transaction, certain proceedings and investigations have been initiated by or at the request of the employees of the facilities against their current employers, the new owners of the current employers, and Alcoa, alleging that certain agreements from the 2019 collective dismissal process remain in force and that, under such agreements, Alcoa remains liable for certain related employment benefits. One such proceeding is a collective case before the Spanish National Court, filed on November 10, 2020, wherein the workers' representatives and employees are seeking to have the terms of a Collective Dismissal Agreement signed between Alcoa and the workers in January 2019 be fulfilled. Other proceedings include: a second collective claim filed in National Court on behalf of employees that were not affected by the 2019 collective dismissal process, numerous individual labor claims filed in the labor courts of Avilés and La Coruña and the initiation of a separate criminal investigation by the National Court.

On June 15, 2021, the Spanish National Court ruled that the collective dismissal agreement for the divested Avilés and La Coruña aluminum facilities should be applied to the situation of the claimant workers, and that Alcoa should be liable for the severance of those employees to the extent they were affected by the 2019 collective dismissal process. Alcoa appealed this ruling to the Supreme Court of Spain.

In July 2021, the Spanish National Court appointed a judicial director to oversee the facilities and later declared the facilities insolvent. In early 2022, the insolvency administrators appointed by the courts (one for each facility) announced their intention to collectively dismiss all employees at the two facilities.

In the first quarter of 2022, the Company recorded a charge of $77 in Restructuring and other charges, net to reflect its estimate for the agreement reached with the workers of the divested Avilés and La Coruña facilities (Spain) to settle various legal disputes related to the 2019 divestiture.

In April 2022, the Company received unanimous acceptance of the offer from all active workers of the divested Avilés and La Coruña facilities and a Global Settlement Agreement (GSA) was fully executed. The Company recorded a charge of $2 in Restructuring and other charges, net in the quarter ended June 30, 2022 to reflect an update to its estimated liability for the GSA. The Company expects to make cash payments in 2023 upon completion of certain administrative and judicial approvals.

General

In addition to the matters discussed above, various other lawsuits, claims, and proceedings have been or may be instituted or asserted against Alcoa Corporation, including those pertaining to environmental, safety and health, commercial, tax, product liability, intellectual property infringement, employment, and employee and retiree benefit matters, and other actions and claims arising out of the normal course of business. While the amounts claimed in these other matters may be substantial, the ultimate liability is not readily determinable because of the considerable uncertainties that exist. Accordingly, it is possible that the Company's liquidity or results of operations in a particular period could be materially affected by one or more of these other matters. However, based on facts currently available, management believes that the disposition of these other matters that are pending or asserted will not have a material adverse effect, individually or in the aggregate, on the financial position of the Company.

Commitments

Purchase Obligations. Alcoa Corporation is party to unconditional purchase obligations for energy that expire between 2040 and 2041. Commitments related to these contracts total $59 in 2023, $62 in 2024, $64 in 2025, $66 in 2026, $68 in 2027, and $716 thereafter. Expenditures under these contracts totaled $58 in 2022, $86 in 2021, and $79 in 2020. Additionally, the Company has entered into other purchase commitments for energy, raw materials, and other goods and services, which total $4,402 in 2023, $2,328 in 2024, $2,004 in 2025, $1,665 in 2026, $1,518 in 2027, and $10,392 thereafter.

AofA has a gas supply agreement to power its three alumina refineries in Western Australia which began in July 2020 for a 12-year period. The terms of this agreement required AofA to make a prepayment of $500 in two installments, the first of which was made in June 2015 for $300. The second installment of $200 was made in April 2016. At December 31, 2022, Alcoa Corporation had a total asset of $348 (A$519), which was included in Prepaid expenses and other current assets ($37) and Other noncurrent assets ($311) (see Note U) on the accompanying Consolidated Balance Sheet related to these prepayments. At December 31, 2021, Alcoa Corporation had a total asset of $417 (A$571), which was included in Prepaid expenses and other current assets ($40) and Other noncurrent assets ($377) (see Note U) on the accompanying Consolidated Balance Sheet.

Guarantees of Third Parties. As of December 31, 2022 and 2021, the Company had no outstanding potential future payments for guarantees issued on behalf of a third-party.

Bank Guarantees and Letters of Credit. Alcoa Corporation has outstanding bank guarantees and letters of credit related to, among others, energy contracts, environmental obligations, legal and tax matters, leasing obligations, workers compensation, and customs duties. The total amount committed under these instruments, which automatically renew or expire at various dates between 2023 and 2024, was $293 (includes $131 issued under a standby letter of credit agreement —see below) at December 31, 2022. Additionally, ParentCo has outstanding bank guarantees and letters of credit related to the Company of $14 at December 31, 2022. In the event ParentCo would be required to perform under any of these instruments, ParentCo would be indemnified by Alcoa Corporation in accordance with the Separation and Distribution Agreement. Likewise, the Company has outstanding bank guarantees and letters of credit related to ParentCo of $8 at December 31, 2022. In the event Alcoa Corporation would be required to perform under any of these instruments, the Company would be indemnified by ParentCo in accordance with the Separation and Distribution Agreement.

In August 2017, Alcoa Corporation entered into a standby letter of credit agreement, which expires on June 27, 2024 (extended in August 2018, May 2019, May 2021, and June 2022), with three financial institutions. The agreement provides for a $200 facility used by the Company for matters in the ordinary course of business. Alcoa Corporation's obligations under this facility are secured in the same manner as obligations under the Company's revolving credit facility. Additionally, this facility contains similar representations and warranties and affirmative, negative, and financial covenants as the Company's revolving credit facility (see Note M). As of December 31, 2022, letters of credit aggregating $131 were issued under this facility.

Surety Bonds. Alcoa Corporation has outstanding surety bonds primarily related to tax matters, contract performance, workers compensation, environmental-related matters, and customs duties. The total amount committed under these bonds, which automatically renew or expire at various dates between 2023 and 2027, was $174 at December 31, 2022. Additionally, ParentCo has outstanding surety bonds related to the Company of $11 at December 31, 2022. In the event ParentCo would be required to perform under any of these instruments, ParentCo would be indemnified by Alcoa Corporation in accordance with the Separation and Distribution Agreement. Likewise, the Company has outstanding surety bonds related to ParentCo of $3 at December 31, 2022. In the event Alcoa Corporation would be required to perform under any of these instruments, the Company would be indemnified by ParentCo in accordance with the Separation and Distribution Agreement.

T. Leasing

Management records a right-of-use asset and lease liability for several types of operating leases, including land and buildings, alumina refinery process control technology, plant equipment, vehicles, and computer equipment. These amounts are equivalent to the aggregate future lease payments on a discounted basis. The leases have remaining terms of less than one to 35 years. The discount rate applied to these leases is the Company's incremental borrowing rate based on the information available at the commencement date in determining the present value of lease payments, unless there is a rate implicit in the lease agreement. The Company does not have material financing leases.

Lease expense and operating cash flows include:

	2022	2021
Costs from operating leases	$ 54	$ 70
Variable lease payments	$ 16	$ 13
Short-term rental expense	$ 2	$ 3

The weighted average lease term and weighted average discount rate were as follows:

December 31,	2022	2021
Weighted average lease term for operating leases (years)	5.1	4.9
Weighted average discount rate for operating leases	5.6%	5.2%

The following represents the aggregate right-of-use assets and related lease obligations recognized in the Consolidated Balance Sheet:

December 31,	2022	2021
Properties, plants, and equipment, net	$ 89	$ 97
Other current liabilities	30	35
Other noncurrent liabilities and deferred credits	59	64
Total operating lease liabilities	$ 89	$ 99

New leases of $26 and $24 were added during the years ended December 31, 2022 and 2021, respectively.

The future cash flows related to the operating lease obligations as of December 31, 2022 were as follows:

Year Ending December 31,	
2023	$ 37
2024	25
2025	14
2026	11
2027	8
Thereafter	16
Total lease payments (undiscounted)	111
Less: discount to net present value	(22)
Total	$ 89

U. Other Financial Information

Interest Cost Components

	2022	2021	2020
Amount charged to expense	$ 106	$ 195	$ 146
Amount capitalized	3	6	9
	$ 109	$ 201	$ 155

Other (Income) Expenses, Net

	2022	2021	2020
Equity loss (gain)	$ 27	$ (105)	$ 46
Foreign currency losses, net	9	3	20
Net loss (gain) from asset sales	10	(354)	(173)
Net (gain) loss on mark-to-market derivative instruments (P)	(174)	(25)	11
Non-service costs – pension and OPEB (O)	60	47	108
Other, net	(50)	(11)	(4)
	$ (118)	$ (445)	$ 8

In 2021, Net loss (gain) from asset sales of $354 was primarily related to the sales of the Rockdale site, the Eastalco site, and the Warrick Rolling Mill (see Note C). In 2020, Net gain from asset sales included a $181 gain related to the sale of EES (see Note C).

In 2022, Other, net of $50 was primarily related to interest income for the Brazil value added tax credits (see Note S).

Other Noncurrent Assets

December 31,	2022	2021
Gas supply prepayment (S)	$ 311	$ 377
Prepaid gas transmission contract	285	304
Value added tax credits	294	215
Deferred mining costs, net	161	149
Prepaid pension benefit (O)	146	164
Goodwill (L)	145	144
Noncurrent restricted cash (see below)	56	106
Noncurrent prepaid tax asset (S)	72	78
Intangibles, net (L)	29	35
Other	94	92
	$ 1,593	$ 1,664

Prepaid gas transmission contract—As part of a previous sale transaction of an equity investment, Alcoa maintained access to approximately 30% of the Dampier to Bunbury Natural Gas Pipeline transmission capacity in Western Australia for gas supply to three **alumina refineries. At December 31, 2022 and 2021, AofA had an asset of $285 and $304, respectively, representing prepayments made under the agreement for future gas transmission services.**

Value added tax credits—The Value added tax (VAT) credits (federal and state) relate to two of the Company's subsidiaries in Brazil, AWAB and Alumínio, concerning the São Luís smelter and refinery and the Juruti mine. This refinery pays VAT on the purchase of goods and services used in the alumina production process. The credits generally can be utilized to offset the VAT charged on domestic sales of alumina and aluminum.

In March 2021, the Brazil Federal Supreme Court provided clarification on an earlier ruling that found the inclusion of state VAT within the federal VAT tax base to be unconstitutional. After receiving further clarification from the court in August 2021, the Company finalized the amount of its recovery claim and submitted the claim to the tax authorities in the fourth quarter and received acknowledgment of the claim in January 2022. As a result, in the fourth quarter of 2021, the Company recorded $95 of additional VAT credits in Other noncurrent assets, $47 payable to Arconic Corporation within Other noncurrent liabilities, $34 in Sales, and $14 of interest income within Other (income) expenses, net. The amount due to Arconic Corporation represents VAT payments related to an Arconic subsidiary previously owned by Alumínio for a portion of the claim years and covered under agreements related to the Separation Transaction (see Note A).

In the fourth quarter of 2018, after an assessment of the future realizability of the state VAT credits, the Company established an allowance on the accumulated state VAT credit balances and recorded a $107 charge in Restructuring and other charges, net, on the accompanying Statement of Consolidated Operations. With the restart of the Alumar smelter in São Luís, Brazil and its first metal sales in June 2022, the Company now has the ability to monetize these credits. In June 2022, the Company reversed the allowance with a credit of $83 to Restructuring and other charges, net and reversed the subsequent additions to the valuation allowance with a credit of $46 to Cost of goods sold (same accounts as when incurred).

Other Noncurrent Liabilities and Deferred Credits

December 31,	2022	2021
Noncurrent accrued tax liability (S)	$ 174	$ 174
Accrued compensation and retirement costs	95	120
Operating lease obligations (T)	59	64
Deferred energy credits	37	54
Value added tax credits payable to Arconic Corporation	51	47
Noncurrent restructuring reserve (D)	3	43
Deferred alumina sales revenue	28	36
Noncurrent site separation reserve (C)	—	26
Other	39	35
	$ 486	$ 599

Deferred energy credits—Deferred energy credits relate to cash received for 2018 and 2019 carbon dioxide emissions related to the San Ciprián smelter ($40) and refinery ($6), as well as the divested Avilés and La Coruña facilities ($7), from a governmental agency in Spain. During 2022, these credits were repaid and cash was received for 2021 San Ciprián smelter carbon dioxide emission credits ($30). The terms of the credits require the Company to comply with certain conditions for a period of three years. These deferred credits will be recognized as a reduction to Cost of goods sold once it is determined to be probable the Company will satisfy all conditions. Should the Company not meet all conditions during the three-year period, the credits will be repaid to the governmental agency.

During the fourth quarter of 2022, the Norwegian government approved a 2023 budget proposal that sets a floor for the carbon dioxide compensation to be paid in 2023 based on 2022 power purchased. The Company recorded an adjustment of $25 in the fourth quarter of 2022 to Cost of goods sold to reverse amounts accrued for 2022 credits earned through September 30, 2022 under the prior carbon dioxide compensation program.

Value added tax credits payable to Arconic Corporation—See, Other noncurrent assets—Value added tax credits, above.

Cash and Cash Equivalents and Restricted Cash

December 31,	2022	2021
Cash and cash equivalents	$ 1,363	$ 1,814
Current restricted cash	55	4
Noncurrent restricted cash	56	106
	$ 1,474	$ 1,924

On December 29, 2021, the Company announced the two-year curtailment of the San Ciprián aluminum smelter in Spain. As a result of the agreement reached between Alcoa and the San Ciprián workers' representatives, the Company has restricted cash of $103 to be made available in the future to cover capital expenditures and future restart costs associated with the planned restart at the end of the curtailment period.

Cash Flow Information

Cash paid for interest and income taxes was as follows:

	2022	2021	2020
Interest, net of amount capitalized	$ 100	$ 191	$ 135
Income taxes, net of amount refunded	504	152	183

V. Subsequent Events

On February 23, 2023, the Board of Directors declared a quarterly cash dividend of $0.10 per share of the Company's common stock, to be paid on March 23, 2023 to stockholders of record as of the close of business on March 7, 2023.

On February 3, 2023, the Company reached an updated agreement with the workers' representatives to commence the restart process of the San Ciprián (Spain) aluminum smelter in phases beginning in January 2024. Alcoa plans that all pots will be restarted by October 1, 2025, and from October 1, 2025 until the end of 2026, the minimum production will be 75 percent of the annual capacity of 228 kmt. Under the terms of the updated agreement, the Company is responsible for certain employee obligations during the extended curtailment period. As a result, the Company will record charges of approximately $50 (pre- and after-tax) in the first quarter of 2023 in Restructuring and other charges, net on the Statement of Consolidated Operations. Cash outlays related to these obligations are expected in 2024 and 2025. In connection with the updated agreement, the Company made additional commitments of $78 for capital improvements at the site to be spent primarily between 2024 and 2025.

In January 2023, the Company reduced production at the Kwinana (Australia) refinery by approximately 30 percent in response to a domestic natural gas shortage in Western Australia due to production challenges experienced by key gas suppliers.

Beginning in January 2023, the financial information provided to the chief operating decision maker (CODM) for the activities of the bauxite mines and the alumina refineries was combined, and accordingly the Company changed its operating segments. Beginning with the first quarter of 2023, the Company will report its financial results in the following two segments: (i) Alumina, and (ii) Aluminum. Segment information for all prior periods presented will be updated to reflect the new segment structure.

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure.

None.

Item 9A. Controls and Procedures.

(a) Evaluation of Disclosure Controls and Procedures

Alcoa Corporation's Chief Executive Officer and Chief Financial Officer have evaluated the Company's disclosure controls and procedures, as defined in Rules 13a-15(e) and 15d-15(e) of the U.S. Securities Exchange Act of 1934, as amended, as of the end of the period covered by this report, and they have concluded that these controls and procedures were effective as of December 31, 2022.

(b) Management's Annual Report on Internal Control over Financial Reporting

Management's Report on Internal Control over Financial Reporting is included in Part II Item 8 of this Form 10-K.

(c) Attestation Report of the Registered Public Accounting Firm

The effectiveness of Alcoa Corporation's internal control over financial reporting as of December 31, 2022 has been audited by PricewaterhouseCoopers LLP (PCAOB ID No. 238), an independent registered public accounting firm, as stated in their report, which is included in Part II Item 8 of this Form 10-K.

(d) Changes in Internal Control over Financial Reporting

There have been no changes in internal control over financial reporting during the fourth quarter of 2022 that have materially affected, or are reasonably likely to materially affect, the Company's internal control over financial reporting.

Item 9B. Other Information.

None.

Item 9C. Disclosure Regarding Foreign Jurisdictions that Prevent Inspections.

Not applicable.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

The information required by Item 401 of Regulation S-K regarding executive officers is set forth in Part I Item 1 of this Form 10-K under the caption "Information about our Executive Officers." The information required by Item 401 of Regulation S-K regarding directors is contained under the caption "Item 1 Election of 9 Director Nominees to Serve for One-Year Terms Expiring in 2024" of Alcoa Corporation's Definitive Proxy Statement for the 2023 Annual Meeting of Stockholders (Proxy Statement), which will be filed with the SEC within 120 days of the end of Alcoa Corporation's fiscal year ended December 31, 2022 (Proxy Statement) and is incorporated herein by reference.

The Company's Code of Conduct and Ethics (Code of Conduct), which incorporates a code of ethics that applies to our principal executive officer, principal financial officer, principal accounting officer or controller, is publicly available on the Company's website at www.alcoa.com under the section "Investors—Governance—Governance Documents—Code of Conduct." Alcoa Corporation will post any amendments to, or waivers of, its Code of Conduct that apply to its principal executive officer, principal financial officer, principal accounting officer or controller on its website at www.alcoa.com.

The information required by Items 407(c)(3), (d)(4) and (d)(5) of Regulation S-K is included under the captions "Item 1 Election of 9 Director Nominees to Serve for One-Year Terms Expiring in 2024—Nominating Board Candidates—Procedures and Director Qualifications," "Corporate Governance—Board Information—Meetings, Attendance and Committee Composition" and "Corporate Governance—Board Information—Committees of the Board" of the Proxy Statement and is incorporated herein by reference.

Item 11. Executive Compensation.

The information required by Item 402 and Item 407(e)(4) and (e)(5) of Regulation S-K is contained under the captions "Item 1 Election of 9 Director Nominees to Serve for One-Year Terms Expiring in 2024—Non-Employee Director Compensation Program," "Executive Compensation," "Corporate Governance—Board Information—The Board's Role in Risk Oversight," "Corporate Governance—Board Information—Committees of the Board," and "Corporate Governance—Compensation Matters" of the Proxy Statement. Such information (other than the Compensation Committee Report, which shall not be deemed to be filed) is incorporated herein by reference.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

The information required by Item 201(d) of Regulation S-K is contained under the caption “Equity Compensation Plan Information” of the Proxy Statement and is incorporated herein by reference.

The information required by Item 403 of Regulation S-K is contained under the caption “Beneficial Ownership” of the Proxy Statement and is incorporated herein by reference.

Item 13. Certain Relationships and Related Transactions, and Director Independence.

The information required by Item 404 of Regulation S-K is contained under the caption “Corporate Governance —Related Person Transactions” of the Proxy Statement and is incorporated herein by reference.

The information required by Item 407(a) of Regulation S-K is contained under the caption “Corporate Governance—Board Information” of the Proxy Statement and is incorporated herein by reference.

Item 14. Principal Accountant Fees and Services.

The information required by Item 9(e) of Schedule 14A is contained under the caption “Item 2 Ratification of the Appointment of PricewaterhouseCoopers LLP as the Company’s Independent Auditor for 2023—Audit Committee Pre-Approval Policy” and “Item 2 Ratification of the Appointment of PricewaterhouseCoopers LLP as the Company’s Independent Auditor for 2023—Auditor Fees” of the Proxy Statement and is incorporated herein by reference.

PART IV

Item 15. Exhibit and Financial Statement Schedules.

(a) The consolidated financial statements and exhibits listed below are filed as part of this report.

(1) The Company's consolidated financial statements, the notes thereto and the report of the Independent Registered Public Accounting Firm are included in Part II Item 8 of this report.

(2) Financial statement schedules have been omitted because they are not applicable, not required, or the required information is included in the consolidated financial statements or notes thereto.

(3) Exhibits.

Exhibit No.	Description of Exhibit
3.1	Amended and Restated Certificate of Incorporation of Alcoa Corporation (incorporated by reference to Exhibit 3.1 to the Company's Current Report on Form 8-K filed November 3, 2016 (File No. 1-37816))
3.2	Amended and Restated Bylaws of Alcoa Corporation, as adopted on December 6, 2017 (incorporated by reference to Exhibit 3.1 to the Company's Current Report on Form 8-K filed December 8, 2017 (File No. 1-37816))
4.1	Indenture, dated May 17, 2018, among Alcoa Nederland Holding B.V., Alcoa Corporation, certain subsidiaries of Alcoa Corporation, and the Bank of New York Mellon Trust Company, N.A., as trustee (incorporated by reference to Exhibit 4.1 to the Company's Current Report on Form 8-K filed May 17, 2018 (File No. 1-37816))
4.2	Supplemental Indenture, dated as of December 9, 2019, among Alcoa Corporation, Alcoa Treasury S.à r.l, Alcoa Nederland Holding B.V., and The Bank of New York Mellon Trust Company, N.A. under the Indenture dated May 17, 2018 (incorporated by reference to Exhibit 4.5 to the Company's Annual Report on Form 10-K for the year ended December 31, 2019, filed February 21, 2020 (File No. 1-137816))
4.3	Indenture, dated July 13, 2020, among Alcoa Nederland Holding B.V., Alcoa Corporation, certain subsidiaries of Alcoa Corporation, and The Bank of New York Mellon Trust Company, National Association, as trustee (incorporated by reference to Exhibit 4.1 to the Company's Current Report on Form 8-K filed July 13, 2020 (File No. 1-37816))
4.4	Indenture, dated as of March 24, 2021, among Alcoa Nederland Holding B.V., Alcoa Corporation, certain subsidiaries of Alcoa Corporation, and The Bank of New York Mellon Trust Company, N.A., as trustee (incorporated by reference to Exhibit 4.1 to the Company's Current Report on Form 8-K filed March 24, 2021 (File No. 1-37816))
4.5	Description of Securities (incorporated by reference to Exhibit 4.6 to the Company's Annual Report on Form 10-K for the year ended December 31, 2019, filed February 21, 2020 (File No. 1-137816))
10.1	Separation and Distribution Agreement, dated as of October 31, 2016, by and between Arconic Inc. and Alcoa Corporation (incorporated by reference to Exhibit 2.1 to the Company's Current Report on Form 8-K filed November 4, 2016 (File No. 1-37816))
10.2	Tax Matters Agreement, dated as of October 31, 2016, by and between Arconic Inc. and Alcoa Corporation (incorporated by reference to Exhibit 2.3 to the Company's Current Report on Form 8-K filed November 4, 2016 (File No. 1-37816))
10.3	Alcoa Corporation to Arconic Inc. Patent, Know-How, and Trade Secret License Agreement, dated as of October 31, 2016, by and between Alcoa USA Corp. and Arconic Inc. (incorporated by reference to Exhibit 2.5 to the Company's Current Report on Form 8-K filed November 4, 2016 (File No. 1-37816))
10.4	First Amendment to Alcoa Corporation to Arconic Inc. Patent, Know-How, and Trade Secret License Agreement, dated January 5, 2017, by and between Alcoa USA Corp. and Arconic Inc. (incorporated by reference to Exhibit 10.4 to the Company's Annual Report on Form 10-K for the year ended December 31, 2021, filed February 24, 2022 (File No. 1-137816))
10.5	Second Amendment to Alcoa Corporation to Arconic Inc. Patent, Know-How, and Trade Secret License Agreement, effective as of October 18, 2021, by and between Alcoa USA Corp. and Howmet Aerospace Inc. (f/k/a Arconic Inc.) (incorporated by reference to Exhibit 10.5 to the Company's Annual Report on Form 10-K for the year ended December 31, 2021, filed February 24, 2022 (File No. 1-137816))
10.6	Arconic Inc. to Alcoa Corporation Patent, Know-How, and Trade Secret License Agreement, dated as of October 31, 2016, by and between Arconic Inc. and Alcoa USA Corp. (incorporated by reference to Exhibit 2.6 to the Company's Current Report on Form 8-K filed November 4, 2016 (File No. 1-37816))

Exhibit No.	Description of Exhibit
10.7	Amended and Restated Alcoa Corporation to Arconic Inc. Trademark License Agreement, dated as of June 25, 2017, by and between Alcoa USA Corp. and Arconic Inc. (incorporated by reference to Exhibit 2 to the Company's Quarterly Report on Form 10-Q filed August 3, 2017 (File No. 1-37816))
10.8	First Amendment to the Amended and Restated Alcoa Corporation to Arconic Inc. Trademark License Agreement, dated as of April 1, 2022, by and between Alcoa USA Corp and Howmet Aerospace Inc. (f/k/a Arconic Inc.) (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q filed July 25, 2022 (File No. 1-37816))
10.9	Third Amendment and Restatement Agreement, dated as of June 27, 2022, which includes, as Exhibit A thereto, the Revolving Credit Agreement, dated as of September 16, 2016, as amended as of October 26, 2016, as amended and restated as of November 14, 2017, as amended and restated as of November 21, 2018, as amended as of August 16, 2019, as amended as of April 21, 2020, as amended as of June 24, 2020, as amended as of March 4, 2021 and as amended and restated as of June 27, 2022, among Alcoa Corporation, Alcoa Nederland Holding B.V., the lenders and issuers from time to time party thereto, and JPMorgan Chase Bank N.A., as administrative agent for the lenders and issuers (incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K filed June 29, 2022 (File No. 1-37816))
10.10	Amended and Restated Charter of the Strategic Council for the AWAC Joint Venture (incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K filed November 4, 2016 (File No. 1-37816))
10.11	Side Letter of November 1, 2016, between Alcoa Corporation and Alumina Limited clarifying transfer restrictions (incorporated by reference to Exhibit 10.3 to the Company's Current Report on Form 8-K filed November 4, 2016 (File No. 1-37816))
10.12	Third Amended and Restated Limited Liability Company Agreement of Alcoa World Alumina LLC, dated as of November 1, 2016, by and among Alcoa USA Corp., ASC Alumina, Alumina International Holdings Pty Ltd, Alumina (USA) Inc., Reynolds Metals Company, LLC and Reynolds Metals Exploration, Inc. (incorporated by reference to Exhibit 10.2 to the Company's Current Report on Form 8-K filed November 4, 2016 (File No. 1-37816))
10.13	Shareholders' Agreement between Alcoa of Australia Limited, Alcoa Australian Holdings Pty Ltd and Alumina Limited, originally dated as of May 10, 1996 (incorporated by reference to Exhibit 10.13 to Amendment No. 2 to the Company's Registration Statement on Form 10 filed September 1, 2016 (File No. 1-37816))
10.14	Kwinana State Agreement of 1961 (incorporated by reference to Exhibit 10.7 to Amendment No. 2 to the Company's Registration Statement on Form 10 filed September 1, 2016 (File No. 1-37816))
10.15	Pinjarra State Agreement of 1969 (incorporated by reference to Exhibit 10.8 to Amendment No. 2 to the Company's Registration Statement on Form 10 filed September 1, 2016 (File No. 1-37816))
10.16	Wagerup State Agreement of 1978 (incorporated by reference to Exhibit 10.9 to Amendment No. 2 to the Company's Registration Statement on Form 10 filed September 1, 2016 (File No. 1-37816))
10.17	Alumina Refinery Agreement of 1987 (incorporated by reference to Exhibit 10.10 to Amendment No. 2 to the Company's Registration Statement on Form 10 filed September 1, 2016 (File No. 1-37816))
10.18	Framework Agreement, dated June 26, 2019, between Saudi Arabian Mining Company (Ma'aden) and Alcoa Corporation (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q filed July 31, 2019 (File No. 1-37816))
10.19	Amendment and Restatement Deed dated June 26, 2019 relating to the Aluminium Project Framework Shareholders' Agreement originally dated December 20, 2009 between Saudi Arabian Mining Company (Ma'aden) and Alcoa Corporation (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q filed July 31, 2019 (File No. 1-37816))
10.20	Alcoa Corporation 2016 Stock Incentive Plan (as Amended and Restated as of May 9, 2018), (incorporated by reference to Exhibit 99.1 to the Company's Current Report on Form 8-K filed May 15, 2018 (File No. 1-37816))*
10.21	Alcoa USA Corp. Deferred Compensation Plan, effective August 1, 2016, as amended November 15, 2021 (incorporated by reference to Exhibit 10.24 to the Company's Annual Report on Form 10-K for the year ended December 31, 2021, filed February 24, 2022 (File No. 1-137816))*
10.22	Alcoa USA Corp. Nonqualified Supplemental Retirement Plan C (incorporated by reference to Exhibit 10.3 to Amendment No. 1 to the Company's Registration Statement on Form 10 filed August 12, 2016 (File No. 1-37816))*
10.23	Amendment 1 to Alcoa USA Corp. Nonqualified Supplemental Retirement Plan C, effective January 1, 2021 (incorporated by reference to Exhibit 10.9 to the Company's Annual Report on Form 10-K for the year ended December 31, 2017, filed February 23, 2018 (File No. 1-37816))*

Exhibit No.	Description of Exhibit
10.24	Form of Amended and Restated Indemnification Agreement by and between Alcoa Corporation and individual directors or officers, effective August 1, 2017 (incorporated by reference to Exhibit 10.5 to the Company's Quarterly Report on Form 10-Q filed August 3, 2017 (File No. 1-37816))*
10.25	Alcoa Corporation Annual Cash Incentive Compensation Plan (as Amended and Restated), effective February 21, 2018 (incorporated by referenced to Exhibit 10 to the Company's Quarterly Report on Form 10-Q filed May 9, 2018 (File No. 1-37816))*
10.26	Alcoa Corporation Amended and Restated Change in Control Severance Plan, dated July 30, 2019 (incorporated by reference to Exhibit 10.5 to the Company's Quarterly Report on Form 10-Q filed October 31, 2019 (File No. 1-37816))*
10.27	Amendment No. 1, dated as of January 8, 2023 to the Alcoa Corporation Amended and Restated Change in Control Severance Plan, dated July 30, 2019 (filed herewith)*
10.28	Amended and Restated Form of Alcoa Corporation Chief Executive Officer and Chief Financial Officer Executive Severance Agreement, effective as of July 30, 2019 (incorporated by reference to Exhibit 10.6 to the Company's Quarterly Report on Form 10-Q filed October 31, 2019 (File No. 1-37816))*
10.29	Amendment No. 1 to Amended and Restated Executive Severance Agreement, between William F. Oplinger and Alcoa Corporation, effective February 1, 2023 (filed herewith)*
10.30	Amended and Restated Form of Alcoa Corporation Corporate Officer Executive Severance Agreement, effective as of July 30, 2019 (incorporated by reference to Exhibit 10.7 to the Company's Quarterly Report on Form 10-Q filed October 31, 2019 (File No. 1-37816))*
10.31	Terms and Conditions for Employee Stock Option Awards (incorporated by reference to Exhibit 10.30 to the Company's Registration Statement on Form S-1 filed January 18, 2017 (File No. 333-215606))*
10.32	Terms and Conditions for Employee Stock Option Awards, dated January 24, 2018 (incorporated by reference to Exhibit 10.30 to the Company's Annual Report on Form 10-K for the year ended December 31, 2017, filed February 23, 2018 (File No. 1-37816))*
10.33	Terms and Conditions for Employee Restricted Share Units, effective October 1, 2019 (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q filed October 31, 2019 (File No. 1-37816))*
10.34	Terms and Conditions for Employee Stock Option Awards, effective October 1, 2019 (incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q filed October 31, 2019 (File No. 1-37816))*
10.35	Terms and Conditions for Employee Special Retention Awards, effective October 1, 2019 (incorporated by reference to Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q filed October 31, 2019 (File No. 1-37816))*
10.36	Terms and Conditions for Employee Restricted Share Units, effective December 8, 2021 (incorporated by reference to Exhibit 10.37 to the Company's Annual Report on Form 10-K for the year ended December 31, 2021, filed February 24, 2022 (File No. 1-137816))*
10.37	Terms and Conditions for Employee Special Retention Awards, effective December 8, 2021 (incorporated by reference to Exhibit 10.38 to the Company's Annual Report on Form 10-K for the year ended December 31, 2021, filed February 24, 2022 (File No. 1-137816))*
10.38	Alcoa Corporation Non-Employee Director Compensation Policy, effective September 28, 2022 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q filed October 27, 2022))*
10.39	Terms and Conditions for Deferred Fee Restricted Share Units Director Awards, effective December 1, 2016 (incorporated by reference to Exhibit 10.34 to the Company's Registration Statement on Form S-1 filed January 18, 2017 (File No. 333-215606))*
10.40	Terms and Conditions for Deferred Fee Restricted Share Units Director Awards, effective May 4, 2022 (incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q filed July 25, 2022 (File No. 1-37816))*
10.41	Terms and Conditions for Restricted Share Units Annual Director Awards, effective December 1, 2016 (incorporated by reference to Exhibit 10.35 to the Company's Registration Statement on Form S-1 filed January 18, 2017 (File No. 333-215606))*
10.42	Terms and Conditions for Restricted Share Units Annual Director Awards, effective May 9, 2017 (incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report Form 10-Q filed August 3, 2017 (File No. 1-37816))*

Exhibit No.	Description of Exhibit
10.43	Terms and Conditions for Restricted Share Units Annual Director Awards, effective May 4, 2022 (incorporated by reference to Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q filed July 25, 2022 (File No. 1-37816))*
10.44	Alcoa Corporation 2016 Deferred Fee Plan for Directors, effective November 1, 2016, as amended and restated on December 5, 2018 (incorporated by reference to Exhibit 10.37 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2018, filed February 26, 2019 (1-37816))*
21.1	List of Subsidiaries (filed herewith)
23.1	Consent of PricewaterhouseCoopers LLP (filed herewith)
23.2	Consent of SLR International Corporation (filed herewith)
31.1	Certification of Principal Executive Officer required by Securities and Exchange Commission Rule 13a-14(a) or 15d-14(a) (filed herewith)
31.2	Certification of Principal Financial Officer required by Securities and Exchange Commission Rule 13a-14(a) or 15d-14(a) (filed herewith)
32.1	Certification of Principal Executive Officer, required by Rule 13a-14(b) or Rule 15d-14(b) and Section 1350 of Chapter 63 of Title 18 of the United States Code (furnished herewith)
32.2	Certification of Principal Financial Officer, required by Rule 13a-14(b) or Rule 15d-14(b) and Section 1350 of Chapter 63 of Title 18 of the United States Code (furnished herewith)
96.1	Technical Report Summary for Darling Range, Western Australia (filed herewith)
96.2	Technical Report Summary for Juruti, Brazil (incorporated by reference to Exhibit 96.2 to the Company's Annual Report on Form 10-K for the year ended December 31, 2021, filed February 24, 2022 (File No. 1-137816))
99.1	Amended and Restated Grantor Trust Agreement by and between Alcoa Corporation and Wells Fargo Bank, National Association, effective October 24, 2017 (incorporated by reference to Exhibit 99.1 to the Company's Annual Report on Form 10-K for the year ended December 31, 2017, filed February 23, 2018 (File No. 137816))
101.INS	Inline XBRL Instance Document
101.SCH	Inline XBRL Taxonomy Extension Schema Document
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document
104	Cover Page Interactive Data File (formatted as Inline XBRL and contained in Exhibit 101)

Certain schedules exhibits, and appendices have been omitted in accordance with to Item 601(a)(5) of Regulation S-K. The Company hereby undertakes to furnish copies of any omitted schedule, exhibit, or appendix to the Commission upon request.

* Denotes management contracts or compensatory plans or arrangements required to be filed as Exhibits to this Form 10-K.

Item 16. Form 10-K Summary.

Not applicable.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

ALCOA CORPORATION

By: /s/ Molly S. Beerman
Molly S. Beerman
Executive Vice President and Chief Financial Officer

February 23, 2023

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities indicated and as of February 23, 2023.

/s/ Roy C. Harvey	/s/ Molly S. Beerman
Roy C. Harvey President, Chief Executive Officer and Director (Principal Executive Officer and Director)	Molly S. Beerman Executive Vice President and Chief Financial Officer (Principal Financial Officer and Principal Accounting Officer)
/s/ Steven W. Williams	/s/ Mary Anne Citrino
Steven W. Williams Director, Chairman of the Board of Directors	Mary Anne Citrino Director
/s/ Pasquale Fiore	/s/ Thomas J. Gorman
Pasquale Fiore Director	Thomas J. Gorman Director
/s/ James A. Hughes	/s/ Carol L. Roberts
James A. Hughes Director	Carol L. Roberts Director
/s/ Jackson P. Roberts	/s/ Ernesto Zedillo
Jackson P. Roberts Director	Ernesto Zedillo Director

ALCOA CORPORATION
AMENDED AND RESTATED CHANGE IN CONTROL SEVERANCE PLAN
AMENDMENT NO. 1

The Company hereby adopts, as of January 8, 2023, this first amendment of the Alcoa Corporation Amended and Restated Change in Control Severance Plan which was most recently amended and restated on July 30, 2019 ("the Plan"). This Plan is amended as follows:

DEFINITIONS, Section 1.24, is amended to read as follows:

1.24 "Tier I Employee" means the Chief Executive Officer, the Chief Financial Officer, the General Counsel of the Company and such other person or position so designated by the Board or Committee from time to time; provided, however, that such person will cease to be a Tier I Employee for all purposes under this Plan, if such person ceases to serve as the Chief Executive Officer, Chief Financial Officer, General Counsel of the Company or, as to such other persons or positions, if the Board or Committee determines such persons or positions cease to be a Tier I Employee prior to a Change in Control under circumstances other than as described in Section 1.21 hereof and; provided further that such person or position may thereafter be a Tier II Employee under this Plan if the Board or Committee designates such person a corporate officer (other than an assistant officer) of the Company as described in Section 1.25 hereof.

AMENDMENT NO. 1 TO
AMENDED AND RESTATED EXECUTIVE SEVERANCE AGREEMENT

WHEREAS, Alcoa Corporation (the "Company") currently employs William F. Oplinger ("Executive") as Executive Vice President and Chief Financial Officer;

WHEREAS, the Company and Executive executed an Amended and Restated Executive Severance Agreement dated and effective as of July 30, 2019 (the "Agreement");

WHEREAS, the Company has offered Executive an appointment to the position of Chief Operations Officer, which Executive accepted;

WHEREAS, contemporaneous with the commencement of Executive's duties as the Company's Chief Operations Officer effective February 1, 2023 (the "Effective Date"), Executive will cease acting as Chief Financial Officer; and

WHEREAS, the Company and Executive desire to have their respective rights and obligations under the Agreement remain in full force and effect while Executive serves as the Company's Chief Operations Officer;

NOW, by this Amendment No. 1 to the Agreement, the Company and Executive, intending to be legally bound, and for good and valuable consideration, agree as follows:

The section in the Agreement titled "Termination of Officer Status and Agreement" is amended to read as follows:

> You hereby acknowledge and agree that, in the event you cease to be the Chief Executive Officer, Chief Financial Officer or Chief Operations Officer of the Company, as the case may be, as designated by the Board or a committee thereof, and remain employed with the Company in another continuing role thereafter, this Agreement shall immediately terminate and become null and void upon such Board determination date, and you shall not have any right to payments or benefits provided hereunder.

All other provisions of the Agreement shall remain in full force and effect.

[remainder of page intentionally left blank]

IN WITNESS WHEREOF, the Company, by its duly authorized representative, and the Executive have executed this Amendment No. 1 to the Agreement on the dates stated below, effective as of the Effective Date.

ALCOA CORPORATION

By:	/s/ Tammi A. Jones
Name:	Tammi A. Jones
Title:	Executive Vice President and Chief Human Resources Officer
Date:	February 10, 2023

WILLIAM F. OPLINGER

	/s/ William F. Oplinger
Date:	February 10, 2023

Exhibit 21.1

SUBSIDIARIES OF THE REGISTRANT

Name	State or Country of Organization
Alcoa Alumínio S.A.	Brazil
Alcoa Australian Holdings Pty Ltd	Australia
Alcoa Nederland Holding B.V.	Netherlands
Alcoa of Australia Limited[1]	Australia
Alcoa USA Corp.	Delaware
Alcoa USA Holding Company	Delaware
Aluminerie Lauralco B.V.	Netherlands

The names of particular subsidiaries have been omitted because, considered in the aggregate as a single subsidiary, they would not constitute, as of the end of the year covered by this report, a "significant subsidiary" as defined in Regulation S-X under the Securities Exchange Act of 1934, as amended.

1 Part of the AWAC joint venture.

Exhibit 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in the Registration Statement on Form S-8 (Nos. 333-214420, 333-214423, 333-218038, and 333-228258) of Alcoa Corporation of our report dated February 23, 2023 relating to the financial statements and the effectiveness of internal control over financial reporting, which appears in this Form 10-K.

/s/ PricewaterhouseCoopers LLP

PricewaterhouseCoopers LLP
Pittsburgh, Pennsylvania
February 23, 2023

SLR Consulting Ltd
7 Wornal Park, Menmarsh Road, Worminghall, HP18 9PH

Exhibit 23.2

February 23, 2023

CONSENT OF QUALIFIED PERSON

Re: Form 10-K of Alcoa Corporation (the "Company")

SLR Consulting Limited ("**SLR**"), in connection with the Company's Annual Report on Form 10-K for the year ended December 31, 2022 (the "**Form 10-K**"), consents to:

- the public filing by the Company and use of the technical report summary titled "Technical Report Summary on the Darling Range, Western Australia," with an effective date of December 31, 2022 and dated February 23, 2023, and the technical report summary titled "Technical Report Summary for Juruti, Brazil," with an effective date of December 31, 2021 and dated February 24, 2022 (together, the "**Technical Report Summaries**"), that were prepared in accordance with Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission, as exhibits to and referenced in the Form 10-K;

- the incorporation by reference of the Technical Report Summaries into the Company's Registration Statements on Form S-8 (Nos. 333-214420, 333-214423, 333-218038, and 333-228258) (collectively, the "**Registration Statements**");

- the use of and references to our name, including our status as an expert or "qualified person" (as defined in Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission), in connection with the Form 10-K, the Registration Statements, and the Technical Report Summaries; and

- any extracts from or a summary of the Technical Report Summaries in the Form 10-K and incorporated by reference in the Registration Statements and the use of any information derived, summarized, quoted, or referenced from the Technical Report Summaries, or portions thereof, that was prepared by us, that we supervised the preparation of, and/or that was reviewed and approved by us, that is included or incorporated by reference in the Form 10-K and the Registration Statements.

SLR is responsible for authoring, and this consent pertains to, the Technical Report Summaries. SLR certifies that it has read the Form 10-K and that it fairly and accurately represents the information in the Technical Report Summaries for which it is responsible.

SLR Consulting Limited

Per:

/s/ John R. Walker

John R. Walker, FGS, MIMMM, FIQ
Technical Director, Mining Advisory Europe

Exhibit 31.1

CERTIFICATIONS

I, Roy C. Harvey, certify that:

1. I have reviewed this annual report on Form 10-K of Alcoa Corporation;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
    (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
    (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
    (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
    (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
    (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
    (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 23, 2023

/s/ Roy C. Harvey

Name: Roy C. Harvey
Title: President and
Chief Executive Officer

Exhibit 31.2

CERTIFICATIONS

I, Molly S. Beerman, certify that:

1. I have reviewed this annual report on Form 10-K of Alcoa Corporation;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
    (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
    (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
    (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
    (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
    (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
    (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 23, 2023

/s/ Molly S. Beerman

Name: Molly S. Beerman
Title: Executive Vice President and
Chief Financial Officer

Exhibit 32.1

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report of Alcoa Corporation (the "Company") on Form 10-K for the period ended December 31, 2022 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), the undersigned, in the capacity and on the date indicated below, hereby certifies pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that to his knowledge:

1. The Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934; and
2. The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: February 23, 2023

/s/ Roy C. Harvey
Roy C. Harvey
President and Chief Executive Officer

A signed original of this written statement required by Section 906, or other document authenticating, acknowledging, or otherwise adopting the signature that appears in typed form within the electronic version of this written statement required by Section 906, has been provided to the Company and will be retained by the Company and furnished to the Securities and Exchange Commission or its staff upon request.

The foregoing certification is being furnished solely pursuant to 18 U.S.C. Section 1350 and is not being filed as part of this report.

Exhibit 32.2

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report of Alcoa Corporation (the "Company") on Form 10-K for the period ended December 31, 2022 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), the undersigned, in the capacity and on the date indicated below, hereby certifies pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that to her knowledge:

1. The Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934; and
2. The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: February 23, 2023

/s/ Molly S. Beerman
Molly S. Beerman
Executive Vice President and
Chief Financial Officer

A signed original of this written statement required by Section 906, or other document authenticating, acknowledging, or otherwise adopting the signature that appears in typed form within the electronic version of this written statement required by Section 906, has been provided to the Company and will be retained by the Company and furnished to the Securities and Exchange Commission or its staff upon request.

The foregoing certification is being furnished solely pursuant to 18 U.S.C. Section 1350 and is not being filed as part of this report.

Technical Report Summary on the Darling Range, Western Australia S-K 1300 Report

Alcoa Corporation

SLR Project No: 410.064663.00001

February 23, 2023

Technical Report Summary on the Darling Range, Western Australia

SLR Project No: 410.064663.00001

Prepared by
SLR International Corporation
22118 20th Ave SE, Suite G202, Bothell, WA 98021 USA

for

Alcoa Corporation
201 Isabella Street, Suite 500
Pittsburgh, Pennsylvania
15212-5858

Effective Date – December 31, 2022
Signature Date – February 23, 2023

Distribution:
1 copy – Alcoa Corporation
1 copy – SLR International Corporation
1 copy – SLR Consulting Ltd

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1.0 EXECUTIVE SUMMARY

1.1 Summary

SLR International Corporation (SLR) was appointed by Alcoa Corporation (Alcoa) to prepare an independent Technical Report Summary on the Darling Range bauxite mines, located in Western Australia. The purpose of this report is to support the Mineral Resource and Mineral Reserve estimates for the mines as of December 31, 2022. This Technical Report Summary (TRS) conforms to the United States Securities and Exchange Commission's (SEC) Modernized Property Disclosure Requirements for Mining Registrants as described in Subpart 1300 of Regulation S-K, Disclosure by Registrants Engaged in Mining Operations (S-K 1300), and Item 601(b)(96) of Regulation S-K, Technical Report Summary.

1.1.1 Conclusions

1.1.1.1 Geology and Mineral Resources

- The QP is independently declaring the 31 December 2022 Mineral Resources for the defined bauxites located within Alcoa's Darling Range deposits. The Mineral Resource models were prepared by Alcoa using their in-house estimation procedures and reviewed extensively by the QP.
- As of December 31, 2022, exclusive of Mineral Reserves, as summarized in Table 11-5 at an appropriate level of precision reflecting confidence, the Measured Mineral Resources are estimated to be 44.9 Mt at a grade of 31.2% available alumina (A.Al2O3) and 1.15% reactive silica (R.SiO2). Similarly, the Indicated Mineral Resources are estimated to be 51.8 Mt at 31.4% A.Al2O3 and 1.17% R.SiO2, and the Inferred Mineral Resources are estimated to be 140.3 Mt at 32.9% A.Al2O3 and 1.26% R.SiO2.
- Drill sampling and sample control procedures at Alcoa's Darling Range Bauxite Operations are adequate and appropriate for use in the estimation of Mineral Resources. The defined volumes and grades of mineralization are not expected to be systematically impacted (biased) by errors in either the collar location or the 3D sample location.
- In the QP's opinion, the QA/QC of sample preparation and assaying is adequate, and the assay results are suitable for use in Mineral Resource estimation.
- Analytical procedures used for the Alcoa Mineral Resource comprises part of conventional industry practice. FTIR is not widely used yet in the bauxite industry but is becoming more widely accepted and applied to more operations. At Alcoa the method has been consistently applied successfully for a decade and is routinely validated by industry standard XRF and wet chemical procedures as discussed in Section 8.3 and 8.4. It is the opinion of the QP based on the studies on FTIR repeatability that the overall precision and accuracy of the FTIR assaying is acceptable.
- The database is adequate, and the data is appropriate for the purpose of Mineral Resource estimation.
- The continuous improvements in the geological modelling, estimation techniques, and block model migration to the 3D approach are appropriate and constantly improve the confidence level and precision of the Mineral Resources.

- The dry bulk density data is less well controlled than other analytes, although different attempts were taken since 1980. However, based on the different reconciliation approaches and on the fact that the polygonal and GSM model have lower confidence level, the density values are acceptable for the Resource estimation.

- The condition of Reasonable Prospects for Economic Extraction is met by constraining the Mineral Resource model using the ArcGIS system, by ensuring that the model defines key parameters for the refinery, and by sound reconciliation practices providing feedback that the modelling is appropriate for the purpose.

1.1.1.2 Mining and Mineral Reserves

- As of December 31, 2022, Proven Mineral Reserves are estimated to total 145.8Mt at 31.4% A.Al2O3 and 1.2% R.SiO2 and Probable Mineral Reserves are estimated to total 255.8Mt at 32.4% A.Al2O3 and 1.2% R.SiO2.

- The QP has used the December 31, 2022 Mineral Resource estimate as the basis for its Mineral Reserve estimate, applying Modifying Factors only to those Resources classified as Measured Mineral Resources and Indicated Mineral Resources.

- The bauxite operations are operating mining projects with a long history of production for which establishment capital has been repaid and for which sustaining capital and supported operating costs have been observed to be applied in economic analysis. The review of the Capex FEL 2 report for the Myara North Crusher move has provided further support. Consequently, the QP considers that support by a Feasibility Study is demonstrated by the history of profitable operation and the level of technical support for the Modifying Factors. The QP has reviewed the operating and planning procedures and parameters for the operations.

- The QP considers that the accuracy and confidence in the Mineral Reserve estimate to be appropriate for the classification applied, which is supported by both the conservative operational processes and the long operational history.

- The QP is not aware of any risk factors associated with, or changes to, any aspects of the Modifying Factors such as mining, metallurgical, infrastructure, permitting, or other relevant factors that could materially affect the Mineral Reserve estimate.

1.1.1.3 Mineral Processing

- The operating data between 2010 to 2021 indicates that the product from the Darling Range operations consisted of an average A.Al2O3 grade of 33%, with R.SiO2 below the target for refinery feed.

- The QP is of the opinion that the Darling Range operation demonstrated that ore can be effectively crushed and supplied to a refinery for further upgrading to produce alumina. The historical operational data confirmed that the ore consistently met refinery specifications without any deleterious elements.

    - Based on this, and additional information provided by Alcoa regarding the mine plan, it is reasonable to assume that the ore from Darling range can be economically processed for the next 10 years.

1.1.1.4 Infrastructure

- The Darling Range mining operations have established and operational infrastructure, with mining hubs that host administrative offices, as well as crushing facilities and maintenance facilities.
    - Hubs are relocated periodically as production moves away from the hub and transportation costs increase. These relocations are well-understood with planning and associated budgeting occurring well in advance of relocations; production restarted seven days after the shutdown.
- An extensive haul road network, rail, and overland conveyors transport crushed bauxite from the Hub to the refineries.
    - Bauxite is transferred from each mine to the refineries primarily via long distance conveyor belt, apart from the Kwinana refinery which receives bauxite via railway.
    - Alumina produced by the three refineries is then shipped to external and internal smelter customers through the Kwinana and Bunbury ports.
- The Huntly and Willowdale mines are located near the towns of Pinjarra and Waroona respectively. These are easily accessible via the national South Western Highway, a sealed single carriageway road, spanning almost 400 km from the southern side of Perth to the southwest corner of Western Australia.
- Sealed access roads to the main hubs have been established, connecting Huntly and Willowdale to the road network.
- Major haul roads have been established to each mining area, while secondary haul roads, cross-cut each individual mining plateau. Roads are unsealed and require continuous maintenance.
- The Darling Range's Pinjarra refinery receives power from the South West Interconnected System (SWIS), but also has internal generation capacity of 100 MW from four steam driven turbine alternators, with steam produced by gas fired boilers and a gas turbine Heat Recovery Steam Generator (HRSG).
    - The refinery supplies power to the Huntly Mine by a 33,000 volt power supply line and two 13,800 volt lines.
- The Wagerup refinery is a net exporter of power to the SWIS, with internal generation capacity of 108 MW from three steam driven turbine alternators and one gas turbine; steam being generated by gas fired boilers.
    - The refinery supplies power to the Willowdale Mine by a single 22,000 volt power supply.
- Water is used on the mines for dust suppression, dieback washdown, vehicle washdown, workshops, conveyor belt wash, construction, and domestic purposes.
    - The water supplies for mining consist of licensed surface water sources supplemented with treated wastewater from vehicle washdowns, stormwater runoff and maintenance workshops.
    - In 2020, water abstraction comprised approximately 74% of the total Department of Water and Environmental Regulation license allocation (for those sites where

abstraction occurred). An additional 336,105kL was also abstracted from South Dandalup Dam under the agreement with Water Corporation.

- On site facilities include offices, ablutions, crib-rooms, and workshops, however there are no Alcoa accommodation facilities, as the Huntly and Willowdale mining areas are close to established population centers.
- No tailings are generated within the boundaries of the mining operations. The management of tailings generated downstream at the refineries is beyond the boundaries of the Darling Range mining operations and are therefore not considered in this TRS. Waste rock is used to backfill shallow completed pits before covering with topsoil and reforesting.

1.1.1.5 Environment

- Alcoa has established processes to facilitate conformance with environmental requirements, while identifying sensitive areas ahead of time enables them to be managed ahead of disturbance.
- Overburden is carefully segregated for later contouring and rehabilitation of adjacent, completed mining operations. Caprock and other non-viable rock is used to backfill these shallow, completed pits and the viable topsoil spread on top, contoured, and revegetated.
- Bauxite processing residue is only generated at the Refineries, with no tailings generated within the boundaries of the mining operations. Absence of mine waste prevents the need for waste dump construction and monitoring.
- Site monitoring is completed in accordance with conditions of government authorizations and operational licenses at Huntly and Willowdale.
- Alcoa implements a comprehensive water management and monitoring program in accordance with the requirements of its abstraction and operational licenses.
- A groundwater monitoring program commenced in H2 2022 across the Darling Range operations to support approvals and operational monitoring.
    - Alcoa will continue to expand its monitoring program, as necessary, if groundwater quality or quantity has been identified as potentially at risk due to operational or mining activities, or potential exists for mining to impact offsite/private groundwater supply quantity or quality.
    - Alcoa has a long-term groundwater research project within the Intermediate Rainfall Zone to evaluate potential impacts of clearing on groundwater salinization.
- Outcomes of and compliance with the management and monitoring programs have most recently been reported within the 2021 Annual Environmental Review report. Consistent with the outcomes reported between 2018 and 2020:
    - Review of the most recent report, published for 2021 largely reported compliance with environmental commitments and success of operational controls to managed environmental objectives.
- Only a small number of reportable environmental incidents were noted; none of which represent a risk that could adversely affect its license to operate.

1.1.2 Recommendations

1.1.2.1 Geology and Mineral Resources

It is apparent to the QP that the long history of exploration, development and mining of Alcoa's Darling Range bauxite tenements have established sound knowledge and understanding of the geology and mineral endowment. The QP has not identified any fatal flaws in the current practices of mapping (based on the ArcGIS system), drill sampling (based on progressive continuous improvement), assaying (based on calibrated and validated FTIR, with reasonable quality control), estimation (3DBM), database management (using acQuire), the application of mining criteria that assure Reasonable Prospects for Economic Extraction (RPEE), and the application of constraints establishing forestry, heritage and noise limits to the Mineral Resource definition. The following recommendations are offered as suggestions for further improvement, aligned with Alcoa's comprehensive approach to research and development (seen for example in the evolution of their drilling, sampling and assaying technologies). These recommendations are prioritized in terms of their perceived value to the overall operation:

- Continuing to replace the GSM and polygonal areas to the 3D block modelling methodology, using a script-based semi-automated approach, which enables more robust rapid model building. The validation of interpolation parameters using risk-based (conditional simulation) techniques to quantify confidence should be considered.
- To improve the reporting of recoverable resources, a re-blocked block model to a minimum practical mining scale or single mining unit (SMU) should be considered. Economical parameters considering more flexible costs and bauxite prices related to the Mineral Reserves can also be implemented in the Mineral Resources workflow, aiming to optimize the bauxite mineable portion including potential marginal grades.
- Investigate whether the 5% bias in the tonnage between the As Mined and sampling tower weightometers is persistent in the 3D block models.
- Further redrilling or where viable re-assaying of pulps
- Implementation of a mine wide reconciliation system should be considered as a way to overcome the issue of density estimation. This could be integrated with the extensive production tracking data already available from the current fleet management system and operational control system (covering the mining equipment, crushers, conveyors, sampling towers, stockpile stackers and reclaimers).
- To include volume surveys using drones and truck gantry scanning, wet mass measurement using weightometers on conveyors and LoadRite sensors on mining equipment, and infra-red moisture determination, mean that better in situ dry density estimation may become possible if the operation requires it for better refinery feedstock control.
- The QP considers that twinned hole studies are of limited value and should only be implemented once the sample splitting and preparation demonstrates good repeatability, using field duplicates (or the equivalent STE samples). They may be of value to investigate specific issues under closely supervised conditions.
- While the STE procedure could be retained for specific studies, in the QP's opinion, the reintroduction of field duplicates using appropriate riffle splitters under supervision should be considered.

- The QP is of the opinion that the grade characteristics of the bauxite profile could be reproduced in the model, which enables optimization techniques to be used for the definition of mining floors and boundaries, better support for ore loss and dilution studies, and more accurate reconciliation studies.

1.1.2.2 Mining and Mineral Reserves

- Currently a dilution and mining recovery factor is applied to the final Reserves to reconcile the tonnes and grade. The QP recommends applying dilution and ore loss at the re-blocked model level before performing the optimization and reporting these values independently.
- The life-of-mine scheduling requires further refinement with regards to sequencing of the different mining areas and assigning the scheduled years back to the OreBest model (the mining output that defines Reserves).
- The QP recommends detailed haulage analysis focusing on haulage profiles and cycle times to provide more accurate operating costs.
- The QP noted the mining models were in both a 2D grid and 3D model system. Aligning all the mining models within the same 3D mining model system will provide clarity and consistency across Darling Range project with regards to evaluation and reporting processes.

1.1.2.3 Mineral Processing

The historical operational data for the Darling Range demonstrates that ore consistently met refinery specifications.

- Ideally, independent verification of sample analysis is conducted, by a certified laboratory, on a structured program, to ensure the QA/QC aspects of the internal analysis. Within this process a proportion of samples from each batch could be sent to the independent laboratory for analysis and the results can be compared with the internal analysis.
- The QP is appreciative that the mine is operational, meaning a trade-off versus logistics / practicality would need to be carried out.

1.1.2.4 Infrastructure

The Darling Range mining operations have well established infrastructure, with mining hubs that are periodically moved to reduce transportation distances between mining operations and the hubs. The QP make no recommendations regarding infrastructure.

1.1.2.5 Environment

Alcoa has established systems to facilitate adherence to environmental commitments. The QP recommends that the following actions are taken to monitor previously enacted corrective actions, made in response to minor environmental incidents:

- Additional monitoring should be undertaken post-implementation of corrective actions to demonstrate their effectiveness, in particular:
    - following drainage failures related to significant rainfall events, which resulted in surface water flow from dieback areas into dieback free areas.

- following recordings of elevated turbidity for a period exceeding the compliance criteria (25 NTU).
- in response to incidents involving PFAS and AFFF contamination.

1.2 Economic Analysis

1.2.1 Economic Criteria

An un-escalated technical-economic model was prepared on an after-tax discounted cash flow (DCF) basis, the results of which are presented in this subsection.

Annual estimates of mine production with associated cash flows are provided for years 2023 to 2031, based on Proven and Probable Reserves only.

Key criteria used in the analysis are discussed elsewhere throughout this TRS. General assumptions used are summarized in Table 1-1. All values are presented in United States Dollars ($) unless otherwise stated.

Table 1-1: LOM Technical-Economic Assumptions

Description	Value
Start Date	January 1, 2023
Mine Life based on Mineral Reserves	9 years
Average LOM Price Assumption	$21.00
Total Operating Costs	$4,330.6 million
Capital over nine years	$603.2 million
Income tax	$472.5 million
Discount Rate	12.25%
Discounting Basis	End of Period
Inflation	0%
Corporate Income Tax Rate	30%

1.2.2 Cash Flow Analysis

The indicative economic analysis results, presented in Table 19-3, indicate an after-tax NPV of $463.9 million at a 12.25% discount rate and an average bauxite price of $21.00/t over LOM.

Capital identified in the economics is for major mine moves, conveyor replacements, haul roads, and other sustaining operations.

The cashflow is presented on a 100% attributable basis.

The economic analysis was performed using the estimates presented in this TRS and confirms that the operations have a positive cash flow that supports the statement of Mineral Reserves.

Table 1-2: LOM Indicative Economic Results

Description	Units	Total LOM
LOM	Years	9
LOM Bauxite Production	Mt	327.8
Average LOM Price	$/t	21.00
Gross Revenue	$ million	**6,895.3**
Labor	$ million	1,597.4
Service	$ million	617.0
Other	$ million	722.8
PAE – Corporate Chargebacks	$ million	194.4
Energy	$ million	119.7
Fuel	$ million	218.9
Supplies	$ million	225.1
Maintenance	$ million	547.6
On-site Mine Operating Costs	$ million	**4,242.9**
Off-site Mine Operating Costs	$ million	**87.7**
Corporate Income Tax	$ million	472.5
Net Income after Taxes	$ million	**1,102.5**
Depreciation Tax Savings	$ million	989.7
Sustaining Capital (2023 to 2031 inclusive)	$ million	$602.8
Closure Costs	$ million	Included in ARO under operating costs
Free Cash Flow	$ million	**882.7**
NPV @ 12.25%	$ million	**463.9**

1.2.3 Sensitivity Analysis

Project risks can be identified in both economic and non-economic terms. Key economic risks were examined by running cash flow sensitivities. The operation is nominally most sensitive to market prices (revenues) followed by operating costs.

1.3 Technical Summary

1.3.1 Property Description

The Mineral Resource estimates declared in this Report were derived for bauxite deposits located within the Darling Range in the southwest of Western Australia. The mining center of Huntly is located approximately 80 km to the southeast of Perth, and approximately 30 km east of the township of Pinjarra. Willowdale is located 100 km south-southeast of Perth, and approximately 15 km east of the township of Waroona.

The Pinjarra refinery is located adjacent to the east of the town of Pinjarra and is approximately 25 km southwest of the Huntly mining areas. The Kwinana refinery, also supplied by Huntly, is approximately 50 km northwest of Huntly in the city of Kwinana, a suburb approximately 40 km south of Perth. The Wagerup refinery, supplied by Willowdale, is located immediately adjacent to the east of the South Western Highway, approximately 8 km south of Waroona and 20 km west of the Willowdale mining area.

1.3.2 Land Tenure

The bauxite deposits are all located within ML1SA. The Agreement permits the exploration and mining of bauxite within the tenement boundaries. ML1SA was granted on 24 September 1961, for four 21-year periods, and the current lease expires on 24 September 2024, with provision for renewal extending beyond 2045. The current lease covers an area of 7,022.61 km², and extends from just north of Perth, to Collie in the south. The legislation under which Alcoa operates is overseen by the Mining and Management Program Liaison Group, which comprises representatives from several State Government departments.

A number of environmental and statutory constraints exist within ML1SA, and Alcoa is not permitted to access bauxite from the areas covered under these constraints. Mineral Resources have not been defined in the constrained areas. In August 2001, Alcoa entered a sub-lease arrangement with a consortium referred to as the Worsley Participants. This arrangement permits the Worsley Participants to mine and process bauxites within the sub-lease area. Alcoa has not declared Mineral Resources within the sub-lease area.

1.3.3 Ownership

The mining rights and assets involved with bauxite mining and alumina refining in Australia are 100% owned by Alcoa of Australia Limited (AofA), an affiliate of Alcoa owned by Alcoa World Alumina and Chemicals (AWAC). AWAC is an unincorporated global joint venture between Alcoa and Alumina Limited, a company incorporated under the laws of the Commonwealth of Australia and listed on the Australian Securities Exchange. AWAC consists of a number of affiliated entities that own, operate or have an interest in bauxite mines and alumina refineries, as well as an aluminum smelter, in seven countries. Alcoa Corporation owns 60% and Alumina Limited owns 40% of these entities, directly or indirectly, with such entities being consolidated by Alcoa Corporation for financial reporting purposes.

1.3.4 History

Bauxite occurrences were first recorded in the Darling Range in 1902. Bauxite was detected as a result of analyzing laterite from Wongan Hills, and subsequently through examination of lateritic road gravels from several localities in the Darling Range. The Geological Survey of Western Australia (Geological

Survey) produced studies and publications, driving the bauxite exploration, though most attention was focused on localities in the Darling Range close either to Perth or to railway lines servicing towns such as Toodyay and York. By 1938 bauxite deposits were known to be common throughout the Darling Range over an area of 560 km long by 40 km to 80 km) wide. The Geological Survey maintained interest in Darling Range laterite as an economic source of aluminum until the 1950s. However, by the late 1950s exploration had been taken over by mining companies. The earliest non-government exploration for bauxite was carried out in 1918 by the Electrolytic Zinc Co. of Australia Pty Ltd, deeming the deposits to be generally low grade and not of commercial value, though like earlier explorers, did not focus upon the underlying friable units.

No further private exploration took place until 1957 when Western Mining Corporation Ltd (WMC) began to explore for bauxite in the Darling Range. Following a regional reconnaissance, a joint venture company, Western Aluminum NL (WANL), formed by WMC with North Broken Hill Ltd and Broken Hill South Ltd, explored temporary reserves over a large portion of the southwest. These areas were part of a Special Mineral Lease (ML1SA) granted to WANL in 1961.

By 1961, WANL had delineated 37 Mt of bauxite at an average grade of 33% A.Al2O3. Also in 1961, WANL joined with the Aluminum Company of America Ltd (Alcoa US), allowing additional systematic exploration of lease ML1SA. Commercial mining was finally started in 1963 at Jarrahdale and continued until 1998, supplying bauxite to the Kwinana refinery.

The Huntly and Willowdale mines commenced commercial production in 1972 and 1984 respectively. In 1977 WANL became Alcoa. As of December 2022, the Huntly and Willowdale mining operations remain active. Huntly supplies bauxite to the Kwinana and Pinjarra refineries (approximately 25 million tonnes per annum, Mtpa) while Willowdale supplies the Wagerup refinery (approximately 10 Mtpa).

1.3.5 Geological Setting, Mineralization, and Deposit

The Mineral Resource estimates declared in this Technical Report Summary were derived for bauxite deposits located within the Darling Range in the southwest of Western Australia. The Darling Range comprises a low incised plateau formed by uplift along the north-south trending Darling Fault, which is a major structural lineament that separates the Pinjarra Orogen to the west, from the Yilgarn Craton to the east. The range extends for over 250 km, from Bindoon in the north to Collie in the south.

Bauxite deposits have been identified throughout the Darling Range and generally occur as erratically distributed alumina-rich lenses within the eroded laterites that mantle the granites to the east of the scarp line. The bauxites are thought to have formed from the lateritization of the peneplained surface of the Western Gneiss Terrane rocks. Lateritization is thought to have commenced during the Cretaceous and continued through to the Eocene, with the subsequent periodic activity of the Darling Fault resulting in the current landform of scarps and deeply incised valleys on the western edge of the Darling Range.

Most of the bauxites display a typical profile comprising the following sequence, from the top down:

- Overburden: A mix of soils, clays, rock fragments and humus that is typically 0.5 m deep, but deeper pockets are common.
- Hardcap: An indurated iron-rich layer that is usually 1 m to 2 m thick. It is generally high in available alumina (A.Al2O3) and low in reactive silica (R.SiO2).
- Friable Zone: A partially leached horizon that usually contains a mix of caprock fragments, clasts, nodules, pisolites, and clays. It is usually a few meters thick but can exceed several meters in places. It is generally high in A.Al2O3 and low in R.SiO2.

- Basal Clay: A kaolinitic clay horizon that represents the transition zone between the Friable Zone and the underlying saprolitic material. It is generally high in R.SiO2 and low in A.Al2O3.

The Hardcap and Friable Zone are targeted as the ore horizon. Selective mining practices are applied to minimize the inclusion of Overburden, because of its elevated organic carbon levels, and Basal Clay because of its elevated R.SiO2 concentrations. Within the Hardcap and Friable Zone, the dominant minerals, in order of abundance, are gibbsite, quartz, goethite, kaolinite, and hematite, with lesser amounts of anatase and muscovite.

1.3.6 Exploration

Systematic exploration for bauxite within the region commenced in the 1960s and is conducted on a continuous basis to maintain sufficient Resources and Reserves to meet refinery supply. Alcoa systematically drills the laterite areas on a regular grid spacing of 60 × 60 m, followed by successive infill programs in selected areas that reduce the spacing to 30 × 30 m, and finally to 15 × 15 m. The 2022 Mineral Resource estimates were derived from data acquired from a total of 332,017 holes, drilled between 1981 and 2022, with almost 80% of the holes drilled after 2009.

The planned drill hole collar locations are pegged by Alcoa surveying staff using real time kinematic differential global positioning system (RTK DGPS). Prior to mid-2015, theodolite/ total stations and DGPS were used to position the 60 m spaced holes, and the 30 m and 15 m grids were positioned by taping and optical square sighting between the 60 m pegs. If the drill rig cannot be setup within 2 m of the peg, the offset distance is measured and marked on the driller's log. Alcoa has recently introduced the practice of resurveying all drill hole locations after drilling. However, the planned coordinates are used for subsequent modelling activities.

All holes are assumed to be vertical. However, the drill rigs have limited levelling capability, and most holes are orthogonal to the local surface gradient, resulting in deviations of several degrees from vertical.

A digital elevation model representing the natural surface was prepared from a combination of collar survey data, LiDAR data, and satellite imagery.

The drilling is conducted using a fleet of tractor-mounted vacuum rigs, which have been modified to operate in forested areas with minimal clearing or ground preparation. In 2015, Alcoa added aircore drilling rigs to the fleet. These rigs are also tractor-mounted and are fitted with a similar sample collection system to that used on the vacuum rigs. The rigs are fitted with hollow-bladed bits that have a nominal cutting diameter of 45 mm and an internal retrieval tube diameter of 22–25 mm.

All samples are collected on 0.5 m intervals, with the material extracted via the hollow drill stem into a collector flask attached to the cyclone underflow. Each sample, which weighs approximately 1.5 kg, is repeatedly passed through a riffle splitter to yield a retained split weighing approximately 200 g. This material is placed into barcode-labelled sample packets for dispatch to the test laboratory. The remaining material is discarded.

For each hole, the drillers prepare a log sheet that contains survey, drilling, geological logging, and sample submission information.

1.3.7 Mineral Resource Estimates

The long production history of Alcoa's ML1SA operations has resulted in the development of an integrated approach for data collection, bauxite delineation, and production planning, aimed at

providing feedstock that meets the technical specification requirements of the local refineries. In the past few years, Alcoa recognized that some of its procedures required optimization and updating to be more consistent with best practice approaches within the industry. They commenced a process of investigation and revision of many of these procedures but recognized that this must be implemented in a staged manner to ensure that the Mineral Resources and Mineral Reserves delineation procedures remain consistent with, and do not result in significant disruption to, current mining practices. In 2019, they began introduction 3D block modelling techniques to replace the polygon and gridded seam modelling resource estimation procedures. Approximately 38% of the tonnages that contribute to the current Mineral Resource (exclusives Mineral Reserves) have been prepared using the new 3D block modelling procedures.

The majority of the estimates that make up the current Mineral Resource inventory were prepared using techniques that Alcoa has developed since the commencement of mining in 1963. Over the period, Alcoa developed an integrated approach to data collection, resource definition, and mining that has proven effective in meeting the refineries' feedstock requirements.

The development of the resource estimation procedures largely predates the wider industry move to block modelling and geostatistical estimation techniques that occurred in the 1990s. Although there have been numerous changes and refinements to Alcoa's procedures, these systems are essentially a semi-automated implementation of the traditional 2D polygonal estimation techniques.

A legacy of the development history of the resource estimation system is that different procedures were used to delineate Mineral Resources using the 30 m and 60 m spaced data, termed the ResTag procedures, compared to those defined using the 15 m spaced data, termed the Gridded Seam Model (GSM) procedures.

The estimates defined using the 15 m spaced data are limited to the material that is planned to be mined. The parameters used by Alcoa meant that the resultant estimates were essentially nearest neighbor polygonal estimates.

In 2019, Alcoa introduced 3D block modelling and geostatistical estimation techniques, which they term the 3D Block Model (3DBM) procedures, to replace the polygonal and gridded seam modelling techniques.

In essence, all techniques largely rely upon the definition of a resource floor based on A.Al2O3 and R.SiO2 cut-off grade criteria applied to both individual and accumulated sample grades (for the traditional approaches) or individual and accumulated model grades (for the 3DBM approach). Minimum thickness criteria are also considered. For the models defined using the 15 m spaced data, practical mining constraints are also included in floor definition, including stripping ratios, and the floor heights in surrounding holes. The sample grades in each drill hole or column of model cells are composited over the interval between the base of overburden and the resource floor.

The lateral constraints are initially defined using A.Al2O3 and R.SiO2 grade thresholds, and then modified to include minimum area, minimum composite numbers, and maximum internal waste criteria. Additional constraints are applied for the resources defined using 15 m spaced data. These include maintaining equipment transit corridors and including minimum buffer distances around environmental exclusion zones and bedrock outcrop.

The resource outlines are divided into resource blocks that delineate sub-regions containing material with similar grade characteristics, and contain tonnages that can be used for long-term, medium-term, and short-term scheduling activities (80 kt to 100 kt for 60 m spacing, down to 20 kt to 40 kt for 15 m

spacing). For the 30 m and 60 m areas, the resource blocks are assigned the length-weighted average grades of the enclosed composites.

The model contains estimates for a range of constituents that are of prime importance for Bayer processing including A.Al2O3, R.SiO2, oxalate, sulphate, boehmite, and iron. Validation included visual and statistical checks between the input data and resource block estimates, comparisons of the estimates derived from different data spacings, and comparisons of the estimates with production data.

The annual reconciliation data for the past 19 years indicate the presence of grade and tonnage biases which, although some show long-term trends, appear to be relatively consistent and predictable on a year-to-year basis. The As Mined tonnage estimates are consistently biased high by approximately 5%. The As Mined A.Al2O3 is biased low but has shown a gradual improvement from 5% to 1%, relative over the past decade. The As Mined R.SiO2 is biased low but has shown a gradual improvement from around 30% to 10% relative over the past decade. Most other constituents exhibit similar bias reductions over the past decade.

The Mineral Resource classifications have been applied to the resource estimates based on consideration of the confidence in the geological interpretation, the quality and quantity of the input data, the confidence in the estimation technique, and the likely economic viability of the material.

There are limited quality assurance data to enable a thorough assessment of the reliability of the estimation datasets, and nowadays the minority of the Mineral Resource estimates (inclusive Mineral Reserves) have been prepared using traditional 2D estimation techniques which have known limitations when used to prepare local estimates. However, the long production history and significant amount of reconciliation data indicate that past estimates prepared using these techniques have been relatively reliable and predictable.

Based on the above considerations, the main controlling factors for Mineral Resource classification are deemed to be sample spacing, geological modelling and block model criteria, and data quality.

1.3.8 Mineral Reserve Estimates

A Mineral Reserve has been estimated for Alcoa's Darling Range bauxite mining operations in accordance SEC S–K 1300 which are consistent with the guidelines of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Mineral Reserves (the JORC 2012 Code).

The QP inspected the Alcoa Huntly and Willowdale operations and Mine Planning Department between October 27th and 1st November 2022 and visited Alcoa's Mine Planning department on November 2nd and 3rd 2022, interviewing relevant personnel on these dates and on other occasions. The QP has prior knowledge of the asset being involved in the previous Mineral Reserve Statement in the preceding year (2021/22).

The Mineral Reserve is classified with reference to the classification of the underlying Mineral Resource and with reference to confidence in the informing Modifying Factors. The QP considers the Proven and Probable classification to be appropriate to the deposit and associated mining operations.

The reference point for the Mineral Reserve is prior to the processing plant at the refinery.

The Proven Mineral Reserve is a subset of Measured Resources only. The Proven Mineral Reserve is within a current mining region and is included in the Ten-Year Mine Plan.

The Probable Mineral Reserve is estimated from that part of the Mineral Resource that has been classified as Indicated or from Measured resources that are outside the current mining regions.

Variable cut-off grades are applied in estimation of the Mineral Reserve, and these are related to operating cost and the nature of the Mineral Resource in relation to blending requirements. The Mineral Reserve estimate is expressed in relation to available aluminum oxide (A.Al2O3) and reactive silica (R.SiO2), this being the critical contaminant in relation to the Refinery.

1.3.9 Mining Methods

The Huntly and Willowdale mines employ conventional open pit mining practices and equipment. The fleet is mixed between contract and owner-operator, depending on the nature of the task at hand. Owner operator equipment is used for mining the bulk of the Mineral Reserve, operating in areas away from those subject to environmental restrictions. Contract mining operates smaller equipment, day shift only, in environmentally (noise) sensitive areas and at the perimeter of the mining area.

Following definition of Mineral Reserve blocks, vegetation is cleared ahead of mining by the Western Australian State Forest Products Commission (FPC), saleable timber being harvested for use. On receipt of clearance to proceed from the FPC, Alcoa operations commence stripping topsoil and secondary overburden removal (SOBR) using small excavators, scrapers, and trucks. Soil is stockpiled at the site, away from the proposed pit, for rehabilitation purposes.

Mining progresses on 4 m benches, utilizing a contour-mining sequence, cutting benches across the topography, working from top to bottom, maintaining the flattest floor obtainable to a maximum gradient of 1:10. This is most pronounced in steep areas. Most of the mineralization lies beneath a gently undulating topography and contour mining is minimal.

After completion of mining, overburden is progressively backfilled into adjacent exhausted pits, topsoiled and rehabilitated by re-establishment of native vegetation, creating a stable post-mining landform that replicates the pre-existing environment.

1.3.10 Processing and Recovery Methods

The QP notes in accordance with the mine planning reviewed, total (T.SiO2) and R.SiO2 contents, on an annual average basis, remains below the target for refineries for the next 10 years. This means, there are no evidence of any deleterious element's presence in the Darling Range ore within the next 10 years of production.

The process plant for the Darling Range operations consists of two separate crushing facilities at the Huntly and Willowdale mines. Both facilities crush the Run-of-Mine (ROM) and convey the crushed ore to three separate refineries located at Pinjarra, Kwinana and Wagerup.

The power consumption of the Huntly operation is approximately 8,000 Megawatt-hour (MWh) to 9,000 MWh per month. The Willowdale power consumption is approximately 2,000 MWh per month.

The process plant is a dry crushing operation and therefore water is only required for dust suppression and is included as part of mine water consumption. Water is not required as a consumable for the plant.

1.3.11 Infrastructure

The infrastructure for the mining operations is established and operational. During 2021, the infrastructure hub for Willowdale was relocated 16 km southwards from Orion (after having been based there for 21 years) to the Larego Hub which is located about 20 km north-east of the town of Harvey. The hub hosts new administrative offices, as well as crushing facilities and maintenance facilities. The Orion Hub site has been decommissioned.

Extensive haul road networks, rail, and overland conveyors transport crushed bauxite from the Hubs to the refineries (namely Kwinana, Wagerup and Pinjarra). Bauxite is transferred from each mine to the refineries primarily via long distance conveyor belt, apart from the Kwinana refinery which receives bauxite via railway. The Alumina produced by the three refineries is then shipped to external and internal smelter customers through the Kwinana and Bunbury ports.

The Darling Range's Pinjarra refinery receives power from the South West Interconnected System (SWIS). The refinery also has internal generation capacity of 100 MW from four steam driven turbine alternators, with steam produced by gas fired boilers and a gas turbine Heat Recovery Steam Generator (HRSG). The refinery supplies power to the Huntly Mine by three different power supply lines (a single 33 kV and two 13.8 kV). Willowdale Mine has a single 22 kV power supply fed from the Wagerup refinery. The Wagerup refinery is a net exporter of power to the SWIS, with internal generation capacity of 108 MW from three steam driven turbine alternators and one gas turbine. The steam is produced by gas fired boilers.

The WA mines are licensed by the Department of Water and Environmental Regulation (DWER) to draw surface water from five locations to meet their water supply requirements. The Huntly mine draws water from Banksiadale Dam and Boronia Waterhole. Huntly mine also holds a license to draw water from Pig Swamp and Marrinup, however these resources are retained as a backup water supply and have not been utilized in recent years. Huntly mine is also permitted to draw water from South Dandalup Dam under an agreement with the Water Corporation. A pumpback facility from South Dandalup Dam to Banksiadale Dam is used to raise levels in Banksiadale Dam during periods of low rainfall runoff. Willowdale Mine draws water from Samson Dam.

There are no Alcoa accommodation facilities within the Darling Range. As described above, the Huntly and Willowdale mining areas are within proximity to established population centers including Pinjarra approximately 25 km to the West of Huntly and Waroona approximately 20 km West of Willowdale. On site facilities includes offices, ablutions, crib-rooms and workshops, all of which were observed to be in excellent condition.

No tailings are generated within the boundaries of the mining operations. The management of tailings generated downstream at the refineries is beyond the boundaries of the Darling Range mining operations and are therefore not considered in this TRS. Alcoa's Darling Range mining operations do not produce mine waste or "mullock" in the same manner as conventional mining operations and waste dumps are not constructed.

1.3.12 Market Studies

Alcoa Corporation is a vertically integrated aluminum company comprising bauxite mining, alumina refining, aluminum production (smelting and casting), and energy generation.

Through direct and indirect ownership, during 2022 Alcoa Corporation had 27 locations in nine countries around the world, situated primarily in Australia, Brazil, Canada, Iceland, Norway, Spain, and the United States. Governmental policies, laws and regulations, and other economic factors, including inflation and fluctuations in foreign currency exchange rates and interest rates, affect the results of operations in these countries.

There are three commodities in the vertically integrated system: bauxite, alumina, and aluminum, with each having their own market and related price and impacted by their own market fundamentals. Bauxite, which contains various aluminum hydroxide minerals, is the principal raw material used to

produce alumina. Bauxite is refined using the Bayer process to produce alumina, a compound of aluminum and oxygen, which in turn is the raw material used by smelters to produce aluminum metal.

Alcoa obtains bauxite from its own resources and processes over 85% of its combined bauxite production into alumina. The remainder is sold to the third-party market. In 2022, total Alcoa production was 42.1 million dmt (dry metric tonne) of bauxite.

China is the largest third-party seaborne bauxite market and accounts for more than 90% of all bauxite traded. Bauxite is sourced primarily from Australia, Guinea, and Indonesia on the third-party market. In the long run, China is expected to continue to be the largest consumer of third-party bauxite with Guinea expected to be the majority supplier. Further, third-party traded bauxite is expected to be in surplus over the next decade, with most new mining projects announced recently being located in Guinea.

Bauxite characteristics and variations in quality heavily impact the selection of refining technology and refinery operating cost. A market bauxite with high impurities could limit the customer volume an existing refinery could use, resulting in a discount applied to the value-in-use price basis.

Besides quality and geography, market fundamentals, including macroeconomic trends – the prices of raw materials, like caustic soda and energy, the prices of Alumina and Aluminum, and the cost of freight – will also play a role in bauxite prices.

In 2016, Darling Range entered into a 5-year third-party sales contract with a major alumina producer in China. Following the expiration of the third-party sales contract at the end of 2021, all bauxite production from Huntly and Willowdale was consumed internally by the Darling Range.

The pricing mechanism of the third-party sales contract was based on a value-in-use methodology (as described in Section 16-1) that was anchored to the customer's other bauxite sources at the time of execution, with a market adjustment factor linked to the Alumina price.

A price of $19/t has been utilized for 2022 with an estimate for economic market-based factors applied throughout the LOM.

1.3.13 Environmental Studies, Permitting and Plans, Negotiations, or Agreements with Local Individuals or Groups

Alcoa has established practices and processes for ensuring conformance to environmental requirements. Sensitive areas are identified and managed ahead of disturbance. Environmental factors are taken into account prior to infill drilling; hence, mining blocks carrying environmental risks do not feature in the Mineral Reserves (for example, areas around granite outcrops and water courses have a buffer applied and are essentially no-go areas from a mining perspective).

Baseline studies completed in 2021 (16) and 2022 (3) for the revised mining proposal areas are available to support the Environmental Protection Act 1986 (WA) and the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) approvals for future extensions to the mining footprint. Baseline studies for future mining areas are guided by the requirements of the Environmental Protection Authority (WA) and are well understood.

No tailings are generated within the boundaries of the mining operations as bauxite processing residue is only generated at the Refineries. Similarly, Alcoa's Darling Range mining operations do not produce mine waste or "mullock" in the same manner as conventional mining operations and as such waste dumps are not constructed. Overburden from Darling Range ore blocks is carefully segregated for later

contouring and rehabilitation of adjacent, completed mining operations. Caprock and other non-viable rock is used to backfill these shallow, completed pits and the viable topsoil spread on top, contoured, and revegetated. As such, there is no requirement for the monitoring of any tailings or mine waste dumps associated within the mining operations as all tailings are processed outside the mine lease boundary.

Alcoa's mine sites are monitored in accordance with the conditions of Government authorizations and its operational licenses at Huntly (L6210/1991/10) and Willowdale (L6465/1989/10). Outcomes of and compliance with the management and monitoring programs are tracked within Alcoa's Environmental Management System and reported within the Annual Environmental Review report.

The environmental reviews and approvals form part of the Mining and Management Program Liaison Group (MMPLG) approvals process. Compliance with the MMPLG is demonstrated through an annual report submitted to the Department of Jobs, Tourism, Science, and Innovation (DJTSI). Operational matters at the Willowdale and Huntly mines are licensed by the Department of Water and Environmental Regulation via instruments L6465/1989/10 and L6210/1991/10, respectively. These licenses condition the processing of ore and reporting is required annually to DWER describing the total volume of bauxite crushed and any non-compliance. The latest available reporting at the time of writing is for calendar year 2020. Compliance with the Alcoa ISO14001 accredited Environmental Management System (EMS) was audited in December 2021, with results reported in August 2022, indicating compliance with environmental commitments and success of operational controls to managed environmental objectives, with only four (4) reportable incidents noted.

Alcoa has established systems and processes for maintaining its social license to operate and was admitted to ICMM in 2019, aligning to its social performance requirements. Related to the requirements of the MMPLG, Alcoa's actions in relation to social performance include an annual consultation process aligned with the 5 Year Mine Plan. The consultation process involves engaging with affected landowners. Alcoa's consultation extends to shires, as well as state and local government members. Where appropriate, the mine plan accommodates community requirements, in particular, concerns related to noise, dust, etc., and allows for buffer zones and modified working hours.

Alcoa's Closure Planning group for Darling Range (located within the Global Planning Team) is responsible for developing the closure planning process as well as the subsequent Long-Term Mine Closure Plans (LTMCPs) of Alcoa's WA Mining Operations (Huntly and Willowdale). Closure Strategies, Schedules and Cost Estimates are being developed across organizational divisions and includes multidisciplinary inputs from Operations, Mid- and Short-term Planning, Finance, Centre for Excellence, Environment and Asset Management (both Fixed and Mobile Plant). The agreed closure requirements for Darling Range centers around the return of Jarrah Forest across the site. End land uses are required to comply with the State's Forest Management Plan and include water catchment protection, timber production and biodiversity conservation.

The Alcoa procurement system defines "local" as the localities of Dwellingup, Harvey, Pinjarra, Waroona, Coolup, North Dandalup, Jarrahdale and Yarloop. Within Alcoa's guidelines of safe, ethical, and competitive business practices, they state they will:

- Invite capable local business to bid on locally supplied or manufactured goods or services.
- Give preference to local business in a competitive situation.
- Work with local business interest groups to identify and utilize local suppliers.
- Where possible, structure bids to enable local supplier participation.

1.3.14 Capital and Operating Cost Estimates

Alcoa forecasts its capital and operating costs estimates based on annual budgets and historical capital and operating costs over the long life of the current operation.

1.3.14.1 Capital Costs

The operation is well-established, and the LOM plan does not envisage any significant change of the production rate over the LOM. Anticipated future major capital expenditure is related to major mine moves and sustaining the on-going operations.

Projected capital expenditure over the next nine years of mine life is estimated to total $603 million. Of this total, $158 million is associated to complete the mine move to the Myara North site. Capital for the Holyoake move is estimated to be $241 million.

A breakdown of the major expenditure areas and total expenditure over the Mine Plan is shown in Table 1-3.

Table 1-3: 10 Year LOM Sustaining Capital Costs by Area

Project	Cost $ Million	Percentage of Total
Mine Moves	399	66.2%
Conveyor Belt Replacements	69	11.4%
Haul Road Improvements	55	9.1%
Other Sustaining capital	80	13.3%
Total	**603**	**100%**

Other capital costs are for replacement of conveyors, haul road improvements and other sustaining capital needed to continue the operations.

Alcoa's sustaining capital estimates for Darling Range are derived from annual budgets and historical actuals over the long life of the current operation. According to the American Association of Cost Engineers (AACE) International, these estimates would generally be classified as Class 1 or Class 2 with an expected accuracy range of -3% to -10% to +3% to +15%.

1.3.14.2 Operating Costs

The main production mining operations are primarily Owner-operated using Alcoa equipment and employees. Contractors are also used for certain activities on site.

Operating costs for the current LOM of nine years are based on the 2023 budget.

No items have been identified that would significantly impact operating costs either positively or negatively over the life of mine. Minor year-to-year variations should be expected based upon maintenance outages and production schedules. Forecast costs for 2023 and average mine operating costs for the nine-year LOM are shown below in Table 1-4.

Table 1-4: LOM On-site Mine Operating Costs by Category*

Cost Centre	2023 ($/wmt)	Average LOM ($/wmt)	Percentage of Operating Cost
Direct Labor	$3.43	$4.87	38%
Services	$2.07	$1.88	15%
Other	$1.45	$2.21	17%
Corporate Chargebacks for support services	$0.53	$0.59	5%
Energy	$0.34	$0.37	3%
Fuel	$0.37	$0.67	5%
Operating Supplies and Spare Parts	$0.44	$0.69	5%
Maintenance (fixed plant and mobile fleet	$1.06	$1.67	13%
Mine Operating Cash Cost ($/wmt)	**$9.70**	**$12.95**	**100%**
Off-site Costs			
G & A, selling and other expenses	$0.28	$0.24	
R & D Corporate Chargebacks	$0.03	$0.03	
Total Cash Operating Costs	**$10.01**	**$13.21**	

**Due to rounding, numbers presented may not add up precisely to the totals provided.*

Services costs includes contractor costs for certain mining activities such as in noise sensitive areas and for haul road construction services, in select areas of pit development, and during landscaping activities for rehabilitation after mining.

As of December 2022, the Huntly and Willowdale operations together employ a total of 887 employees consisting of 48 technical, 77 management and 762 operations employees. Additionally, 67 employees are centrally employed on the combined operations.

2.0 INTRODUCTION

SLR International Corporation (SLR) was appointed by Alcoa Corporation (Alcoa) to prepare an independent Technical Report Summary (TRS) on the Darling Range bauxite mines, located in Western Australia. The purpose of this report is to support the Mineral Resource and Mineral Reserve estimates for the mines as of December 31, 2022. This Technical Report Summary conforms to the United States Securities and Exchange Commission's (SEC) Modernized Property Disclosure Requirements for Mining Registrants as described in Subpart 1300 of Regulation S-K, Disclosure by Registrants Engaged in Mining Operations (S-K 1300), and Item 601(b)(96) of Regulation S-K. This Technical Report Summary updates the TRS titled "Technical Report Summary for Darling Range, Western Australia," with an effective date of December 31, 2021, that was prepared in accordance with S-K 1300 and Item 601(b)(96) by SLR for Alcoa.

Alcoa is one of the world's largest aluminum producers and is a publicly traded company on the New York Stock Exchange (NYSE). The company owns and operates integrated bauxite mining, alumina refining and aluminum smelting operations at numerous assets globally across nine countries. Alcoa is also a Joint Venture partner for several other integrated operations in Brazil, Canada, Guinea, and Saudi Arabia.

The Darling Range, located south of Perth in Western Australia, comprises two active bauxite mining areas – the Huntly and Willowdale mines – owned and operated by Alcoa of Australia Limited, which is 60% owned by Alcoa Corporation and 40% owned by Alumina Limited. The Huntly and Willowdale operations collectively represent one of the world's largest bauxite mines which supplies Alcoa's three aluminum refineries in the region: Kwinana, Pinjarra, and Wagerup. On the basis that both mining areas supply ore to the same local refineries which are also operated by Alcoa, and that both mining areas are located within the same mining lease boundary, SLR considers the mines a single property for the purposes of this report.

Alcoa has a long history of mining in the Darling Range with Huntly and Willowdale commencing commercial production in 1972 and 1984 respectively. These mining areas were preceded by the Jarrahdale bauxite mine which was operational between 1963 and 1998. The Huntly mine currently supplies bauxite to the Pinjarra and Kwinana refineries, while the Willowdale mine supplies the Wagerup refinery. The mines collectively produce approximately 35 Mtpa of bauxite, with approximately 25 Mtpa from Huntly and 10 Mtpa from Willowdale.

2.1 Site Visits

SLR Qualified Persons (QPs) visited the sites between October 27th to November 3rd, 2022. The SLR Geologist and SLR Mining Engineer were accompanied by Alcoa's Principal Geologist Global Planning to undertake site visits and inspections of various aspects of the Huntly and Willowdale mining areas.

The site visit commenced with a general induction and operations overview at Alcoa's Pinjarra office (Bindjareb). SLR's mining engineer was provided a general overview of the transitional process used to develop the 3d block models from the historical gridded data. The process was developed in the DeepLime platform, a scripted platform to facilitate the transition. Following the overview, the visit moved to the Pinjarra refinery for a discussion with management regarding the Capex planning and operational costs.

The following day, 28th October, SLR's Geologist joined the visit team. The group undertook an inspection of the Huntly mine site. A review of the drilling operations was initially undertaken, this

incorporated confirmation of sample selection process from the drilling and generally to review the QA/QC procedures. Drilling rig 9011 was operating, and three holes were observed being drilled and sampled. The restoration, rehabilitation of a mine out hill area was then reviewed. This was followed with the inspection of the procedures for organic stripping to review the interface of the domains to the upper bauxite layer as related to confirm the dilution assumptions as appropriate.

Occasional areas of sterilization were observed as small protective circular islands approximately 30m-50m diameter. The full section profile of the operation could be surveyed in this sterilized island. Restoration after stripping on steeply inclined fills was also noted, confirming the ability to mine at the gradients noted in the Reserve estimation.

A further mining hill pod was inspected, operations were cutting the pre-stripped organic layer to provide the main bauxite excavation. EX 1021 excavator was stopped, and the excavated face inspected. Potential for dilution was reviewed and confirmed as suitable. Visit then stopped at the main Myara (Huntly) crusher station to review the primary crushing operation. The twin hopper station was observed from distance as four number 200t trucks tipped. The trucking was not utilizing the surge area at the time.

Haul roads were in excellent condition and of suitable design and width to accommodate the Cat 789c (190t) trucks. Segregation and right-angle crossing points for light vehicles were at high standard. Infrastructure for plant and water management was of a very high standard.

Discussions with Huntly site engineering team took place over the 4 hour visit to the various mining areas. The Digital fleet management system (FMS) was reviewed at the Myara site. The mine dispatch office was reviewed. Controls for the Myara main surge area before the Primary Crusher, the Primary Crusher itself and the controls for the conveyors and stackers downstream were also viewed. The 17 No trucks all have telemetry data, as do all excavators and dozers, 10 dozers (D11 to D10 size), 4 No Cat 993 size front load shovels, 5 No prime excavators (EX 2600, PC 3000), plus various other ancillary equipment to operate one of the world's largest bauxite mines.

Site visit on the Monday 31st of October started in the Pinjarra mine office (Bindjareb). The Geological team provided an overview of H07_Holyoake_Central modelling approach. Optimization, depletion related to constraints, cut off grades etc. were all reviewed. This model was also taken forward to the mining review and reconciliation by QPs as part of the audit review process. The model was also reviewed at Alcoa Head Office on the 2nd of November.

Inspection was then undertaken of the lab facilities at Kwinana refinery and the independent labs (Bella Analytical Systems PTY Ltd) used for the ore sample preparation and testing. The drilled packet samples are brought to this lab for preparation and testing. Sample ID system was reviewed, and a number of online tests were reviewed by the audit review team. Sample ID J661503 was witnessed. The team then went to the main refinery to review testing procedures for other criteria and reference testing to the Bella Lab. Bomb Digest systems QXRD, XRF systems etc. were all reviewed. Historical control charts and procedures were all reviewed during the visit to gain an understanding of Alcoa's QA/QC procedures and exceeded the standard testing approach expected.

On the 1st of November and following a review of the Ore Best GIS model at Pinjarra office, the team visited Willowdale mine site (specifically, the new mine office near the Larego crusher) as well as various locations on Larego accompanied by Alcoa's Short Term Planning Superintendent. A relatively new black top access road has been constructed from the main highway to the Larego office complex. Larego consists of a new mine office and Mine infrastructure area. Black top car parking exists for the mine staff and personnel. An overview of the mine planning activities was provided. New and existing haul roads

were all in excellent condition. The organic stripping operation, and drilling of hard cap was reviewed. Mine water treatment facilities were seen by drive by. Komatsu 730e trucks were witnessed on the haul roads. Ore loading operations were reviewed. The Mine Infrastructure Area (MIA) was noted to be very well kept order. Larego Primary Crusher was inspected (at the time down for standard repairs), conveyor sections and route to the stacker reclaimer were reviewed.

The QPs then inspected the Darling Scarp including the covered downhill conveyor, sampling station, ore stockpile stacker/reclaimer, and Wagerup refinery.

The QPs interviewed several senior Alcoa staff at the operational sites.

Alcoa provided permission to document the site visit with video, photos and audio which were shared with the other SLR team members.

QPs visited the Alcoa's Mine Planning department at Booragoon on November 2nd, 2022, for discussions about Alcoa's mine planning systems. Both of SLR's QPs carried out inspections of the Kwinana laboratory facilities, in particular the FTIR assaying procedures on 31st October 2022. Drilling methods were inspected on site on October 28th, 2022, along with an examination of the database management procedures.

The SLR Metallurgist QP did not visit the site, however, the site was visited by the Mining and Geology QPs who reviewed all Modifying Factors.

2.2 Sources of Information

During the preparation of this Technical Report Summary, discussions were held with personnel from Alcoa Corporation and the Huntly and Willowdale Mines, including:

- Mr Alex Hatch, Principal Geologist, Alcoa Global Planning
- Mr Thomas Green, Resource Development Manager, Alcoa Global Planning
- Mr Quentin Swart, Senior Resource Geologist, Alcoa Global Planning
- Mr Lucas Tuckwell, Senior Resource Geologist, Alcoa Global Planning
- Mr Peter Hill, Exploration Superintendent, Alcoa Global Planning
- Mr Levi Barnes, Exploration Geologist, Alcoa Global Planning
- Mr Francois Vorster, Senior Project Manager, Capital, Alcoa
- Mr Masud Hosain, Senior Mine Planning Engineer, Alcoa Global Planning
- Mr Neylor Aguiar, Principal Mining Engineer, Alcoa Global Planning
- Mr Scott Hann, Short Term Planning Superintendent Willowdale Mine, Alcoa
- Mr Mohammad Babei Fardvatan, Mine Engineer, Huntly Mine, Alcoa
- Mr John Greenwood, Director of Bella Analytical Services
- Mr Andrew Richardson, Senior Environmental Scientist – Approvals and Compliance – WA Mining, Alcoa

This Technical Report Summary was prepared by QPs and updates the Technical Report Summary for Darling Range, Western Australia, dated February 24, 2022, with an effective date of December 31, 2021

prepared by SLR. The documentation reviewed, and other sources of information, are listed at the end of this report in Section 24.0 References.

2.3 List of Abbreviations

Units of measurement used in this report conform to the metric system. All currency in this report is United States dollars (US$), unless otherwise noted.

Abbreviation	Description
°C	degree Celsius
°F	degree Fahrenheit
2D	2-dimensional
3D	3-dimensional
3DBM	3D Block Model
a	annum
A	ampere
A.Al_2O_3	available alumina
AACE	American Association of Cost Engineers
AFFF	Aqueous Film Forming Foams
AGD	Australian Geodetic Datum
Alcoa	Alcoa Corporation
Alcoa US	Aluminum Company of America Ltd
AMG	Australian Map Grid
AMPD	Absolute Mean Percentage Difference
AMSL	above mean sea level
AMWU	Australian Metal Workers Union
AofA	Alcoa of Australia Ltd
API	Alumina Price Index
ARO	Asset Retirement Obligations
AWAC	Alcoa World Alumina and Chemicals
AWU	Australian Workers Union
B&P	Bias and Precision
bbl	barrels
BD	Bomb digest
BD-GC	bomb digest gas chromatography
BD-ICP	bomb digest inductively coupled plasma
BD-NDIR	bomb digest non-dispersive infrared
Bella	Bella Analytical Systems
Btu	British thermal units
BV	Bureau Veritas
C$	Canadian dollars
cal	calorie
CalVal	calibration and validation for FTIR
cfm	cubic feet per minute
CIM	CIM (2014)
cm	centimeter
cm²	square centimeter

Abbreviation	Description
CRM	certified reference material
CV	Coefficient of Variation
d	Day
DBCA	Water Corporation, Department of Biodiversity, Conservation and Attractions
DCF	Discounted Cash Flow
DEM	Digital Terrain Model
DG	Discrete Gaussian
DGPS	(Differential) Global Positioning System
dia	Diameter
DIBD	dry in situ bulk density (t/m3)
DJTSI	Department of Jobs, Tourism, Science and Innovation
DMIRS	Department of Mines Industry Regulation and Safety
dmt	dry metric tonne
DWER	Department of Water and Environment Regulation
dwt	dead-weight ton
EMS	Environmental Management System
ETU	Electrical Trades Union
EWR	Ecological water requirements
FMS	Fleet Management System
FPC	Forest Products Commission
ft	foot
ft/s	foot per second
ft^2	square foot
ft^3	cubic foot
FTIR	fourier transform infrared spectrometry
g	gram
G	giga (billion)
g/L	gram per liter
g/t	gram per tonne
Gal	Imperial gallon
GC	gas chromatography
Geological Survey	Geological Survey of Western Australia
GIS	Geographical Information System
Gpm	Imperial gallons per minute
gr/ft^3	grain per cubic foot
gr/m^3	grain per cubic meter
GSM	gridded seam model
ha	hectare
HARD	Half Absolute Relative Difference
hp	horsepower
hr	hour
HRSG	Heat Recovery Steam Generator

Abbreviation	Description
Hz	Hertz
ICP-OES	inductively coupled plasma optical emission spectrometry
IDW	inverse distance weighting
in.	inch
in²	square inch
IRM	internal reference material
IRR	Internal Rate of Return
ISO	International Standardization Organization
J	Joule
JORC	JORC Code (2012)
k	kilo (thousand)
kcal	kilocalorie
kg	kilogram
km	kilometer
km/h	kilometer per hour
km²	square kilometer
kPa	kilopascal
kV	kilovolt
kVA	kilovolt-amperes
kW	kilowatt
kWh	kilowatt-hour
KWI	Kwinana Mining Laboratory
L	liter
L/s	liters per second
lb	pound
LiDAR	Light Detecting and Ranging
LIMS	laboratory information management system
LME	London Metal Exchange
LOM	Life of Mine
LTMCPs	Long-Term Mine Closure Plans
m	micron
m	meter
M	mega (million); molar
m²	square meter
m³	cubic meter
m³/h	cubic meters per hour
Ma	Million years ago
MALSI	microwave available alumina (AL) and reactive silica (SI)
MASL	meters above sea level
MD	microwave digest
MD-ICP	microwave digest inductively coupled plasma optical emission spectrometry
mg	microgram

Abbreviation	Description
mi	mile
min	minute
mL	milliliters
ML	Mineral Lease
mm	millimeter
MMPLG	Mining and Management Program Liaison Group
MMPs	Mining and Management Programs
mph	miles per hour
MS	Ministerial Statement or Magnetic Susceptibility
Mtpa	Million tonnes per annum
MVA	megavolt-amperes
MW	megawatt
MWh	megawatt-hour
NATA	Australian National Association of Testing Authorities
NI 43-101	National Instrument 43-101 (2014)
NPC	Net Present Cost
NPV	Net Present Value
NTU	Nephelometric Turbidity Units
NYSE	New York Stock Exchange
OK	ordinary kriging
oz	Troy ounce (31.1035g)
oz/st, opt	ounce per short ton
PFAS	per- and polyfluoroalkyl substances
ppb	part per billion
ppm	part per million
psia	pound per square inch absolute
psig	pound per square inch gauge
QA	Quality Assurance
QA/QC	Quality Assurance / Quality Control
QC	Quality Control
QP(s)	Qualified Person(s)
R.SiO_2	reactive silica
RC	Reverse Circulation
REF	reference method
ResTag	mineral resource estimation system
RL	relative elevation
ROM	Run of Mine
RTK	real time kinematic
s	second
SEC	Securities and Exchange Commission
S-K 1300	Subpart 1300 of Regulation S-K
SLR	SLR International Corporation

Abbreviation	Description
SMU	Single Mining Unit
Snowden	Snowden Mining Consultants
SOBR	stripping topsoil and secondary overburden removal
SPU	sample presentation unit
SRK	SRK Consulting (Australasia) Pty Ltd
st	short ton
STE	sample to extinction
stpa	short ton per year
stpd	short ton per day
SWIS	South West Interconnected System
t	metric tonne
T.Al2O3	Total Alumina
T.SiO2	Total silica
TICTOC	Total Inorganic Carbon and Extractable Organic Carbon
tpa	metric tonne per year
tpd	metric tonne per day
TRS	Technical Report Summary
US$	United States dollar
USg	United States gallon
USgpm	United States gallon per minute
V	volt
W	watt
WA	Western Australia
WANL	Western Aluminum NL
WMC	Western Mining Corporation Ltd
wmt	wet metric tonne
wt%	weight percent
XRD	x-ray diffraction
XRF	x-ray fluorescence
Xstract	Xstract Resources
yd^3	cubic yard
yr	Year

3.0 PROPERTY DESCRIPTION

3.1 Location

The Darling Range is located in the southwest of Western Australia and comprises an extensive uplifted plateau of bauxite deposits which is host to several mining operations including the Huntly and Willowdale mining areas, approximately 80 km and 100 km southeast of Perth, respectively. The nearest towns to the mining centers are North Dandalup (approximately 15 km west of Huntly) and Waroona (approximately 15 km west of Willowdale). Both towns are within the Peel Region of southwest Western Australia and are on the route of the South Western Highway, a major national road connecting Perth with the south coast.

All spatial data used for Mineral Resource estimation are reported using a local grid based on Australian Map Grid 1984 (AMG84) system (Zone 50) and using Australian Geodetic Datum 1984 (AGD84) coordinate set. The approximate coordinates of the mining areas are 410000 m East and 6390000 m North (Huntly) and 410000 m East and 6365000 m North (Willowdale). The Huntly and Willowdale mining areas are separated by approximately 35 km (Figure 3-1).

The Pinjarra refinery is located adjacent to the east of the town of Pinjarra and is approximately 25 km southwest of the Huntly mining areas. The Kwinana refinery, also supplied by Huntly, is approximately 50 km northwest of Huntly in the city of Kwinana, a suburb approximately 40 km south of Perth. The Wagerup refinery, supplied by Willowdale, is located immediately adjacent to the east of the South Western Highway, approximately 8 km south of Waroona and 20 km west of the Willowdale mining area.

3.2 Land Tenure

The Huntly and Willowdale bauxite mines are covered by a single mineral concession referred to as Mineral Lease (ML) 1SA. The concession was originally granted on September 25, 1961, by the State Government of Western Australia under the Alumina Refinery Agreement Act, 1961, permitting the exploration and extraction of bauxite. ML1SA was granted for a period of four, 21-year periods the third period of which is due to expire on September 24, 2024. Prior to September 24, 2024, Alcoa will notify the State Government of Western Australia of its intention to exercise its right to renew for a further 21-year period to extend the concession to 2045. Subject to Alcoa having complied with the Alumina Refinery Agreement Act, 1961, the State Government will grant Alcoa the renewal. The State Government concession agreement includes the potential for conditional renewal beyond 2045. This will require negotiation between Alcoa and the State Government prior to this date to agree on an extension of the agreement, and is therefore not guaranteed.

Conditions which must be fulfilled by Alcoa to retain ML1SA include annual reporting requirements under several State Agreement Acts, Ministerial Statements, and Environmental Protection Acts. These are described in Section 3.6 below.

The current concession of ML1SA covers an area of 7,022.61 km², extending from the north of Perth on the eastern side to the town of Collie in the south (Table 3-1). Alcoa has the exclusive right to explore for and mine bauxite on all Crown Land within the ML1SA. This area includes sub-lease arrangements made between Alcoa and the Worsley Alumina joint venture participants which include South32, Japan Alumina Associates (Australia) Pty Ltd and Sojitz Alumina Pty Ltd (Worsley Participants). The agreements, made in August 2001 and September 2016, provide bauxite mining concessions to the

Worsley Participants. No Mineral Resources or Mineral Reserves attributable to the Darling Range mining areas have been declared within these sub-lease areas.

Table 3-1: ML1SA License Details

Concession Name	Title Holder	Expiry Date	Area (km²)
ML1SA	Alcoa of Australia	24/09/2024	7,022.61

Alcoa pays rental for each square mile of ML1SA in accordance with the Alumina Refinery Agreement Act 1961 (WA). In 2022, this amounted to A$13,560.

The boundary of the ML1SA concession area, including the limit of the Worsley Participants' area, is illustrated in Figure 3-1. The contained Mining Regions are shown in Figure 3-4, while the extents of the mined areas and Mineral Resources and Mineral Reserves are shown in Figure 3-3:

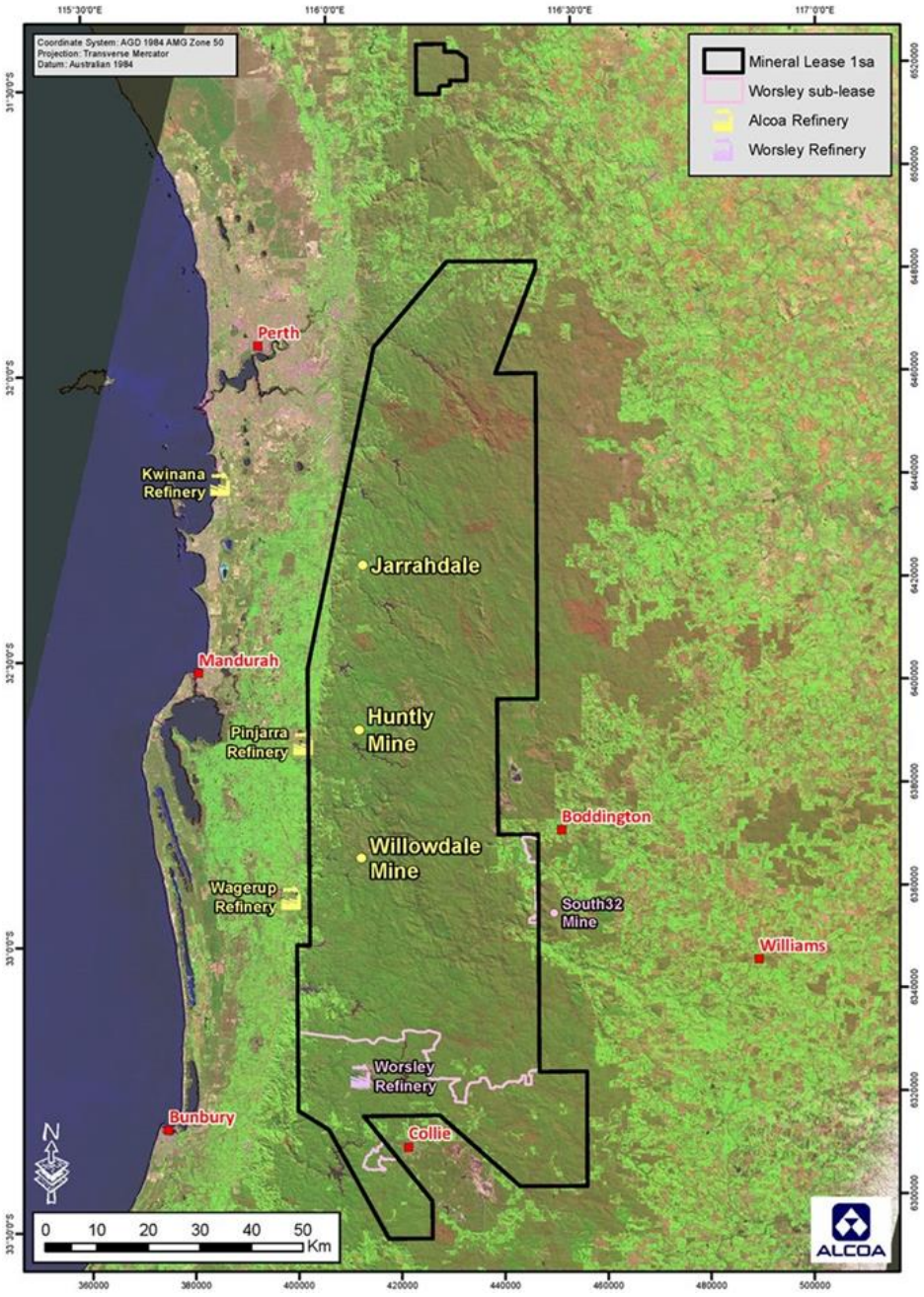


Figure 3-1: ML1SA Lease Extents (Alcoa, 2022)

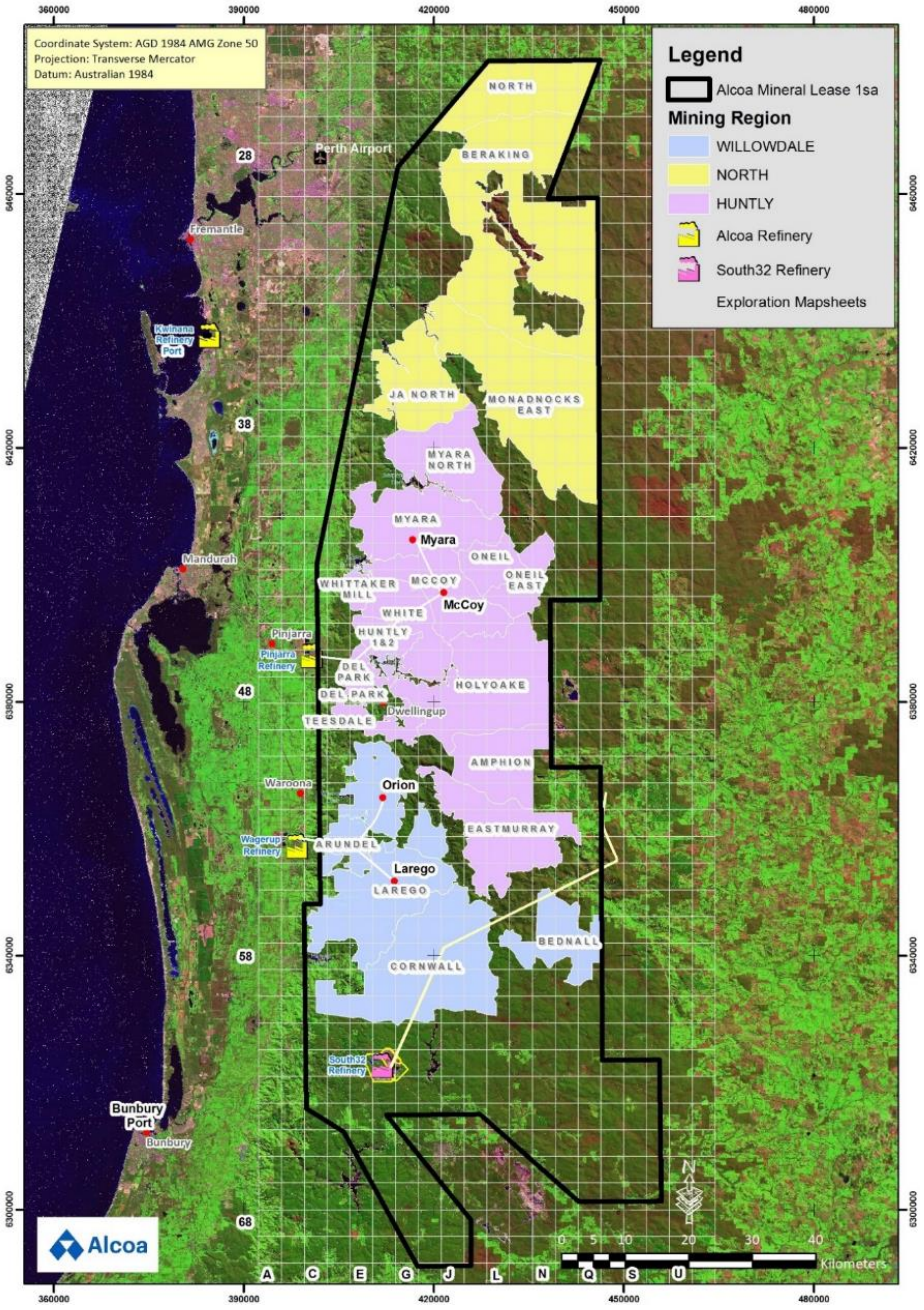


Figure 3-2: Map of Mining Reporting Centers, Mining Regions, and Production Sheets (Alcoa, 2022)

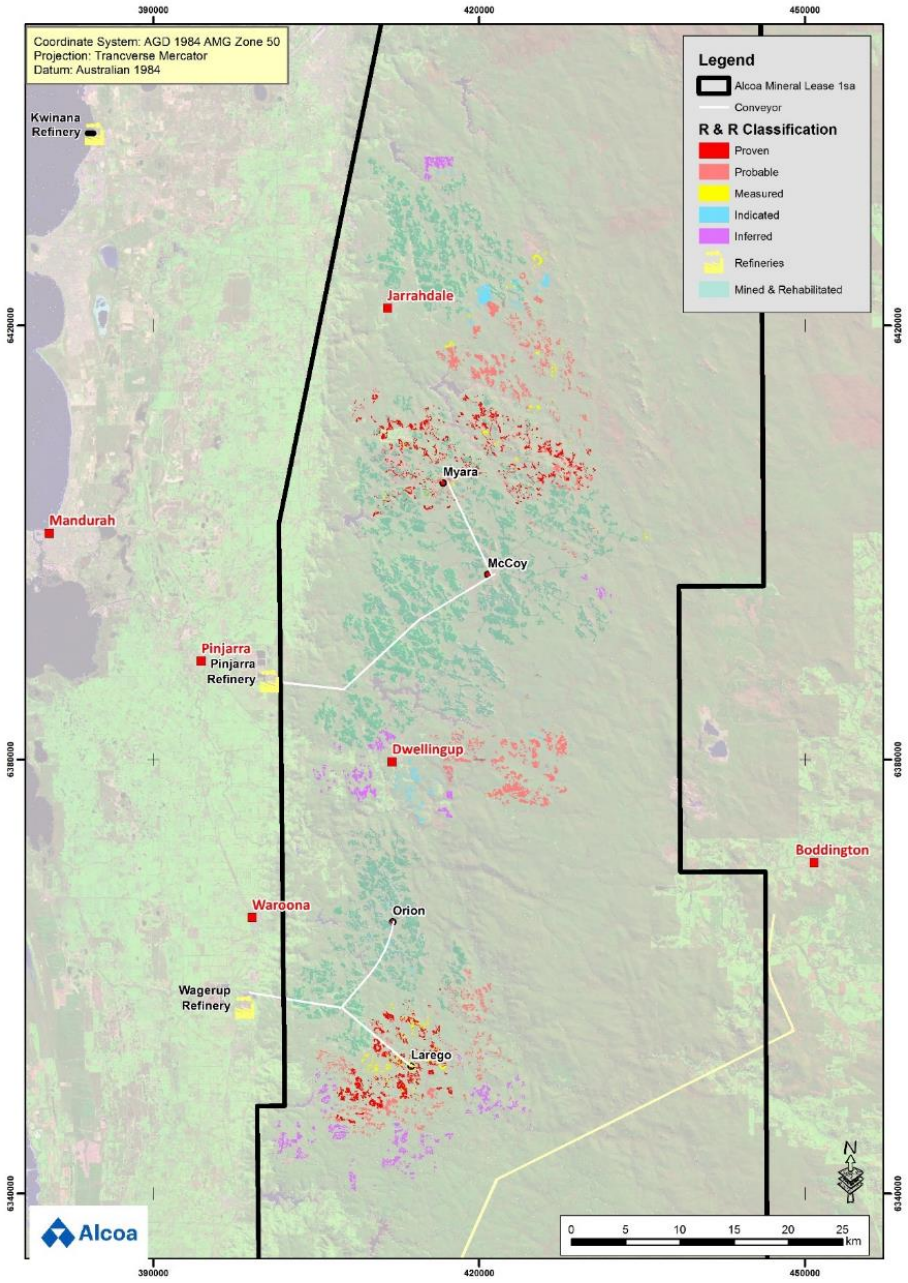


Figure 3-3: Map of Current Mineral Resource and Mineral Reserve Extents (Alcoa, 2022)

3.3 Naming Conventions

Alcoa has developed a terminology to refer to various parts of the Mineral Lease. There are three major Mining Reporting Centers exist in ML1SA: North (previously Jarrahdale), Huntly in the central area, and Willowdale in the south. The boundaries are nominal and may change to match the planned ore destination. The southernmost region of the North mining center was reallocated to Huntly in 2017 and named Myara North.

Mining Regions subdivisions of the Reporting Centers that cover several years of mining activities, focused on a specific crusher location. The boundaries are named after forestry blocks. A total of 12 Mining Regions is represented in the current resource estimate: 1 in North, 7 in Huntly, and 4 in Willowdale.

Mining Pits are named based on their sequence along haul roads. These names are used by the mining fleet when referring to local short-term production. The map reference system outlined below is used for drilling, estimation, and long-term planning.

The Mineral Lease is divided into a grid of Exploration Sheets being rectangles 4.2 km (north) by 3.6 km (east). Each 15.12 km² Exploration Sheet is assigned a name and coded using letters A to V (west to east), and numbers 10 to 80 (north to south), e.g., G45.

Each Exploration Sheet is divided into 28 Production Sheets 900 m (east) by 600 m (north), an area of 0.54 km². The Production Sheets are assigned a number (1 to 28), sequentially 4 across (towards the east) and 7 down (towards the south), e.g., G4520.

Each Production Sheet is divided using a 15 m by 15 m grid resulting in 2,400 grid cells (40 north by 60 east). Each of these is regarded as a point and assigned a numeric code 1 to 40 towards the south and 1 to 60 towards the east. These are appended to the Production Sheet name to provide a grid point label, e.g., G4520 1430 and used on 1:1000 Map Sheets to define drill hole locations.

The Exploration Sheet, Production Sheet, and Map Sheet conventions are shown in Figure 3-4:

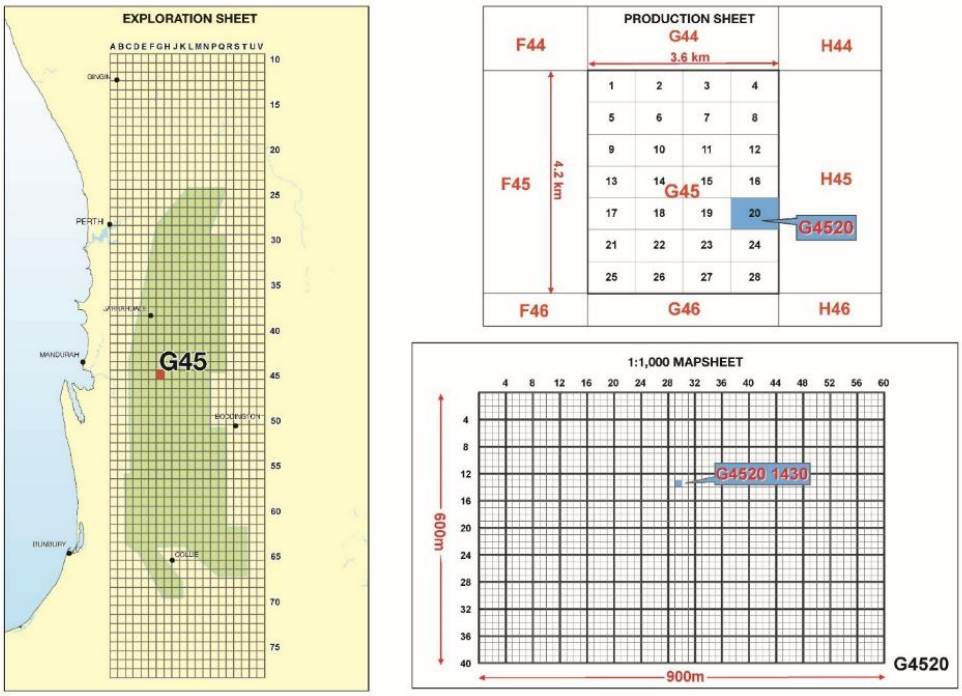


Figure 3-4: Exploration Sheet, Production Sheet, and Map Sheet Conventions (SRK, 2021)

3.4 Encumbrances

Constraints on mining activities within the ML1SA concession are in place which prevent bauxite mining in these areas including:

- Within 200 m from the Top Water Level of Drinking Water Reservoirs
- National Parks
- Aboriginal Heritage Sites
- Old Growth Forest
- Formal Conservation Areas
- Within a 50 m buffer of Granite Outcrop (greater than 1 ha).

Mineral Resources and Mineral Reserves have not been defined in these restricted areas. Operating rights are obtained by Alcoa through annual submission and approval of the Mining and Management Programs (MMPs) which include mining schedules and the authorizations provided by the Mining and Management Program Liaison Group (MMPLG).

Mining on a day-only basis is conducted in “noise zones” where noise from the mining operations will potentially exceed allowable levels. The operation actively seeks to maintain lower noise levels than

those mandated, thus mining in these areas is undertaken by contract miners using smaller equipment on day shifts only.

3.5 Royalties

Alcoa is the holder of ML1SA. For bauxite that is mined and processed in Alcoa's Western Australian alumina refineries, Alcoa pays royalties on the alumina produced in accordance with the Alumina Refinery Agreement Act 1961 (WA). For bauxite that is mined and exported, Alcoa pays royalties in accordance with the Mining Act 1978 (WA).

3.6 Required Permits and Status

Alcoa operates under several State Agreement Acts as well as Ministerial Statements and environmental operating licenses issued under the Environmental Protection Act 1986 (WA) including:

- Alumina Refinery Agreement Act 1961 (WA)
- Alumina Refinery (Pinjarra) Agreement Act 1969 (WA)
- Alumina Refinery (Wagerup) Agreement Act 1978 and Acts Amendment Act 1978 (WA), which provided for the creation of the MMPLG
- Alumina Refinery Agreements (Alcoa) Amendment Act 1987 (WA)
- Ministerial Statement 728 (as amended by Ministerial Statements 897, 1069 and 1157) (MS728)
- Ministerial Statement 646
- Environmental Protection (Alcoa – Huntly and Willowdale Mine Sites) Exemption Order 2004 (Exemption Order)
- Environmental licenses L6210/1991/10 and L6465/1989/10 granted under Part V of the Environmental Protection Act 1986 (WA)

The MMPLG is chaired by the Department of Jobs, Tourism, Science and Innovation. The MMPLG was first established in 1978 and consists of representatives of the Department of Jobs, Tourism, Science and Innovation (DJTSI), Department of Water and Environment Regulation (DWER), Water Corporation, Department of Biodiversity, Conservation and Attractions (DBCA), and the Department of Mines Industry Regulation and Safety (DMIRS). The MMPLG is recognized by the Minster for Environment in Ministerial Statements (95, 390, 564, 728, 897 and 1069) regarding expansion of Alcoa operations. The management and oversight of all Darling Range operations by the MMPLG involves:

- Provide oversight to mining, infrastructure, processing and related operations within ML1SA
- Advise on the environmental and social adherence of the 5-year MMPs developed by Alcoa on a recurring annual basis.
- Provide six-monthly authorizations for ground clearance for mining in accordance with the submitted and approved MMPs.
- Provide oversight to ongoing rehabilitation of mined areas

The permitting and approval processes, as provided by Alcoa, are summarized below:

- Clause 9 (1) of the 1961 State Agreement provides Alcoa the sole rights to explore and mine the bauxite deposits within ML1SA.
- Clause 5 of the Wagerup State Agreement specifies that Alcoa must consult with the DBCA in relation to the requirement to submit annual mine plans for mining associated with the Wagerup refinery.
- Under Clause 6 (1) of the Wagerup State Agreement, Alcoa has submitted several environmental review documents to the State Government for subsequent approvals of the Wagerup refinery construction and expansions. Within these environmental assessment documents, significant information on Alcoa's bauxite mining operations associated with the Wagerup refinery was included, resulting in several conditions in relation to Alcoa's bauxite mining operations associated with the Wagerup refinery being incorporated in the Ministerial Statements of which the current one is Ministerial Statement 728 (as amended). Procedure 3 of MS728 outlines Alcoa's requirements to have a publicly available Completion Criteria document for its bauxite mining operations, developed in consultation with the MMPLG. Procedure 4 of MS728 outlines the MMPLG's authority to review and approve Alcoa's mining operations through the five-year Mine Plan process. To the extent the conditions on bauxite mining operations in Ministerial Statement 728 and the predecessor Ministerial Statements did not cover bauxite mining unrelated to the Wagerup refinery, Alcoa agreed to extend the conditions to the rest of its bauxite mining.
- Through the Wagerup State Agreement, MS728, and agreement between the State Government and Alcoa, the MMPLG is responsible for reviewing and providing a recommendation to the Minister for Environment and the Minister for State Development to approve Alcoa's five-year Mine Plans.
- Alcoa's mining operations within ML1SA are also conducted in accordance with the Environmental Protection (Alcoa – Huntly and Willowdale Mine Sites) Exemption Order 2004 (Exemption Order) made by the Minister for the Environment. The Exemption Order is consistent with the Wagerup State Agreement that established the MMPLG and MMP processes and it also reflects the procedures of MS728 that sets out the MMPLG's responsibility to review annual rolling 5-year mine plans for Alcoa's operations.

Alcoa reports that all licenses and permissions for the mining operations are currently valid. However, Alcoa is seeking formal environmental impact assessment and approval from the State and Federal Government, which is required prior to mining within the Myara North and Holyoake regions of the Huntly mine. These approvals will be through the current process under the Environmental Protection Act 1986 (WA) and the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). Alcoa is seeking these approvals to facilitate the transition of the mine from Huntly to Myara North and Holyoake and a 5% increase in production at the Pinjarra refinery. The process also seeks to modernize aspects of the regulatory framework for the Huntly mine.

3.7 Other Significant Factors and Risks

SLR is not aware of any environmental liabilities on the property. Alcoa has all required permits to conduct the proposed work on the property. SLR is not aware of any other significant factors and risks that may affect access, title, or the right or ability to perform the proposed work program on the property.

4.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

4.1 Accessibility

As described in previous sections, the Darling Range Huntly and Willowdale operations are located approximately 150 km south of Perth. The Darling Range is readily accessible via road from Perth and surrounding areas. The mines are near the towns of Pinjarra and Waroona. Both towns are easily accessible via the national South Western Highway, a sealed single carriageway road, which starts on the southern side of Perth and continues for almost 400 km to the southwest corner of Western Australia.

Huntly is accessible from the South Western Highway via Del Park Road, a sealed single carriageway road which connects the town of North Dandalup in the north with Dwellingup in the south. From Del Park Road, a 3km sealed road following the route of the bauxite conveyor to the Pinjarra refinery provides access to the Huntly site administration offices.

Willowdale is similarly accessible 19 km from the South Western Highway via Willowdale Road, a sealed single carriageway road to the south of Waroona.

There are several airstrips in the region, although the closest major airport is in Perth, approximately 70 km north of North Dandalup. The nearest commercial port is at the Kwinana refinery, approximately 40 km south of Perth (as illustrated on Figure 15-1).

While an extensive haul road network and overland conveyors transport crushed bauxite from the main mining hub to the Wagerup and Pinjarra refineries, bauxite is also transferred to the Kwinana refinery via the Kwinana freight railway system, using the Kwinana–Mundijong line.

4.2 Climate

The southwest region of Western Australia exhibits a temperate climate, with very hot and dry summers (December to February) and mild winters (June to August). Rainfall is generally low and variable, ranging from an average rainfall of 25 mm during the three summer months and exceeding 200 mm during the three winter months (Australian Government, Bureau of Meteorology). Local climate conditions generally do not interrupt the mining schedule, which continues throughout the year. Occasionally however, significant rainfall inhibits access and can impact mining activities.

Table 4-1: Historical Climate Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
°C Mean Max	29.7	29.7	27.1	22.6	18.6	16.1	15.1	15.8	17.4	20.1	23.8	27.4
°C Mean Min	14.3	14.6	13.0	10.4	7.7	6.5	5.5	5.5	6.5	8.1	10.5	12.6
mm Mean Rainfall	16.5	22.0	26.8	65.1	156.4	233.7	234.9	193.4	130.1	79.2	46.2	20.6

Notes:

1. Temperature and rainfall data sourced from the Australian Government Bureau of Meteorology, collected from the weather station at Dwellingup http://www.bom.gov.au/climate/averages/tables/cw_009538.shtml
2. Data includes that collected from 1935 to 2021.

4.3 Local Resources

The Darling Range is located in an easily accessible region of southwest Western Australia with the Huntly and Willowdale mining areas both within 15 km of well-established towns which act as residential and commercial centers. Several other towns and smaller settlements are positioned along the South Western Highway which acts as a major connection for the Darling Range to the city of Perth where a far greater range of general services is available.

4.4 Infrastructure

The following section refers to several named mining areas within the Huntly and Willowdale mining centers, including Myara, Larego, Orion, and Arundel, each of which is illustrated in Figure 3-2 above.

Mining infrastructure in the Darling Range is generally concentrated in the Myara site in the northwest of the Huntly mining center, and at the Larego area in the center of the Willowdale mining area (20 km southeast of Wagerup) having been relocated 16 km southwards from the Orion Hub during 2021). Both operations include various ancillary facilities that are not listed exhaustively here, however both infrastructure areas include:

- Ore crushing and handling facilities
- Ore stockpile stacker/reclaimer
- Maintenance facilities
- Sampling stations
- Site offices including a production tracking room
- Haul road networks
- Overland conveyors, as illustrated on Figure 15-1.
- Water supplies consisting of abstraction from licensed surface water sources supplemented with treated wastewater from vehicle washdowns, stormwater runoff, and maintenance workshops. Water sources are illustrated on Figure 15-1.
    - The Huntly mine draws water from Banksiadale Dam and Boronia Waterhole. The mine also holds a license to draw water from Pig Swamp and Marrinup, although these are reported as being rarely utilized, and it is permitted to draw water from South Dandalup Dam under an agreement with the Water Corporation.
    - Willowdale Mine draws water from Samson Dam, approximately 10 km southeast of Waroona.

The Willowdale five-year mining plan recently included the relocation of the crusher from the former Orion infrastructure area in the north to Larego in the south. This included supporting infrastructure construction activities including:

- Overland conveyor construction from Arundel to Larego, as illustrated in Figure 151.
- Haul road development into new mining areas
- Establishment of production office facilities
- Access routes between gated mining areas and fire-fighting tracks

- Water offtake points for Larego (along the Samson Dam)

Personnel are sourced from the area around Perth, Western Australia, which benefits from a skilled workforce due to the relatively large number of operating mines in the region. Personnel typically have private accommodation in the nearby city of Mandurah (60 km from the mine) and towns (Waroona, Hamel, Yarloop, Harvey and Wagerup).

Huntly Mine has three power supplies fed from the Pinjarra refinery. A single 33 kilovolt (KV) supply and two 13.8 kV supplies. The Pinjarra refinery is a net importer of power from the South West Interconnected System (SWIS), with internal generation capacity of 100 Megawatt (MW) from 4 steam driven turbine alternators. The steam is produced by gas fired boilers and a non-Alcoa gas turbine Heat Recovery Steam Generator (HRSG).

Willowdale Mine has a single power supply fed from the Wagerup refinery. A single 22 kV supply. The Wagerup refinery is a net exporter of power to the SWIS, with internal generation capacity of 108 MW from three steam driven turbine alternators and one gas turbine. The steam is produced by gas fired boilers.

4.5 Physiography

The western edge of the Darling Range is characterized by scarps and incised valleys, landforms which are attributed to tectonic activity along the Darling Fault, the dominant structural feature in the region which acts as the western boundary of the deposits. This feature is observable in regional topographical survey information and satellite imagery to roughly follow the coastline of southwest Western Australia and is approximately demarcated by the extent of Jarrah Forest, a recognized bioregion.

The topography of the ML1SA concession generally comprises wide valleys and undulating hills separated by minor surface water drainage channels and streams. Vegetation across the ML1SA is dominated by several areas of State Forest including Dwellingup, Lane Poole, and Youraling. These include distinct areas of old growth forest within which mining is prohibited.

The typical elevation ranges from 300 m to 400 m in the mining areas, however the highest points of the region (outside of the mining areas) are approximately 550 m.

Topography data was acquired from:

- Drill hole collar survey data
- Light Detecting and Ranging (LiDAR) surveys
- Landgate satellite data.

5.0 HISTORY

5.1 Prior Ownership

Prior to 1961, there were no records of ownership of the Darling Range mines. A Special Mineral Lease (ML1SA) was granted to Western Aluminum NL (WANL) in 1961. In the same year WANL joined Aluminum Company of America Ltd (Alcoa US). In 1977 WANL became Alcoa.

5.2 Exploration and Development History

The following text is sourced and modified from Hickman, et al, 1992.

Bauxite occurrences were first recorded in the Darling Range in 1902. Bauxite was detected as a result of analyzing laterite from Wongan Hills, and subsequently through examination of lateritic road gravels from several localities in the Darling Range. The Geological Survey of Western Australia (Geological Survey) produced studies and publications, driving the bauxite exploration, though most attention was focused on localities in the Darling Range close either to Perth or to railway lines servicing towns such as Toodyay and York. The Geological Survey mapped the extent of laterite in the Darling Range (close to Perth) to determine whether it contained commercial deposits of iron or aluminum ore.

The earliest non-government exploration for bauxite was carried out in 1918 by the Electrolytic Zinc Co. of Australia Pty Ltd, deeming the deposits to be generally low grade and not of commercial value, though like earlier explorers, did not focus upon the underlying friable units.

Of 46 early samples of laterite analyzed in 1919, 26 contained 35% or more available alumina. It was then assumed that bauxite in the Darling Range was confined to the duricrust part of the profile, and not considered in the underlying friable units. By 1938 bauxite deposits were known to be common throughout the Darling Range over an area of 560 km long by 40 km to 80 km wide.

The Geological Survey maintained an interest in Darling Range laterite as an economic source of aluminum until the 1950s. However, by the late 1950s exploration had been taken over by mining companies.

No further private exploration took place until 1957 when Western Mining Corporation Ltd (WMC) began to explore for bauxite in the Darling Range. Following a regional reconnaissance, a joint venture company, WANL, formed by WMC with North Broken Hill Ltd and Broken Hill South Ltd, explored temporary reserves over a large portion of the southwest. Profiles were sampled from road cuttings, with samples collected at 400 m intervals along main roads. Selected lateritic ridges and plateaus were sampled at 90 m intervals. These areas were part of a Special Mineral Lease (ML1SA) granted to WANL in 1961.

By 1961, WANL had delineated 37 Mt of bauxite at an average grade of 33% A.Al2O3. Also in 1961, WANL joined with the Alcoa US, allowing additional systematic exploration of lease ML1SA (Figure 5-1). Holes were drilled initially on 370 m by 185 m centers. Progressive in-fill drilling down to a spacing of 45 m by 45 m blocked out the ore at Jarrahdale and was followed by grade-control drilling. Commercial mining was finally started in 1963 at the former Jarrahdale mining center and continued until 1998, supplying bauxite to the Kwinana refinery.

The Huntly and Willowdale mines commenced commercial production in 1972 and 1984, respectively. In 1977 WANL became Alcoa. As of 2022, the Huntly and Willowdale mining operations remain active.

Huntly supplies bauxite to the Kwinana and Pinjarra refineries (approximately 27 Mtpa) while Willowdale supplies the Wagerup refinery (approximately 10 Mtpa).

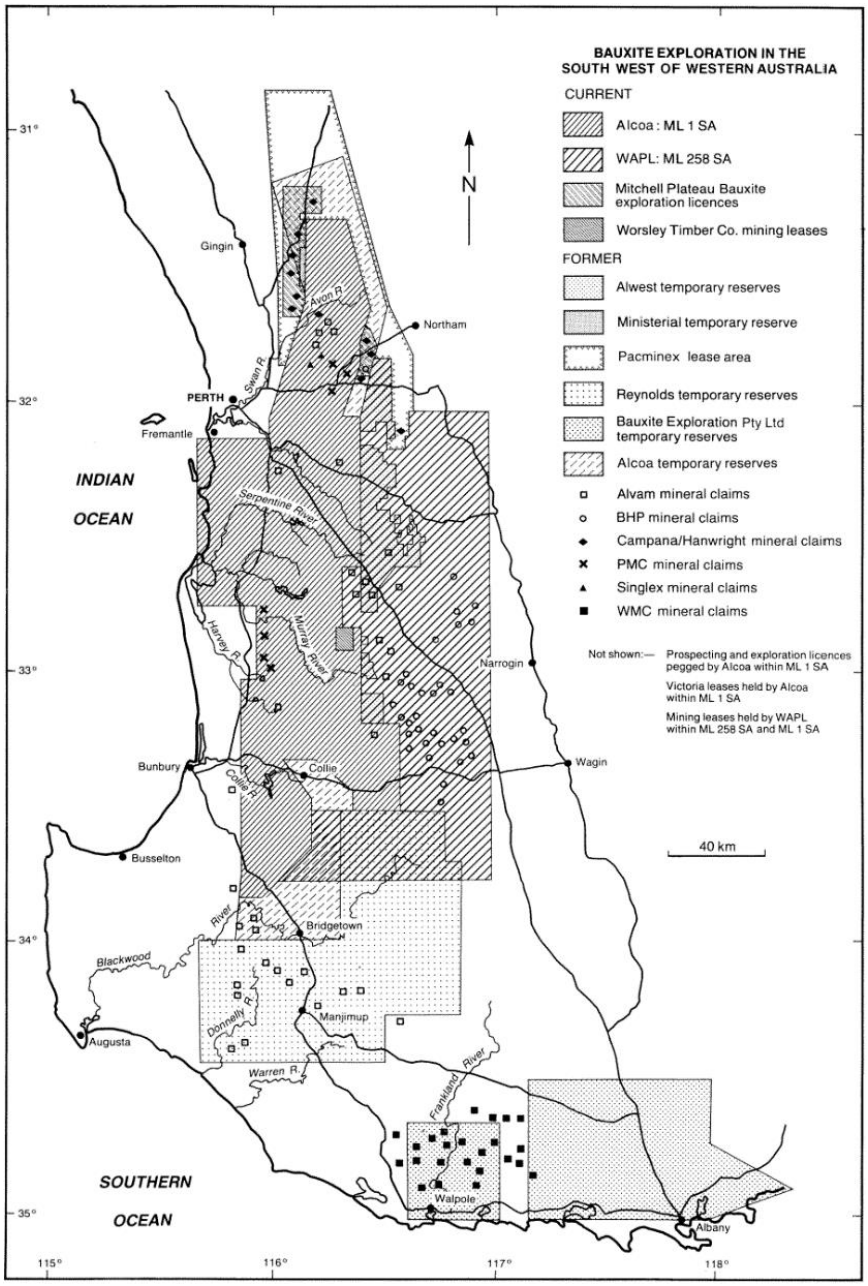


Figure 5-1: Bauxite Exploration in the Southwest of Western Australia 1961 (adapted from Hickman, 1992)

6.0 GEOLOGICAL SETTING, MINERALIZATION, AND DEPOSIT

6.1 Bauxite Deposits

Bauxite deposits, economic concentrations of aluminum oxide, represent the world's major source of aluminum and consist primarily of the minerals gibbsite, boehmite, and diaspore. These are commonly found alongside iron oxide minerals including goethite and hematite, kaolinite clay minerals, and minor accessory minerals.

Lateritic bauxite deposits such as those in the Darling Range of WA generally formed in tropical (hot and humid) environments through chemical weathering. As a result, lateritic bauxite deposits are known to exist across Central and South America, West Africa, Central Asia, and Australia.

With its large available resources, access to a stable workforce, infrastructure (comprising conveyors, rail, road, and port access), and three captive (mine-to-mill) dedicated alumina refineries, Alcoa's Darling Range Bauxite operations near Perth WA, has been one of the world's leading alumina producing regions for at least 30 years (Hickman *et al*, 1992), or approximately 60 years as of 2022.

6.2 Regional Geology

The bauxite deposits of the Huntly and Willowdale operations are located in the Darling Range region of southwest Western Australia. The predominant topographic feature of the region is the Darling Range Fault, a north-south trending scarp which extends approximately 220 km from Bindoon (70 km north-northeast of Perth) to Collie (160 km south-southeast of Perth).

The Darling Range Fault is the structural boundary between two geological terranes: the Pinjarra Orogen to the west, now the sedimentary Swan Coastal Plain, and the Yilgarn Craton to the east, a gneissic granite complex with greenstones. To the east of the Darling Range Fault intense weathering and erosion of exposed Archean basement rocks of the Western Gneiss Terrane, the western portion of the Yilgarn Craton, formed widespread lateritic bauxite deposits by the intense weathering, accumulation and leaching of the aluminosilicate rich material of the bedrock granites (Hickman *et al*, 1992).

Alcoa's current bauxite mining areas of Huntly and Willowdale are on the eastern side of the Darling Range Fault, as low-lying plateaus separated by valleys in which alluvial deposits have accumulated. Figure 6-1 shows the regional geology of the southwest region of Western Australia and Alcoa's ML1SA lease boundary in relation to Perth, while Figure 6-2 shows the distribution of surficial deposits across the region.

The Jarrahdale, Del Park, Huntly and Willowdale areas that have been mined by Alcoa are on laterite within the Western Gneiss Terrane (Figure 6-2), formed over granites that have been intruded by numerous north trending tholeiitic, quartz dolerite dykes, of early to late Proterozoic age, with thicknesses ranging from 1 m to 200 m.

Lateritic bauxite developed from the Late Cretaceous (65 million years ago, Ma) to the Eocene (40 Ma), with several periods of erosion and intense weathering of the basement granites and dolerites. Subsequent reactivation of the Darling Fault combined with periods of erosion led to the establishment of plateaus and incised valleys, trending to wider valleys and low hills to the east which now characterize the physiography of the region.

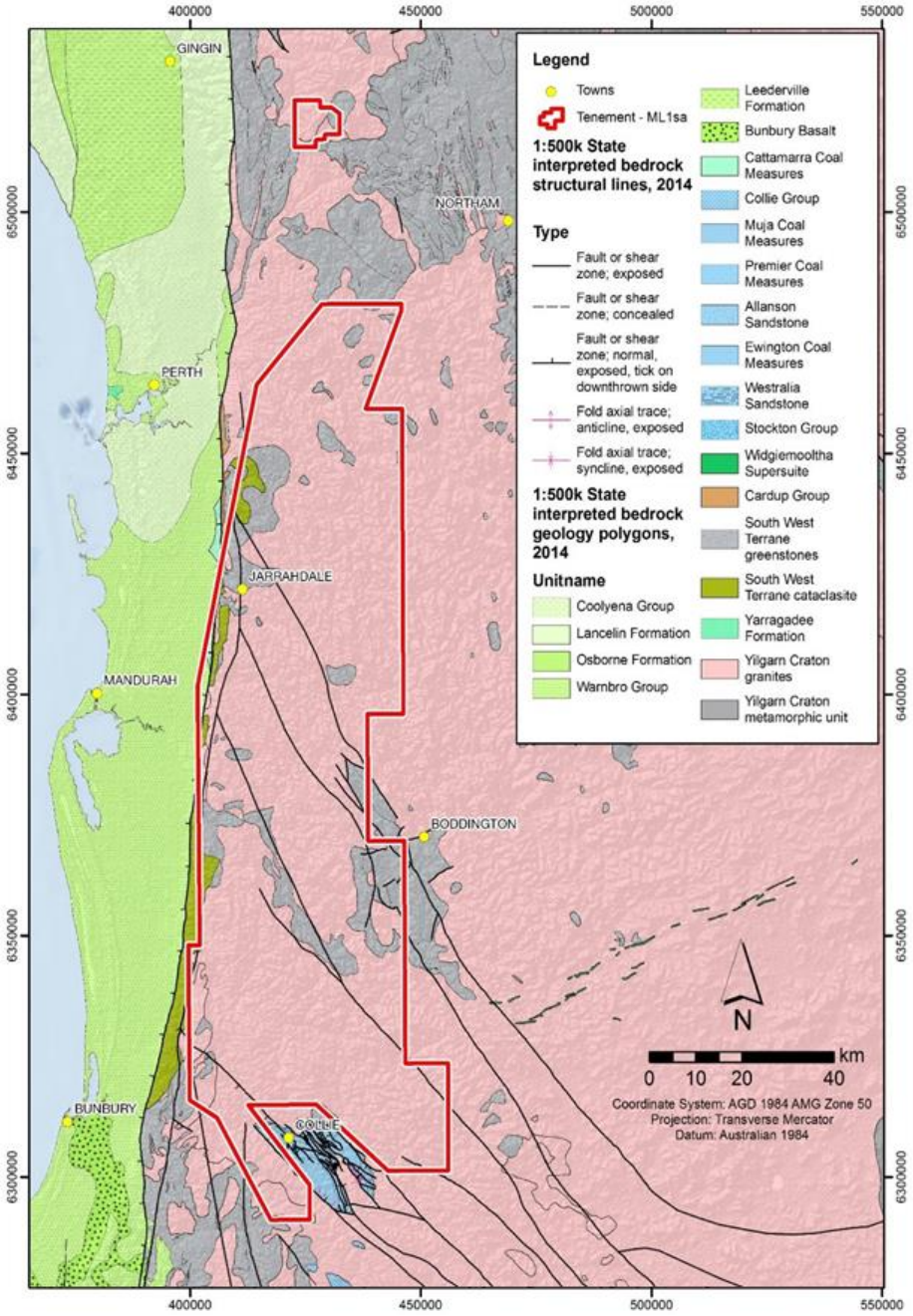


Figure 6-1: Regional Geology (adapted from SRK, 2021)

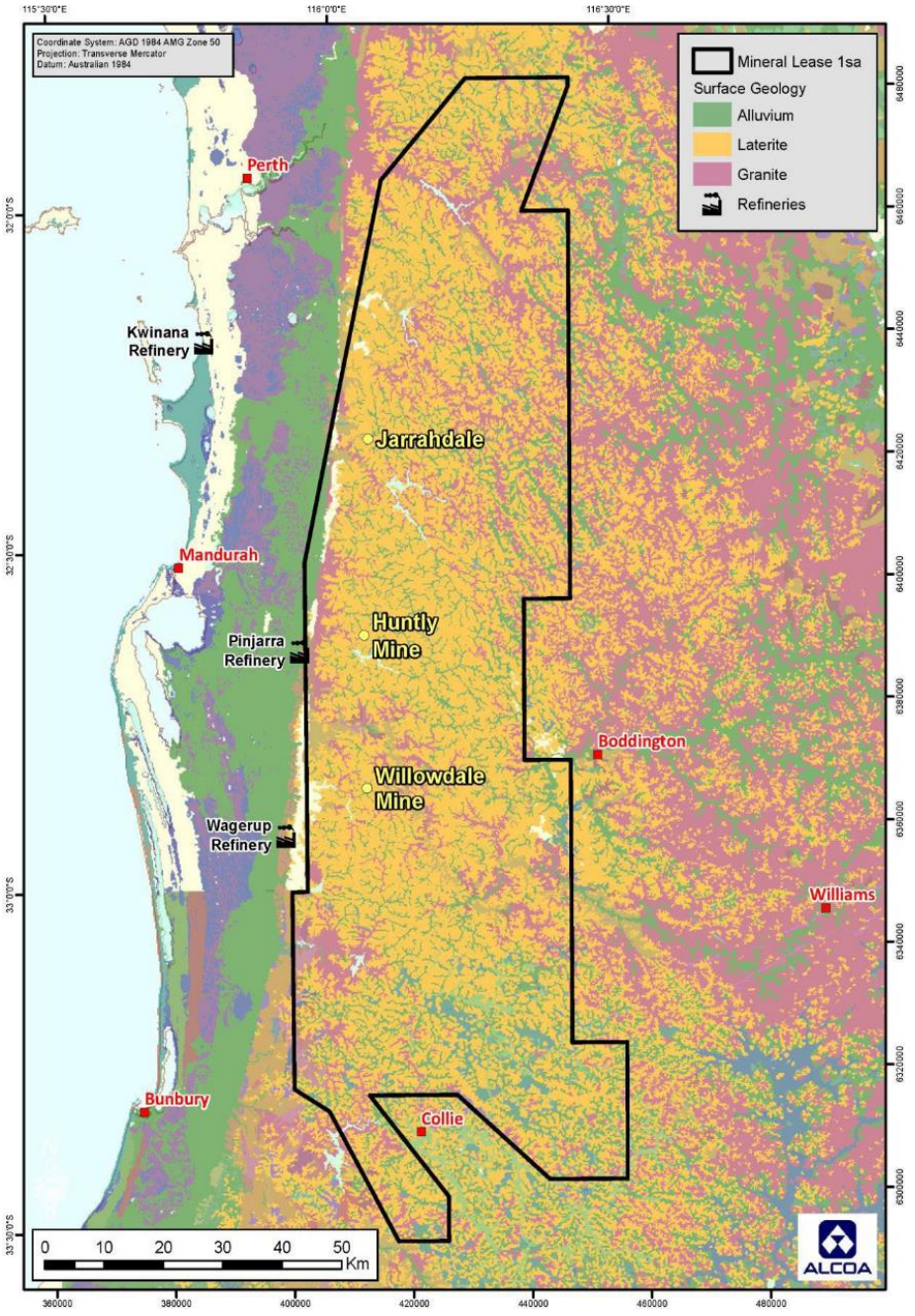


Figure 6-2: Surface Geology Showing Laterite Over Granite (Alcoa, 2015)

6.3 Local Geology

Laterite remnants are thickest and most extensive over a 150 km long region between the Avon and Harris Rivers, and within about 50 km of the Darling Scarp. The laterite occupies gently sloping (3° to horizontal) upland areas with an average elevation of 280 to 300 meters above sea level (MASL), and high annual rainfall. Steeper slopes may have a thin cover of partly transported laterite with bedrock near the surface. Above 340 m the laterite is penetrated by bedrock which rises above the general topographic level. Below 200 m drainage has removed pre-existing laterite. Blocks of laterite, released by headward erosion of streams, decay to lateritic gravels on the lower slopes of valleys, which pass laterally into alluvial sands and silt in the valley floors (Hickman *et al*, 1992).

Bauxite deposits typically occur as irregularly shaped lenses on the flanks of plateaus. Critical to this is the laterite position on the slopes (Figure 6-3): erosion generally dominates on steeper slopes which prevent accumulation and effective bauxite formation, whereas flat areas lack the necessary sub-surface water flows which drive the removal of clays and the enrichment of soluble silicate minerals.

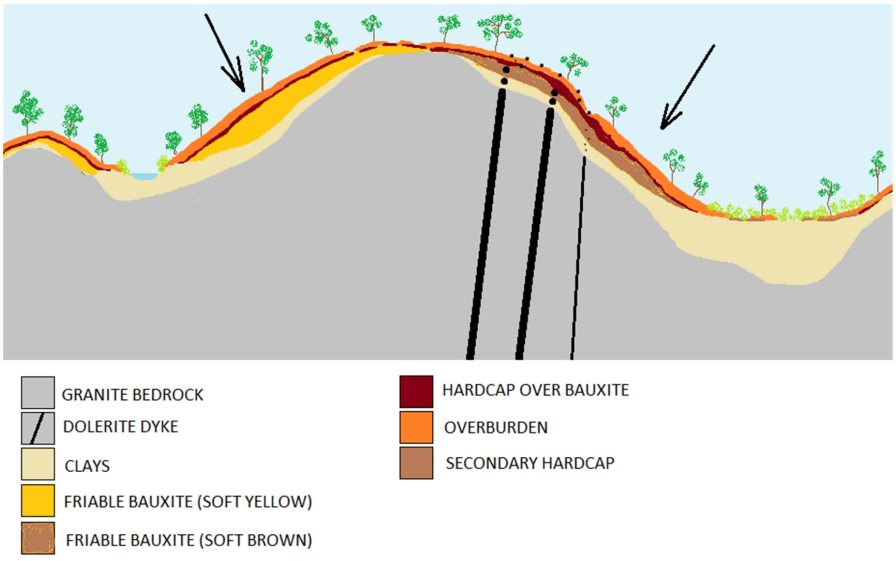


Figure 6-3: Bauxite Deposit Formation Schematic – Relief Exaggerated (Alcoa, 2021)

6.4 Mineralization

Weathering, alteration and leaching of the granite bedrock has developed the bauxite mineralization which principally occurs as 65% microcrystalline gibbsite Al(OH)3 with minor to rare boehmite ALO(OH), and accessory minerals of 18% goethite FeO(OH), 7% hematite Fe2O3, 9% quartz SiO2, 1% kaolinite/halloysite Al2Si2O5(OH)4, and 0.5% anatase/rutile TiO2.

Other minerals within the bauxite that may influence the alumina refinery performance include:

- Boehmite: generally occurring below 1%, this can cause premature precipitation of dissolved gibbsite resulting in alumina being lost to the red mud residues.

- Organic Carbon: as oxalate, typically less than 0.2%, (2.0 kg/t, measured as $Na_2C_2O_4$) this can result in reduced digestion efficiencies and cause crystal growth issues during precipitation.
- Sulphate: generally occurring at 0.25%, this can consume caustic soda during digestion resulting in lower yields.

6.5 Property Geology

Table 6-1 provides a summary of the typical stratigraphy defined by Alcoa across their Darling Range deposits. The Hardcap and Friable Zones represent the primary horizons of economic interest due to their concentrations of alumina. A generalized mineralogical profile through these horizons is provided in Figure 6-4 and a typical grade profile in Figure 6-5 showing the alumina and iron-rich Hardcap, with increasing silica and decreasing alumina through the Friable Zone.

Table 6-1: Alcoa's Darling Range Deposit Typical Stratigraphic Column

Stratigraphic horizon	Typical thickness range (m)	Description
Overburden	0 to 0.5	Mixed soils and clays, high in organic matter, generally forming a thin layer which can penetrate deeper if the underlying Hardcap surface is variable.
Hardcap (Caprock)	1 to 3	Ferricrete formed by the remobilization of iron into a layer comprising iron and alumina-rich nodules which can exhibit the highest alumina concentrations across the deposit. Highly variable in thickness but generally 1 m to 3 m with a sharp contact against the underlying Friable Zone.
Friable Zone	3 to 5	Leached horizon resulting in the accumulation and enrichment of bauxite minerals. The Friable Zone comprises a mixture of the overlying Hardcap, clasts, Al and Fe rich nodules, and clays. Upper contact with the Hardcap is variable, found as a sharp or transitional boundary in places. Available Alumina ($A.Al_2O_3$) typically reduces with depth as Reactive Silica ($R.SiO_2$) increases, defining the lower boundary with the Basal Clay.
Basal Clay	-	Kaolinitic clay horizon which, transitions into a saprolitic zone above unweathered basement. This horizon is typically used as a marker indicating the full bauxite zone has been intersected and where drilling is often stopped.

Alcoa's bauxite deposits across the Darling Range show high variability in both the thickness and relative proportion of each horizon. Table 6-2 provides an extract from the acQuire database for the Mining Centres of Huntly (in the north) and Willowdale (more southerly) showing the most common (modal) Depth To Top and Thickness of the four stratigraphic horizons, based on logged drill holes from 2016 to 2020.

Table 6-2: Summary of Typical (Modal) Stratigraphic Horizons Within Each Area

Area	Description (m)	Overburden	Hardcap	Friable Zone	Basal Clay
Huntly	Depth to top	-	0.64	1.51	4.54
	Thickness	0.64	0.87	3.04	-

Area	Description (m)	Overburden	Hardcap	Friable Zone	Basal Clay
Willowdale	Depth to top	-	0.58	1.51	4.91
	Thickness	0.58	0.93	3.40	-
North	Depth to top	-	0.64	1.78	4.45
	Thickness	0.64	1.14	2.67	-

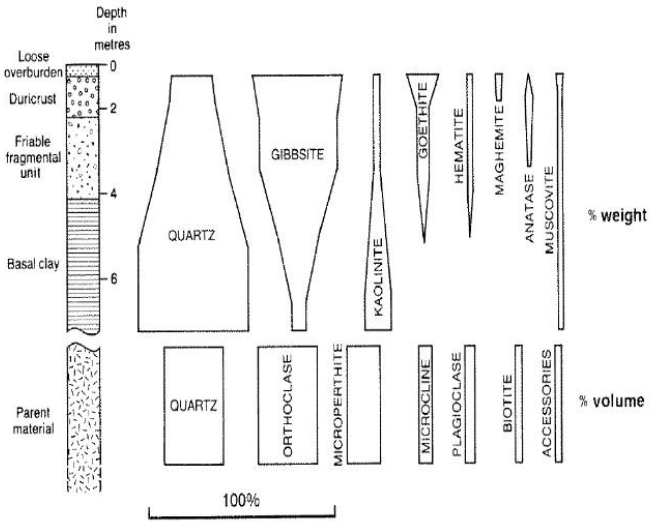


Figure 6-4: Typical Alcoa Darling Range Mineralogy Profile (Hickman et al, 1992)

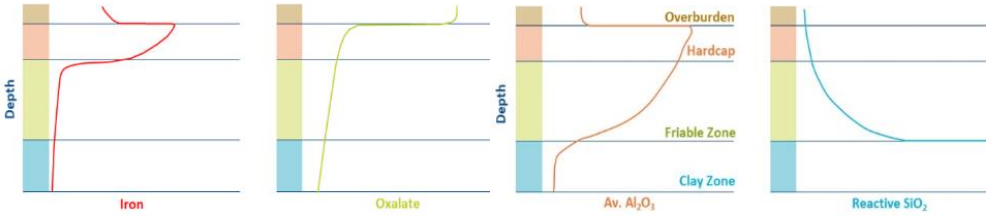


Figure 6-5: Typical Alcoa Darling Range Grade Profile (Alcoa, 2015)

Typical photos of the bauxite profile in current mining areas observed on 14 October 2021 are provided in Figure 6-6.



Left: Vegetation cleared prior to mining. Right: Top soil and oxalate removed leaving Hardcap



Left: Blastholes on Hardcap after sheeting with low grade. Right: Hardcap (hard brown) Friable (soft yellow), relict fresh remnant Dolerite dyke boulder



Sandy topsoil, Hardcap (hard brown), Friable (soft yellow), Basal Clay (white clay, lower right in the floor).

Figure 6-6: Typical Alcoa Darling Range Mining Sequence and Vertical Profile (SLR, 2021)

7.0 EXPLORATION

7.1 Exploration

WANL, which became Alcoa (in 1977), carried out exploration over much of the ML1SA lease area in the 1960s as mentioned in Section 5.2. Samples were assayed for Total Al2O3 only and the data, referred to as the Imperial Drilling, is still retained comprising approximately 104,400 holes and approximately 670,000 samples.

The Imperial Drilling has not been used to prepare the current Mineral Resource estimate because the sample collection, preparation, and assaying techniques were not consistent with current practices and can no longer be validated.

7.2 Resource Definition Drilling

Resource definition drilling is initially done on a nominal regular grid spacing of 60 by 60 m. Infill drilling programs are then scheduled as required to reduce the drill spacing to 30 by 30 m, and then 15 by 15 m.

The planned drill hole collars are assigned a hole identifier (Hole ID) using the code of the 15 by 15 m grid point on the 1:1,000 Map Sheets (Section 3.3).

A total of 332,017 holes were used to the resource estimate, and theses holes were drilled between 1981 to 2022, with approximately 80% drilled after 2009.

A tabulation of the drill quantities by year and location is presented in Table 7-1, and a graphical summary is shown in Figure 7-1.

Table 7-1: Drill Quantities by Year and Location

Year	Holes				Meters				Assay			
	Huntly	North	Willowdale	Total	Huntly	North	Willowdale	Total	Huntly	North	Willowdale	Total
1981	656			656	5,574			5,574	10,415			10,415
1983	199			199	1,090			1,090	1,899			1,899
1984	995			995	7,083			7,083	12,119			12,119
1985	393			393	2,815			2,815	4,971			4,971
1990	13			13	58			58	101			101
1991	2,900		1,073	3,973	16,145		8,335	24,480	28,170		15,066	43,236
1992	6,169		1,512	7,681	34,156		10,868	45,024	59,442		19,632	79,074
1993	2,264		546	2,810	13,022		3,502	16,525	22,723		6,424	29,147
1994	6,527	632	1,168	8,327	36,032	4,019	6,453	46,504	62,083	7,103	11,224	80,410
1995	4,354	79	1,843	6,276	25,841	477	10,543	36,861	45,064	871	19,021	64,956
1996	4,673	336	641	5,650	26,196	1,522	4,025	31,743	45,771	2,667	7,300	55,738
1997	808		2,908	3,716	4,868		18,422	23,290	8,603		33,146	41,749
1998	7		835	842	61		5,149	5,209	111		9,339	9,450
1999	18		906	924	137		4,325	4,462	239		7,603	7,842
2000	22		174	196	187		1,022	1,210	344		1,852	2,196
2001	538		317	855	4,893		2,087	6,980	9,038		3,805	12,843
2002	1,104		252	1,356	9,187		1,440	10,627	16,789		2,551	19,340
2003	287		1,221	1,508	1,973		8,032	10,005	3,557		14,727	18,284
2004			272	272			1,413	1,413			2,569	2,569
2005	783		1,641	2,424	5,655		9,588	15,243	10,248		17,503	27,751
2006	1,357		508	1,865	9,815		3,212	13,027	18,090		5,936	24,026
2007	4,241		2,832	7,073	29,312		19,353	48,665	53,795		35,473	89,268
2008	2,975		739	3,714	18,299		4,524	22,823	32,639		8,101	40,740

Year	Holes				Meters				Assay			
	Huntly	North	Willowdale	Total	Huntly	North	Willowdale	Total	Huntly	North	Willowdale	Total
2009	4,468		324	4,792	25,928		1,901	27,829	45,870		3,451	49,321
2010	9,027		1,568	10,595	52,706		10,755	63,460	92,198		19,778	111,976
2011	10,072		925	10,997	54,908		6,404	61,313	95,665		11,696	107,361
2012	10,507		1,198	11,705	59,552		9,352	68,903	103,654		17,326	120,980
2013	11,656		2,629	14,285	69,457		21,002	90,459	121,176		38,816	159,992
2014	8,977		9,406	18,383	50,588		64,736	115,324	88,452		119,187	207,639
2015	14,737		9,987	24,724	82,480		61,418	143,897	144,552		111,469	256,021
2016	14,738		330	15,068	88,714		1,737	90,451	156,269		3,019	159,288
2017	7,245		6,317	13,562	39,253		37,467	76,720	68,540		66,311	134,851
2018	11,027		10,596	21,623	59,764		55,857	115,620	105,317		98,614	203,931
2019	15,437		10,949	26,386	89,967		72,144	162,111	158,019		129,773	287,792
2020	22,487		16,278	38,765	118,632		102,516	221,147	206,952		184,609	391,561
2021	19,418		12,677	32,095	123,602		96,872	220,474	218,276		176,705	394,981
2022	19,637		7,682	27,319	120,056		57,600	177,656	214,432		104,561	318,993
Total	**220,716**	**1,047**	**110,254**	**332,017**	**1,288,008**	**6,018**	**722,050**	**2,016,076**	**2,265,582**	**10,641**	**1,306,587**	**3,582,810**

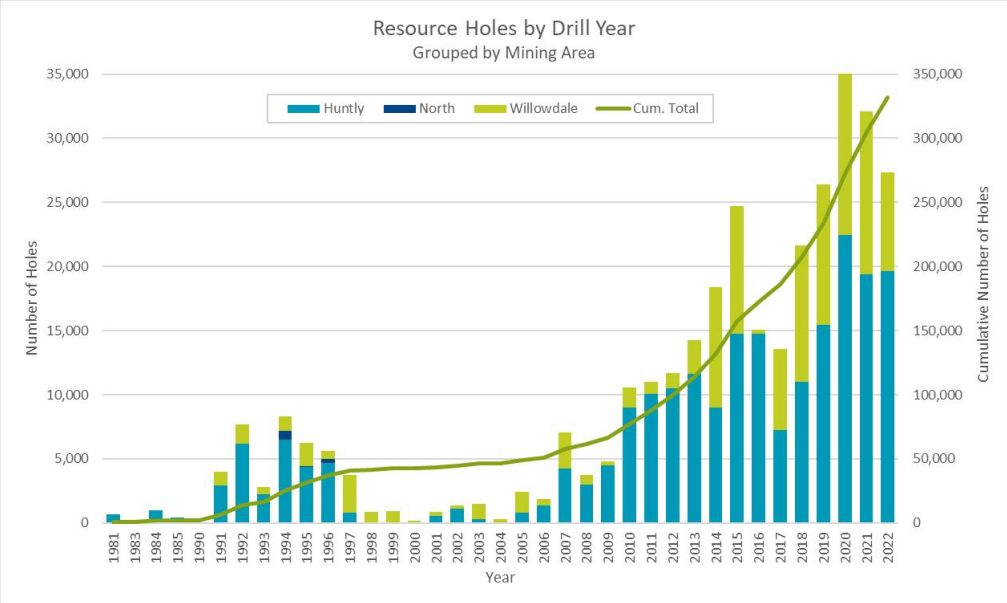


Figure 7-1: Chart of Resource Drill Holes by Year (Alcoa, 2022)

The Darling Range deposits contain more than three million drillholes distributed across a lease of over 7,000 km², making it unfeasible to show a plan view of the property with the locations of all drill holes and other samples. Figure 3-3, however, shows the lateral extent of Alcoa's mined areas and Mineral Resources and Mineral Reserves within the ML1SA lease. The Darling Range bauxite project is considered to be in the process of sustaining Mineral Reserve from already defined mineralization, rather than in Exploration mode, looking for new, broader targets. Resource Definition drilling is planned to continue throughout all areas where Alcoa has mining permits as described, to sustain the Mineral Reserves and future production. Figure 7-2 shows a typical section through 30 m spaced Resource definition drillholes:

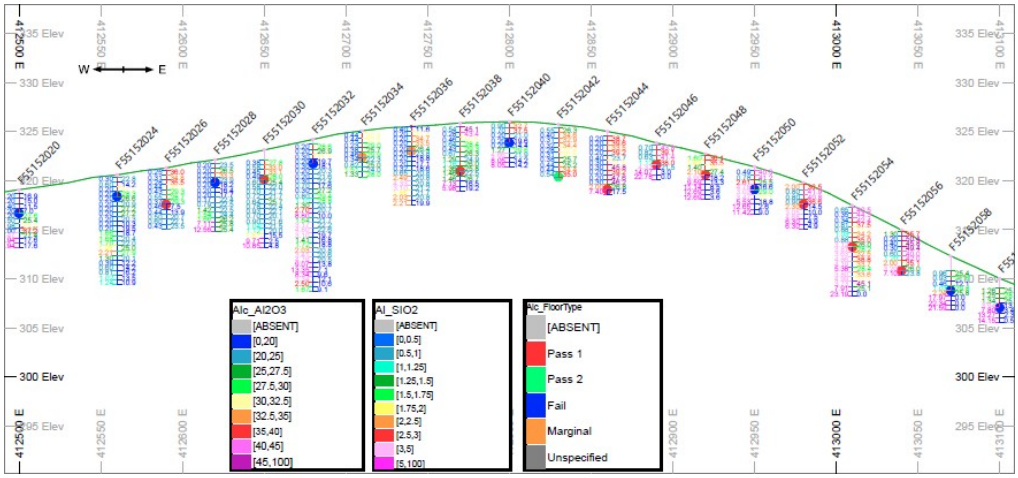


Figure 7-2: Example Geological Section – F55 N 6,325,500 (SRK, 2021)

7.3 Drilling Methods

The methods currently used for drill sampling in the Darling Range by Alcoa have been consistently used since the 1980s. Drilling is done using dedicated drills mounted on a fleet of tractors which can be driven off tracks into the forest, causing minimal damage or disturbance and obviating the need to clear drilling pads. Planned hole positions are located by the driller using Global Positioning System (GPS). The articulated tractors are highly maneuverable and there is only minor disruption to groundcover vegetation and saplings which may be eased out of the way (Figure 7-3).



Figure 7-3: Resource Drilling Tractor Accessing the Forest (SLR, 2021)

Drilling is completed by; Alcoa using vacuum drill rigs, by contractor Wallis Drilling using their patented reverse circulation (RC) aircore rigs, and by contractor JSW using a similar RC method. Wallis and JSW holes are both referred to as aircore drilling. In 2021 there were 5 Alcoa rigs, 3 Wallis rigs, and 4 JSW rigs.

In recent years the drilling period has been extended from 9 to 10 months. More wet ground is now encountered and, where required, vacuum drilling is either deferred until the ground conditions improve, or is re-assigned for aircore drilling.

Drilling is rapid with holes typically completed every 15 minutes from locating the collar position to completing the drilling, cleaning the sampling equipment and readying the samples for dispatch. While 12 rigs are currently used, the procedure is consistent across all rigs and virtually unchanged since the early 1990s at Jarrahdale. Minor modifications to the drilling procedures that have occurred include (in order of importance for their impact on the resource database):

- Drilling initially was done by vacuum rigs but this has been supplemented by the aircore rigs.
- GPS methods have been introduced to locate the drill hole collar positions in 3D space, providing more precision on the hole and sample locations (noting that hole positions are assigned to the planned position, see Section 7.6.
- The sample catching, splitting and logging procedures have been progressively upgraded, following review by various independent consultants (Holmes, 2018; Snowden, 2015; SRK, 2017, 2018, 2019b, 2021a; Xstract, 2016). The riffle splitting system has been enhanced through simple changes to provide a better, more robust method.
- The logging system has changed from manual paper plods to a completely digital recording system, albeit with paper backup where needed. Barcodes are now used on samples and matching these to the logs is now semi-automatic.
- The splitting and logging equipment on the drill rig has been progressively improved to make setup and pack-down more efficient and to protect the logging equipment during site moves.
- Rollover bars, guards, shields, lockouts and other safety protections have been added and safety procedures enhanced with industry norms.
- Environmental protections and reporting have been enhanced to best practice in SLR's opinion.

Samples used for Mineral Resource estimation are only acquired using vacuum drilling or aircore reverse circulation. Both methods generally drill dry holes in that water is not added. Water ingress into vacuum holes destroys the sample circulation and wet holes are abandoned. Alcoa commenced aircore drilling in 2015, with the initial plan being to phase out vacuum drilling. The prime advantage of aircore over vacuum is sample recovery when holes do encounter groundwater.

For the 2022 Mineral Resource inventory, 12% of the estimation dataset is derived from aircore holes. In the 2019-2021 drilling for which assay data is available, 79% was performed using aircore (71% for Huntly and 89% for Willowdale).

In vacuum drilling the sample is finely ground and sucked up from the bottom of the hole by a top-mounted vacuum pump. In aircore drilling, compressed air is blown down the annulus between the inner and outer drill string tubes, pushed out through ports on the face of the bit and then blows the sample through the center of the bit and up the drill string.

In both methods, the sample material is extracted from inside the bit, avoiding sample delineation error (contamination), and carried up the center of the drill string into the sampling container, avoiding sample extraction error (sample material left down the hole or lost as dust).

The aircore drilling uses a blade bit with a nominal cutting diameter of 45 mm and an internal retrieval tube diameter of 22 mm (Figure 7-4). Alcoa increased the internal diameter to 25 mm in 2018 to reduce blockages. The particle size of drilled material is sufficiently small (less than 10 mm) to promote good sample splitting in dry conditions.



Figure 7-4: Drill Bits, Reverse Circulation Drill String and Particle Size of the Sample Residue (SLR, 2021)
Scale pen diameter 13 mm

7.4 Drill Sampling

7.4.1 Procedure

The sample catching, splitting and logging procedures are the same for both vacuum and aircore drilling (Figure 7-5).

The drilling and logging are controlled by the driller with minimal supervision by geologists. This has been observed and is deemed reasonable by the QP due to the combination of very simple logging, experienced personnel, employment continuity and continual review by geologists.

Sampling commences at the base of the overburden and continues until the driller considers that the basal clays have been penetrated for at least 1 m or for infill holes at a 15 m spacing to the depth defined on the drill hole plan from surrounding data. Alcoa estimates that between 10% and 15% of the limited depth holes terminate in bauxite.

Samples are collected at 0.5 m intervals, measured using a laser gauge mounted on the rig. At the end of each 0.5 m interval, the drilling is paused and the sample passes from the cyclone (for aircore) into the collection flask. For vacuum drilling the collection flask is at the end of the vacuum system.

The sample, nominally 1.5 kg, is poured from the flask into a feed tray, distributed evenly, then on the vacuum rigs the tray is pivoted to feed a small 12-vane riffle splitter (the rotating tray is excellent but

not yet fitted to the aircore rigs). Where (usually) required, the splitting is repeated to give a retained split of 150 to 200 g, small enough to be collected into a 120 mL measuring cup with minimal spillage. The riffle split subsample is poured into a barcoded Kraft packet and boxed for dispatch to the assay laboratory. The sample retrieval and splitting systems are cleaned with compressed air after each hole.

During the site inspection, the JSW RC sampling procedures were observed closely. It was found that the principles of correct sampling were understood by all personnel at the rig and the equipment and practices were observed to be satisfactory.

Over the period 2015 to 2021 the drill sampling procedures have been externally reviewed (Snowden, 2015; Holmes, 2018; and others) and various improvements have been made such as using riffle splitters with more vanes, using a pivoting tray to consistently feed the splitter, training in the correct splitting and retention of all the subsample, digital recording of logging, monitoring of accuracy with Standards, and monitoring of precision with duplicates.



Figure 7-5: Sample Catching and Riffle Splitting Practices (SLR, 2021)

7.4.2 Recording Sampling Data

The drill hole and sample information are recorded digitally onto a tablet at the rig during drilling (Figure 7-6). The data is automatically loaded into an acQuire database. In previous years the same information was all recorded in a ticket book and manually transferred to the database. This approach remains as a backup method when needed. Data recorded includes hole number, drill rig number, driller name, offsider name, depth of overburden, depth of Caprock, map reference, material type code, and comments on the reason for ending the hole, e.g. if bedrock or water was encountered.



Figure 7-6: Barcode Reader and Digital Recorder Mounted on the Drill Rig (SLR, 2021)

7.4.3 Sample Logging

The geology of the Darling Range bauxite is well understood. The Material Type codes have been simplified to meet the production needs of the operation and the drill crew has been trained in their identification, which is primarily based on color and hardness.

This results in logging of a reasonably consistent regolith profile formed by surface weathering of the few bedrock types (granite or dolerite). A comprehensive geological log is not produced but the Material Type codes can be ratified by the assay results. The Material Type codes are provided in Table 7-2.

Table 7-2: Logging Codes for Material Type

Material Type	Description	Comment
HB	Hard brown	Hardcap and Friable Zone
HSB	Hard / soft brown	
SB	Soft brown	
SY	Soft yellow	
CLB	Clayish brown	
CLY	Clayish yellow	Basal Clay Zone
BC	Brown clay	
YC	Yellow clay	
WC	White clay	
DOL	Dolerite	Intrusion
GR	Granite	
WET	Wet	Other
ROD	Broken rod	

7.5 Topography

Topography data was acquired from:

- Drill hole collar survey data and check surveys performed using Trimble R10 real time kinematic differential global positioning system (RTK DGPS) equipment.
- LiDAR surveys conducted in April 2015, November 2016, and June 2018 (no further surveys have been required). A plan showing the LiDAR coverage for each survey is provided in Figure 7-7.
- Landgate satellite data collected in the late 1990s.

A digital elevation model representing the natural surface was prepared by combining (in order of priority) the collar survey data, the LiDAR data and the satellite data.

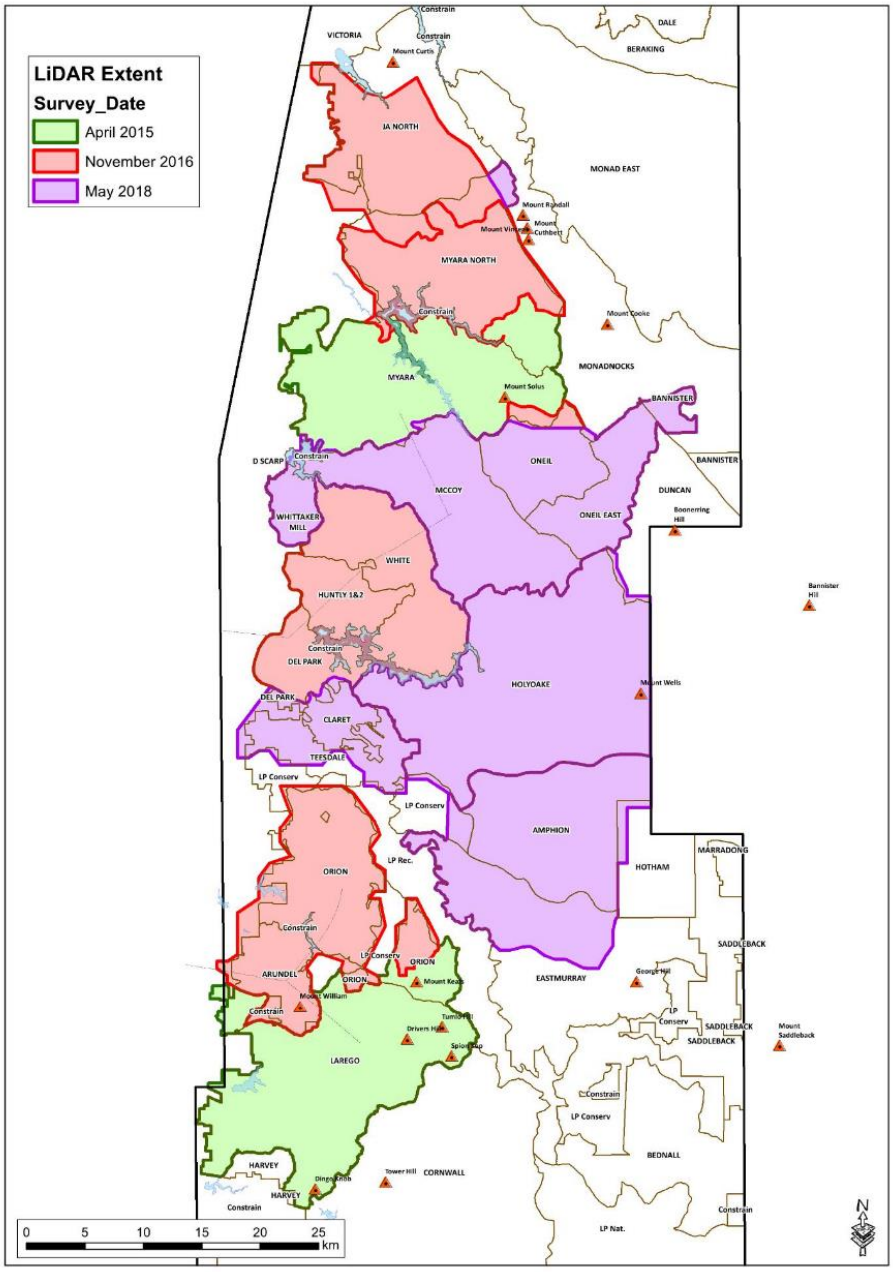


Figure 7-7: Topographic Data Coverage of the 2015, 2016 and 2018 LiDAR Surveys (Alcoa, 2022)

7.6 Surveying

Alcoa has consistently drilled the Darling Range bauxite deposit on a 60 by 60 m grid (with infills to 30 by 30 m and 15 by 15 m) since the 1970s. Initially collar peg positions were surveyed using either a theodolite or Total Station. The 30 m and 15 m pegs were positioned between the 60 m pegs using tape and an optical square. Alcoa commenced using GPS survey control (RTK DGPS) in mid-2015.

Drilling is conducted before any forest clearing activities, which are only carried out for mine development. Positioning the drill rigs is thus imperfect. If the actual coordinates are within 2 m of the planned coordinates, the hole is considered to be correctly located, and the planned coordinates are used in in all subsequent processing. Holes that are collared more than 2 m away from the planned location are flagged accordingly in the database, but the planned coordinates are still used in preference to the actual locations. In 2015, Alcoa commenced check surveying of collar positions after drilling. Most of the holes drilled in 2016 and 2017 were check surveyed. Major discrepancies, such as large differences between the actual coordinates and the coordinates defined by the hole identifier, are investigated and corrected in the database.

The planned coordinates at the 15 by 15 m grid points on Map Sheets (see Section 3.3) are used in preference to the actual coordinates because the original resource delineation systems (Polygonal and GSM, see Section 11.3) were based on the use of regularly gridded data. The use of planned instead of actual coordinates does introduce some uncertainty in the local sample position and consequently the local estimates. However, it is noted that:

- The lateral error is random, small in magnitude compared to the smallest drill grid spacing (15 m) and monitored (Figure 7-8) with deviations from plan greater than 7 m redrilled.
- The error affects few holes (for 2020 of the 52,546 holes drilled, 65.0% were within 2 m, and 99.7% within 5 m).
- The long range of the grade continuity of mineralization as shown by the variograms is several hundred meters.
- The local small-scale variations on the grade of mineralization due to variations in the amount of lateralization are uncontrolled and unpredictable (see discussions of drill hole twinning in Section 8.5.3.3).
- The effect is a controlled ‘random stratified grid’, given that the nominal collar position is always used for estimation and there is no evident bias.

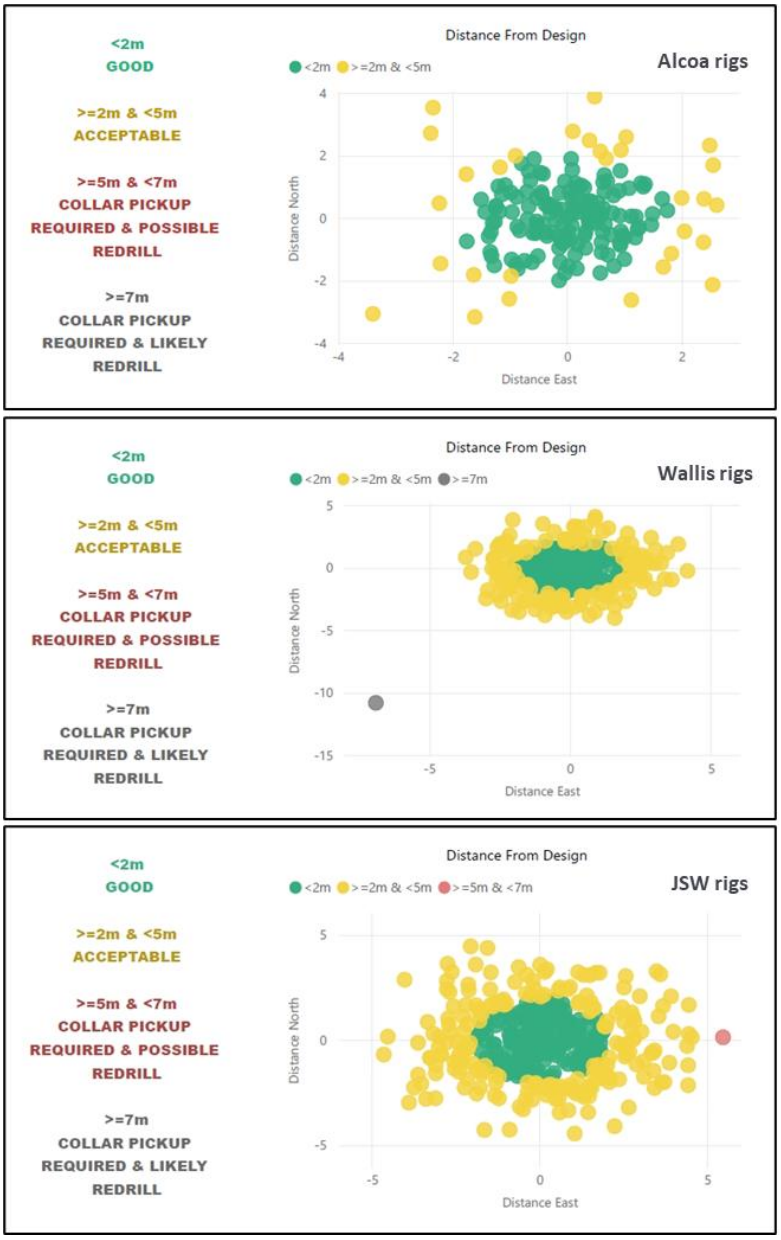


Figure 7-8: Error in Actual Collar Location from the Nominal (planned) Position is Monitored for the Three Drill Rig Types (Alcoa, 2021)

Downhole surveys are not performed in drill holes because of their generally shallow depth and narrow diameter, so all holes are assumed to be vertical.

The drill rigs have limited capacity to be levelled and cannot drill angled holes, so in some circumstances the holes may be drilled perpendicular to the natural surface. The rigs are designed to safely operate on gradients of up to 15°, so holes could be drilled up to 15° off the vertical. For a 6 m hole drilled at the planned collar position, the offset may be up to 1.55 m horizontally and 0.2 m vertically (Figure 7-8).

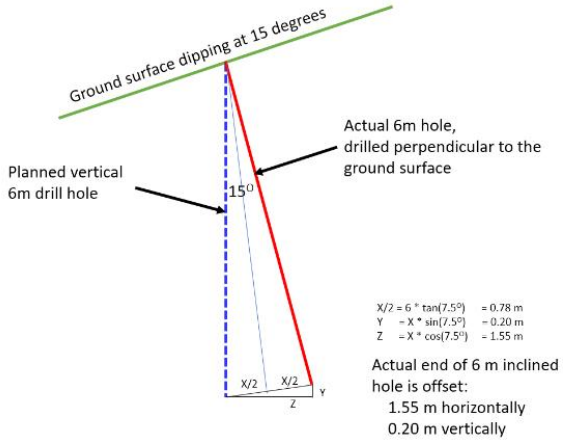


Figure 7-9: Possible Lateral and Vertical Sample Location Error on 15° Sloping Ground (SLR, 2021)

The impact of differences between the actual locations of samples in 3D space compared to their nominal location on the mine plan is considered to not materially impact on the Mineral Resource because the errors in the spatial controls on mining are likely to be of the same magnitude as the spatial errors in mining (±2 m laterally and ±0.3 m vertically). Mining is locally controlled by DGPS on mining equipment to meet short-term plans and visually for indications of the base of ore (e.g., WC white clay).

7.7 Sampling Conclusions

In the QP's opinion, the drill sampling and sample control procedures at Alcoa's Darling Range Bauxite Operations are adequate and appropriate for use in the estimation of Mineral Resources. The defined volumes and grades of mineralization are not expected to be systematically impacted (biased) by errors in either the collar location or the 3D sample location.

7.8 Hydrogeology Data

Historically, no site-specific hydrogeological data was available on the basis that no hydrogeological considerations are required for the definition of mining plans in Alcoa's Darling Range operations. However, extension of mining activities into the proposed Myara North and Holyoake development envelopes was recently considered to potentially pose a risk to the multiple uses of groundwater in the area including drinking water production, timber harvesting, pine plantation and recreation.

Alcoa has collected groundwater level and groundwater quality data within the Myara North mine region since the 1970s, with available groundwater data typically concentrated within the eastern areas

of the mine region. In contrast, only limited water level and water quality data had been obtained within the Holyoake mine area. As part of the 2020 to 2021 baseline monitoring program, the monitoring network and program was expanded to include:

- 18 new groundwater bores at 16 locations within the Myara North mine region, to supplement 25 existing Alcoa groundwater bores. Two sites included installation of a shallow and deep paired bores, providing data on groundwater for the upper 'perched' unit and the underlying more regional groundwater.
- 17 new groundwater monitoring bores were installed in 2020 within the Holyoake mine region, to supplement 8 existing Alcoa groundwater bores.
- The baseline groundwater monitoring program comprised monthly water level dips and physico-chemical parameter measurements from October 2020, with groundwater samples collected for laboratory analysis of a broader suite of parameters in October 2020 and February 2021.

In consideration of the data obtained from the expanded monitoring network, several hydrogeologic and hydrologic investigations were undertaken by GHD Pty Ltd (GHD) throughout 2021 and into 2022, including:

- Implementation of a baseline surface and groundwater monitoring program including installation of a monitoring network
- Groundwater modelling for Myara North and Holyoake mine regions
- Drinking water risk assessment for Serpentine, Serpentine Pipehead, South Dandalup and Wungong Brook catchments.

The results of these investigations will be assessed as part of the Pinjarra Alumina Refinery Revised Proposal (Assessment No. 2253), which includes the Huntly Bauxite Mine transition to Myara North and Holyoake (See Section 17.1.2).

7.9 Geotechnical Data

No site-specific geotechnical data is available; however, as the slopes are so shallow, no geotechnical considerations are required for the definition of mining plans in Alcoa's Darling Range operations.

8.0 SAMPLE PREPARATION, ANALYSES, AND SECURITY

Sample preparation is performed by Bella Analytical Systems (Bella). Although the laboratory is located within Alcoa's Kwinana Refinery complex and only processes Alcoa material, it is independently owned and operated by Bella. A link exists between the Bella and Alcoa Laboratory Information Management System (LIMS) for the two-way exchange of data. Bella does not have Australian National Association of Testing Authorities (NATA) accreditation.

All assays produced by Bella are monitored and controlled by Alcoa at the Kwinana Mining Laboratory (KWI), which, although it has a QA/QC system based on ISO 9001 protocols, only has one section of the laboratory certified to ISO 9001 for the purpose of certification of shipment assays of alumina.

A robotic processing system is used to prepare each sample for Fourier Transform Infrared Spectrometry (FTIR) and Reference Method (REF) testing. This entails pulverizing each sample in a flow-through ring mill to a nominal grind size of 85% passing 180 µm, and then splitting off sufficient material to fill a barcoded scanning flask (20 mm high with an 80 mm diameter). The material from the ring mill is discharged through a rotary splitter, with approximately 80–100 g of material retained for geochemical testing, and the remainder discarded. A duplicate sample is collected from 1% of the samples via a rotary splitter fitted with twin select chutes. These samples are used for Reference Methods testing.

8.1 Sample Security

Subsamples are collected by the drillers, sealed into Kraft packets with barcodes and submitted for assay. Cardboard boxes holding 50 packets are delivered at the end of each shift, by the drilling crew, to secure sample storage facilities. Unfilled boxes are stored in the drill support vehicle and completed in the next shift.

The filled sample boxes are stacked onto pallets in batches of 40 (i.e., 2,000 samples), wrapped with plastic and dispatched by courier to the Bella assay facility at the Kwinana Refinery.

8.2 Sample Preparation

Upon receipt by Bella, the sample barcodes are scanned and checked against the submission data in the Bella LIMS. Each sample packet is then split open at the top, placed in a cardboard drying tray and oven-dried at 100°C for 10 hours. The packets are transferred to a customized holder in batches of about 60, with a control between each batch, and automatically fed to a bank of 10 Rocklabs flow-through ring mills, (Figure 8-1), each of which have three concentric milling rings. The barcode is read, the sample is pulverized, a subsample is rotary split, captured in a single-use plastic Petri dish with the barcode printed on the lid, then sent to the spectral analyzer for assay. The ring mills are air flushed and vacuumed between samples.

Each sample is pulverized to a nominal grind size of 85% passing 180 µm. The ring mill discharges through a chute and rotary splitter, retaining 80 to 100 g and discarding the rest. One of the ring mills is set up to take two splits and these are used for pulp duplicate assays and to generate the Reference (REF) samples. These are sent to the KWI for wet chemical assay checking of the spectral assay. Pulverized samples are stored in a barcoded dedicated receptacle for assay (Figure 8-2).

The robotic system can run 24 hours a day handling approximately 3,000 samples per day. Only the Mineral Resource estimation samples are processed at Bella with all other stockpile and processing control samples processed using the same methods as the REF samples.



Figure 8-1: The Bella Robotic Sample Preparation using Rocklabs Ring Mills (SLR, 2021)



Figure 8-2: The Pulverized Sample is Stored in a Barcoded Dedicated Receptacle for Assay (SLR, 2021)

A LIMS system controls the progress of the sample packet through the whole of the sample preparation and assay procedure enabling digital tracking of all stages (Figure 8-3). This ensures *inter alia* that the sample is valid, not previously assayed, and the assay looks like one for a bauxite sample. It also generates pulp duplicates at a frequency of 1 in 100 which are also the REF samples.

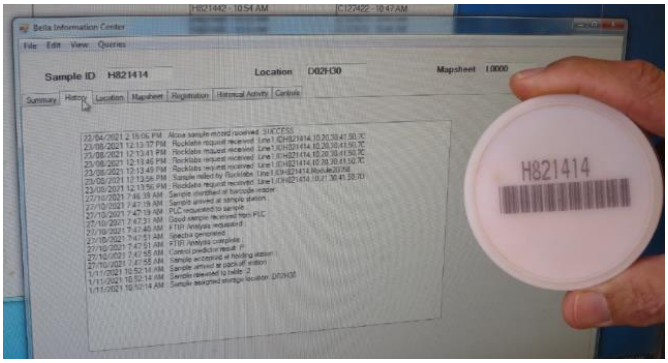


Figure 8-3: The Pulverized Sample is Tracked Digitally Through the Bella Preparation and Assaying (SLR, 2021)

Grind size monitoring is carried out with the advantage of the robotic sample preparation being consistent grind size. A risk with all such systems is the possibility of contamination between samples. This is usually avoided by inserting blank samples of zero grade into the sample processing stream. The difficulty is that the blank samples may themselves contaminate the next sample being assayed. Blank sample submission is discussed in Section 8.4.2.

Quality control (QC) procedures were developed and implemented to monitor the Bella robotic sample preparation system (Franklin, 2019) and they include:

- Temperature testing on the ovens. These are recorded between 2 and 5 times a year since 2017 at 8 positions for each of 4 ovens and demonstrate consistent safe drying temperatures below 100ºC (average 97.9°C for 352 readings).

- Daily grind size checks. The percentage passing 180 microns and percentage exceeding 300 microns is recorded at Bella on all 10 ring mills at a rate of 1:200 for the resource drill samples, with independent checks by the KWI on a random selection of all samples milled for the week. These demonstrate satisfactory sample preparation, and the consistency of the Bella robotic system, which is critical for effective FTIR assaying (Figure 8-4).

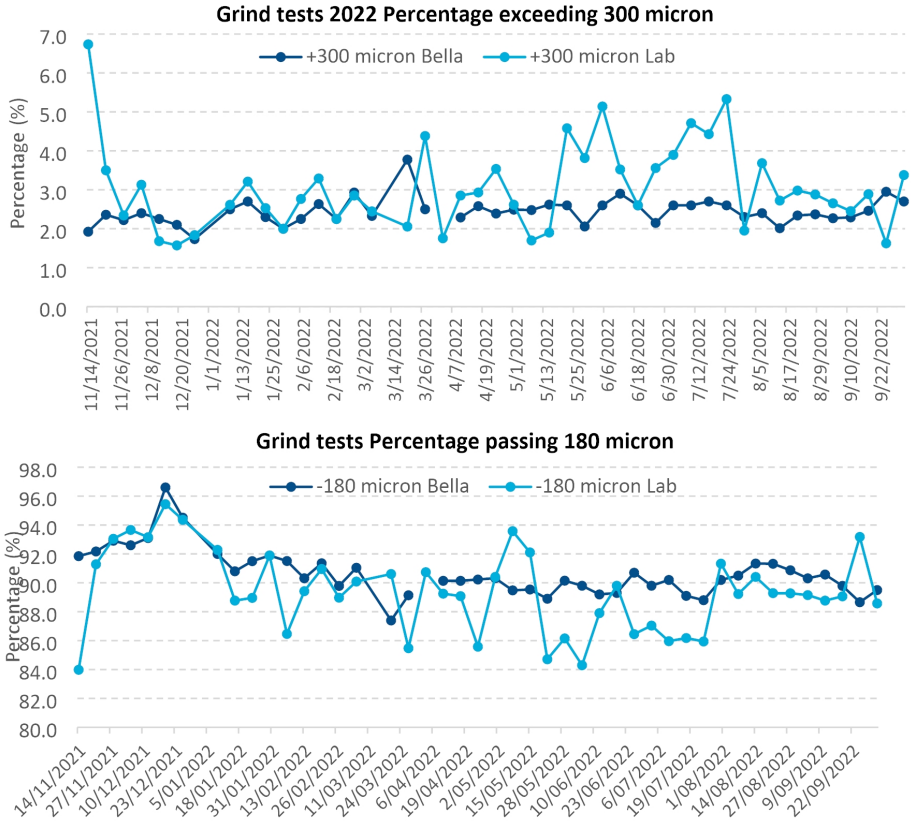


Figure 8-4: Sample Preparation Monitoring: Grind Sizes for the Robotic Sample Preparation Unit Tested by Bella and by KWI (Alcoa, 2022)

8.3 Assaying

Assaying of the drill samples is based on a spectral method, using a Nicolet 6700 FTIR Spectrometer with a robotic feeder (Figure 8-5). FTIR obtains an infrared absorption spectrum from the sample. The FTIR spectrometer simultaneously collects high-resolution spectral data over a wide spectral range. A mathematical process (Fourier transformation) converts the raw data into the actual spectrum for subsequent determination of the component analytes.

All drill samples are currently assayed using a customized, bespoke FTIR method, with the final corrected results used for Mineral Resource estimation. Calibration and monitoring of the FTIR results are done using the Reference Method assay results.

Bella generates the raw FTIR spectral dataset for each sample, which is transferred to the Alcoa LIMS system for post-processing. Alcoa performs all the Reference Method analyses at KWI.

The FTIR spectra are determined using a robotic scoop arm that collects an approximately 5 g aliquot of the pulp from the Petri dish and presents it to a platinum crucible. The material in the crucible is pressed flat to ensure an even surface for scanning. The crucible is then rotated several times through the spectrometer and 20 scans are conducted on the aliquot. The scans are processed and validated by the Bella system and when accepted, they are then transferred to the Alcoa LIMS system for post-processing and further validation.

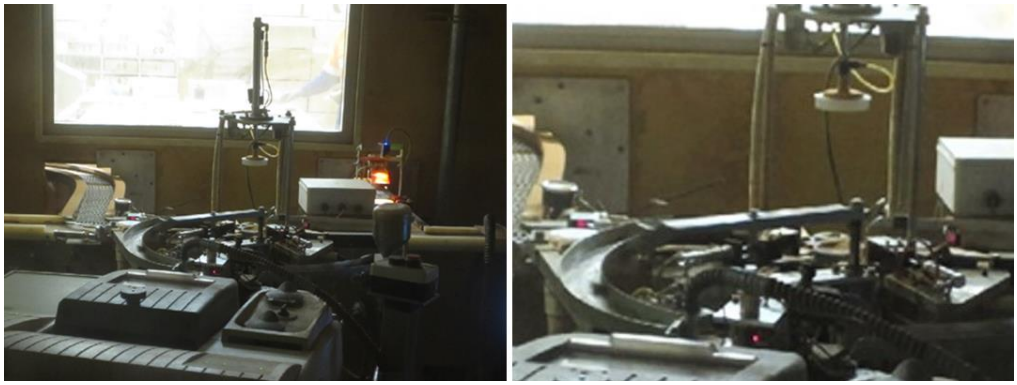


Figure 8-5: The Robotic FTIR Assaying Equipment
(RHS shows the sampling scoop arm and pulp dish with the lid elevated) (SLR, 2021)

8.3.1 FTIR Method Assays and the CalVal Dataset

The FTIR Method for bauxite assay uses infrared absorption spectra to characterize the presented sample for multiple analytes as element, compound, or mineral percentages. The approach has been developed using an extensive calibration and validation (CalVal) dataset, constant monitoring of Reference samples and Standards, and periodic revision of the prediction algorithms.

In 1990, an initial set of approximately 2,300 CalVal samples was collected covering the Darling Range tenement. A subset of approximately 700 samples was used to develop the initial FTIR prediction model. Extra CalVal samples have been added to help predictions in areas of low Reactive Silica (less than 0.5% R.SiO2) and high Total Iron (greater than 50% Fe). The CalVal samples are run randomly through the FTIR equipment in triplicate, under differing conditions (time of day, season, operator, order, etc.) to test for external factors. The FTIR results based on the prediction model algorithm are monitored using the REF assays (Franklin, 2019).

Initially some FTIR analytes (Available Alumina, Total Iron, Carbonate, Sulphate, Total Silica, Total Phosphorus and Magnetic Susceptibility) were all determined using a 'common' algorithm, whereas Reactive Silica, Oxalate, Extractable Organic Carbon, Total Alumina and Boehmite each used a specific algorithm. Since 2017 specific algorithms have been used for all analytes. The algorithms are periodically updated, typically if there has been a change in equipment or Reference Method. Retaining all FTIR

spectra now means additional analytes can be determined using specific algorithms, with three new analytes being added to Method Set MIC#00005 in 2021 (Potassium, Titanium and Gallium).

8.3.2 Reference Method (REF) Assays

The REF assaying is done by Alcoa in the KWI to validate and calibrate the FTIR assays. This is a suite of assays and tests that are carried out by wet chemical and other means and has included:

- XRFx-ray fluorescence spectroscopy
- ICP-OESinductively coupled plasma optical emission spectrometry
- XRDx-ray diffraction
- MSmagnetic susceptibility, a proxy for grindability
- BD-ICPbomb digest in a caustic solution, with an ICP-OES finish
- BD-GCbomb digest in a caustic solution, with a gas chromatography finish
- BD-NDIRbomb digest in a caustic solution, with a non-dispersive infrared finish
- MD-ICPmicrowave digest in a caustic solution, with ICP-OES finish

There are differences in the nature of these tests. Both XRF and ICP methods are instrument-based methods designed to replicate wet chemical analysis results, either total or partial assays depending on the digestion. Both XRD and MS methods are used to investigate mineralogy contents so are regarded as proxies for assays. Bomb digest (BD) methods have been developed by the alumina refining industry to determine the expected yield of bauxite ore during processing. They are the basis for 'metallurgical assays' that are designed to replicate the physicochemical reactions in the refinery and accordingly may be customized for a particular ore type or process plant. At Alcoa some BD assaying has been replaced with a microwave digest (MD) method.

8.3.2.1 REF Assaying Methods

A summary of the assaying used for the REF samples, which are used to calibrate and validate the FTIR Method, is provided in Table 8-1.

Table 8-1: Assaying Methodologies for Resource Estimation Samples

Name	Analyte	Code	Units	Reference Method
Available Alumina	A.Al2O3	AL	%	MD – ICP (MALSI)
Reactive Silica	R.SiO2	SI	%	MD – ICP (MALSI)
Total Iron	Fe2O3	FE	%	XRF and FTIR
Oxalate	Na2C2O4	OX	kg/t	BD – GC
Carbonate	Na2C2O3	CO	kg/t	BD – NDIR (TICTOC)
Extractable Organic Carbon	C	EO	kg/t	BD – NDIR (TICTOC)
Total Phosphorous	P2O5	PT	%	XRF
Sulphate	Na2SO4	SU	kg/t	XRF

Name	Analyte	Code	Units	Reference Method
Total Silica	SiO2	ST	%	XRF
Magnetic Susceptibility	MagSus	MS	None	MS (CGS system)
Total Alumina	Al2O3	AT	%	XRF
Boehmite	ALO(OH)	BO	%	XRD

The bomb digest (BD) method involves adding a measured amount of carbonate free 52% caustic soda to the sample aliquot (1 g), sealing it in a small 10 mL pressure vessel and then cooking it at 145°C. After cooling, the solution is assayed by titration or other methods to determine the alumina and silica contents. As the digestion of these elements by the hot caustic solution is determined by the physical conditions during digestion (mainly temperature and pressure) the results provide a proxy for the expected performance of ore of that nature in the alumina refinery plant. The resulting assays are termed available alumina (A.Al2O3) and reactive silica (R.SiO2), measured as percentages.

The MD method was introduced in 1996 to supplant the BD methods for assaying of the Mineral Resource drill samples. Atmospheric digestion is done in a microwave oven using a 13% caustic solution. The advantage of this is that it is faster, more repeatable and uses a bigger aliquot (0.5 g). The MD assays are collectively named 'microwave available alumina and reactive silica' (MALSI). The BD methods are still used for the refinery monitoring samples including those taken from the sampling towers prior to the feed stockpiles of crushed ore.

Following digestion using either MD, BD, or wet chemical methods, the analytes are assayed (Table 8-1) using the following methods (Figure 8-6):

- For ICP the digestion liquor is read using a PerkinElmer Optima 8300 machine.
- For XRF an aliquot of 0.7 g is combined with a lithium borate flux, fused in platinum crucibles on a dedicated Phoenix 8-bank burner, and batches are assayed on an Axios Max PW4400 machine.
- For gas chromatography (GC) a 1.00 g aliquot is used and assayed on an Agilent 7890B machine.
- For Total Inorganic Carbon and Extractable Organic Carbon (TICTOC) a 1.00 g aliquot is digested and assayed using an Analytical Aurora 1030 Total Organic Carbon Analyzer with carousel.



Figure 8-6: Digestion and Assay Equipment used for REF Samples at the KWI
Clockwise from top left: BD, MD, TICTOC, ICP, XRF, GC (SLR, 2021)

Details on the assaying method used for the final (Best) assay value for every sample interval are carried in the acQuire database.

For resource estimation, the Reference Method results are used to monitor the performance of the FTIR assaying, and to calibrate (adjust) the FTIR results on a batch-by-batch basis. The Reference Method is also used for all monitoring of the refinery performance including the grades of ore presented to the sampling towers at Pinjarra and Wagerup prior to stockpiling and reclaiming of the ore feed.

A consistent approach to sample collection, preparation and assaying for Mineral Resource estimation has been used since 1980. Refinements to the assaying methods have comprised:

- 1996 Microwave digestion was introduced instead of bomb digestion for the REF samples
- 1999 The collection of the FTIR spectral data was outsourced to Bella, with direct control of processing and prediction still done by Alcoa
- 2006 Robotic sample preparation was introduced at Bella
- 2006 Digital retention of all FTIR spectral data was introduced, enabling additional post-processing of assayed samples for new analytes
- 2017 The calibration sets were rescanned with FTIR and an updated Method Set (MIC#00005), was developed
- 2018 Original wet chemical assays were replaced by FTIR for approximately 73,000 samples (drilled in Myara North from 1992 to 2002)
- 2019 Original wet chemical or FTIR assays were replaced by FTIR for approximately 251,000 samples (drilled in Myara North from 1991 to 1997).

The impact of these changes and validation of the results were investigated by Alcoa personnel and independently by SRK (2021a). It was concluded that the assaying precision (i.e. repeatability) and accuracy (lack of bias, as demonstrated by quantile-quantile plots) did not show significant differences between the pre-2018 and post-2018 data sets.

Since completion of the 2021 Mineral Resource inventory, an additional 56,825 vacuum and aircore holes have been drilled and approximately 640,000 routine FTIR analyses performed. These represent holes drilled between September 2021 and June 2022.

8.4 Quality Assurance and Quality Control

Quality assurance (QA) consists of evidence that the assay data has been prepared to a degree of precision and accuracy within generally accepted limits for the sampling and analytical method(s) to support its use in a Mineral Resource estimate. Quality control (QC) consists of procedures used to ensure that an adequate level of quality is maintained in the process of collecting, preparing, and assaying the drilling samples.

8.4.1 QA/QC Protocols

The following QA/QC protocols are implemented and managed by Alcoa's team, and QA/QC samples are not blind to the laboratory, with the exception of STE samples. Batches of samples are submitted to the Bella laboratory daily. Internal standards created from the stockpile of the Darling Range bauxite are introduced by the Bella Laboratory every 50 samples during the FTIR analysis to check the chain of process. All standard sample insertions and batches maintain consecutive numerical order. Calibration is done at first to generate the reference mean of the standard as well as the acceptable minimum and maximum values totaling three standard deviations.

After the boxes of drill samples are received at Bella, packets of Reference Method samples (REF) are split out by the robotic sample preparation, based on a random selection by Alcoa LIMS, at a frequency of 1 in 100 (1%). These are submitted to the KWI in batches of 19 for REF assaying to calibrate and validate the quality of the FTIR Bella assays. As the FTIR assays are adjusted to match the REF assays (using a 'broken stick' curve adjustment to remove bias and maintain precision, see Figure 8-13) it is expected that there should be minimal bias between REF and FTIR corrected results (FTIR_corr). However, the repeatability between the two methods is an important attribute of the quality of the assay results used for Mineral Resource estimation. Each batch of REF samples includes 1 Blank and 1 Standard. The REF samples are considered to serve the same purpose as pulp repeats in defining the repeatability of the assays. Alcoa also sends checks of REF samples assayed at Bella and KWI to an independent laboratory, Bureau Veritas (BV).

Alcoa introduced in 2018 an alternative procedure to field duplicates, termed Sample To Extinction (STE). This involves taking the normal 0.5 m drill sample (referred to as the Parent) and collecting all the residue from that drilled interval (i.e. the riffle split reject, and previously any material left in the sampling cup). This residue is collected once per shift from each rig under supervision by the geologist. The residue is pulverized and homogenized, then two equal splits (referred to as the "Daughters") are assayed.

Following receipt of results from the laboratories, Alcoa geologists review the values, and sample batches identified as anomalous are repeated by the laboratory. QA/QC reports are produced monthly upon receiving new results. The QP recommends the preparation of quarterly and yearly QA/QC reports to track possible issues that might arise over time.

The following are the existing written QA/QC procedures available to all staff:

- Franklin (2019) describing the FTIR process.
- Use of the customized in-house Exploration PowerApps digital module to record and document field inspections by the geologist at the drill rigs (documenting visible contamination, Sample ID, Hole ID, splitting, chip size of sample, split volume, depth measurement, collection of Sample To Extinction (STE) samples, collection of further FTIR calibration and validation (CalVal) samples, as well as other prestart, safety, risk and EHS inspections.
- Procedures for generating STE samples.
- Various PowerPoint presentations providing an overview of the laboratory procedures.

QP reviewed QA/QC information compiled in the previous report (SLR, 2022) and analyzed the new QA/QC data compiled by Alcoa between February 2021 and October 2022. The results of this analysis are summarized in the following sub-sections.

8.4.2 Blanks

Blanks are not routinely introduced in FTIR submission batches into the robotic mills at Bella and there is no check on cross-contamination during sample preparation. Given the style of mineralization, the ore grades being assayed, and the volume of material milled compared to the final aliquot assayed, the absence of sample preparation blanks is not considered material. There is also no available blank sample on the market that would not introduce contamination of the mills by very low-grade samples at Bella. KWI laboratory submits blanks with a frequency of 1 to 19 in the REF samples sets compiled and dispatched regularly by Bella, however that information was not available for review.

8.4.3 Standards

Standards evaluate accuracy of the assaying by detecting the differences between a result and an expected value, also known as a bias. Alcoa has used a series of specially prepared Internal Reference Material (IRM) samples derived from Darling Range bauxite, pulverized and homogenized by Gannet Holdings, labelled KH09 to KH18. Between 2021 and 2022, only IRM KH14 and KH20 have been used at the Bella Laboratory and KH10 at the mining laboratory. Monitoring using these IRM samples provides arguably better assurance of assaying accuracy than commercial Certified Reference Material (CRM) samples. The IRMs have generally been sourced from stockpile material and used in both coarse-crushed and pulp form. The IRMs have not been externally certified. A summary of the IRMs is provided in Table 8-2.

Table 8-2: Standards Used for Drilling and REF Monitoring (IRMs)

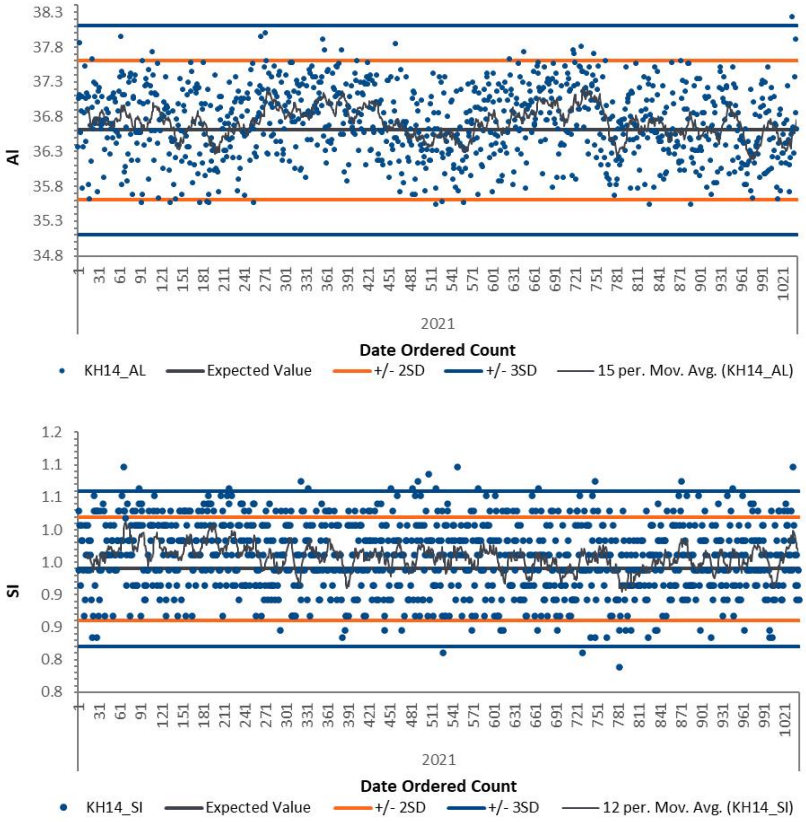
Standard	Date	Comment
KH09	May 1999 to present	Boehmite analysis, FTIR, MD-ICP, and XRF analysis Mining reference analysis (IRM)
KH10	May 2012 to present	Mining reference analysis (IRM)
KH11	July 2008 to March 2015	FTIR analysis (IRM)
KH12	July 2008 to April 2014	Grind size control (IRM)
KH13	April 2014 to present	Grind size control (IRM)
KH14	March 2015 to October 2021	FTIR analysis (IRM)
KH15	October 2015 to September 2017	Preparation and analytical control – introduced at the drill rig (IRM)
KH16	September 2017 to December 2018	Preparation and analytical control – introduced at the drill rig (IRM)
KH17	September 2017 to December 2018	Preparation and analytical control – introduced at the drill rig (IRM)
KH18	September 2017 to December 2018	Preparation and analytical control – introduced at the drill rig (IRM)
KH20	October 2021 to present	FTIR analysis (IRM)

Control of the accuracy of FTIR samples is currently monitored at the Bella laboratory using IRMs KH14 and KH20. The IRMs are inserted every 50 FTIR samples. FTIR batches totaling 21,983 samples of KH14 and KH20 analyzed between February 2021 to October 2022 and using Priority Codes P177 to P193 were sent to SLR for review. Priority Codes represent batches assayed by the FTIR Method using the same batch correction factors.

The QP selected six batches; three to review KH14 and three for KH20. The QP prepared control charts for available Al, reactive Si and Fe and analyzed temporal and grade trends, reviewed the data for low and high biases, and the failure rate of each standard. The failure rate was defined as a value reporting more than three standard deviations (SD) from the expected value.

Results of Alcoa's KH14 for batches P177, P179 and P181 were reviewed. Available Al (A.Al2O3) results are well behaved, have a very low failure rate (0.09% in batch P181 only) and present no bias. The

plotted values of A.Al2O3 of KH14 from batch P181 can be visualized in Figure 8-7. Conversely, reactive Si (R.SiO2) presents either a high or a low bias, with a failure rate ranging between 0.25% to 1.92%. Temporal trends are also distinguishable in P177 and P181. Results of R.SiO2 from batch P181 are also presented in Figure 8-7. The analysis of KH14 Fe2O3 results show variability by showing some high biases, a local temporal trend and a failure rate located between 0% and 1.15% (P181). The Fe2O3 values of batch P181 are too pictured in Figure 8-7. Values of A.Al2O3 for KH14 reviewed ranged between 35.86% and 36.61%, which is comparable to the extents of the average grade of the deposit. The values of R.SiO2 were also similar to the average grade of the deposit, ranging between 0.91% and 0.94%. The overall take on the analysis of KH14 indicates a relatively good and consistent precision at the laboratory. The QP recommends investigating these local biases with the Bella Laboratory.



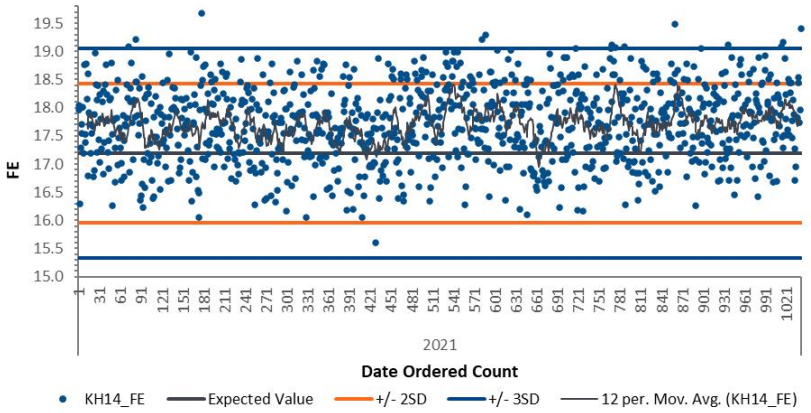
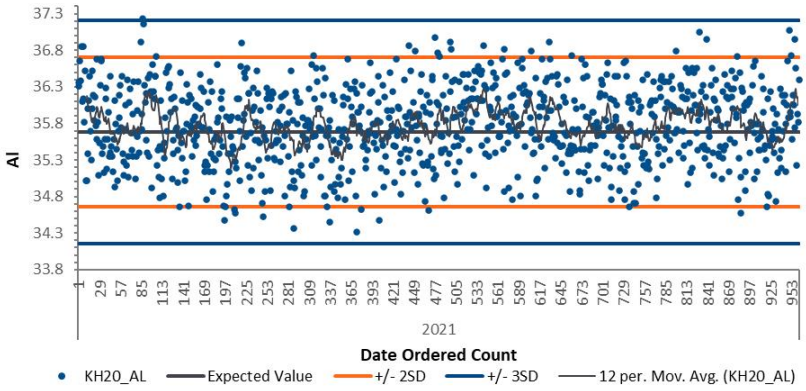


Figure 8-7: KH14 Control Chart of AL, SI and Fe from Batch P181

Batches P183, P186 and P191 were examined for standards KH20. Its A.Al2O3 expected values in percent are between 33.14% and 35.68% while R.SiO2 range between 1.00% and 1.09%. For Fe2O3, the average expected results are between 15.16% and 16.07%. This standard is representative of the average grades of the deposit. The control charts for KH20 of batch P183 is shown in Figure 8-8. Overall, A.Al2O3 values are generally well behaved and are found between the acceptable low and high limits of three SD, with the exception of one sample in batch P183 and P191, causing low failure rates ranging between 0.07% and 0.1%. Results for R.SiO2 indicates generally good accuracy at the Bella Laboratory. A failure rate between 0.7% and 2.47% was observed for batch P183 and P186, respectively, and there are temporal low grade biases in all batches reviewed. All Fe2O3 samples returned values within the three SD range, and only one batch (P191) showed values mostly distributed below the mean after the first quarter, possibly indicating a low bias. The QP recommends investigating the bias observed to ensure that economic areas are not incorrectly excluded from the Mineral Resource domains.



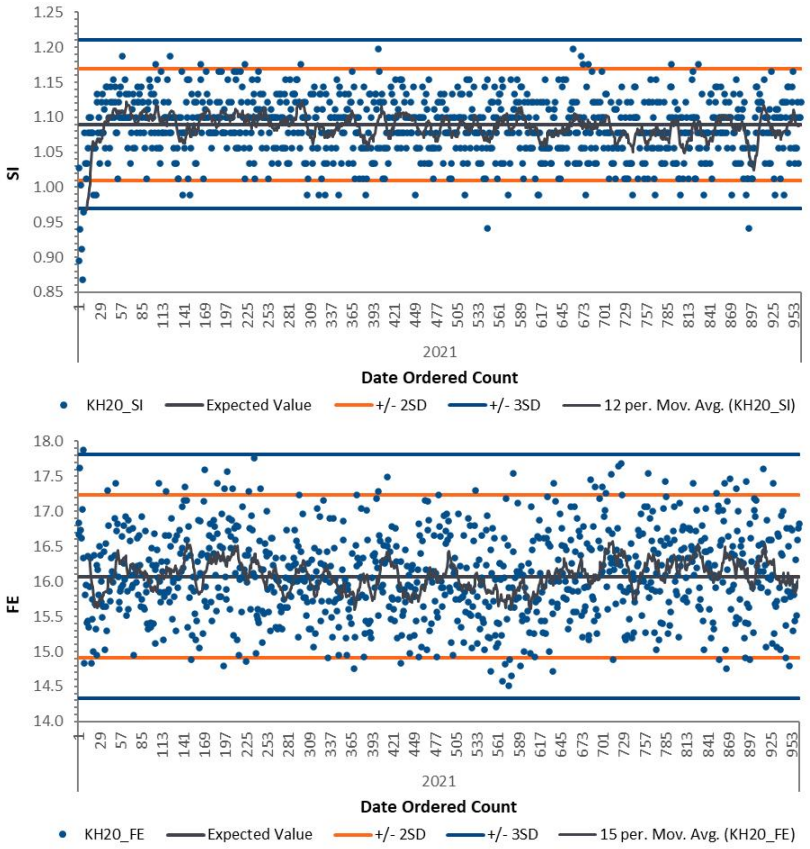


Figure 8-8: KH20 Control Chart of AL, SI and Fe from Batch P183

The frequency of insertion of IRMs at the mining laboratory of standard KH10 is 1 in every 19 samples (one REF batch). The frequency of re-assaying the FTIR results (if rejected by a REF assay) has an expected rate of less than 1.5%. Actual performance depends on the total number of FTIR assayed samples, the area where they were drilled and whether there were issues with the Sample Presentation Unit (SPU) in the FTIR process.

The QP selected three batches, P184, P188 and P193, to examine the values of A.Al2O3, R.SiO2 and Fe2O3 analytes in KH10 standards used in 2021 and 2022 for additional review. KH10 expected values are close to the average grade of the deposit. Results from the analyte A.Al2O3 of standard KH10 from the three revised batches indicate mostly good laboratory accuracy and precision. No failure was observed although a slight low bias was distinguished in P188.

Standards performance overall is excellent for Al, good for Fe and generally reasonable for Si analytes.

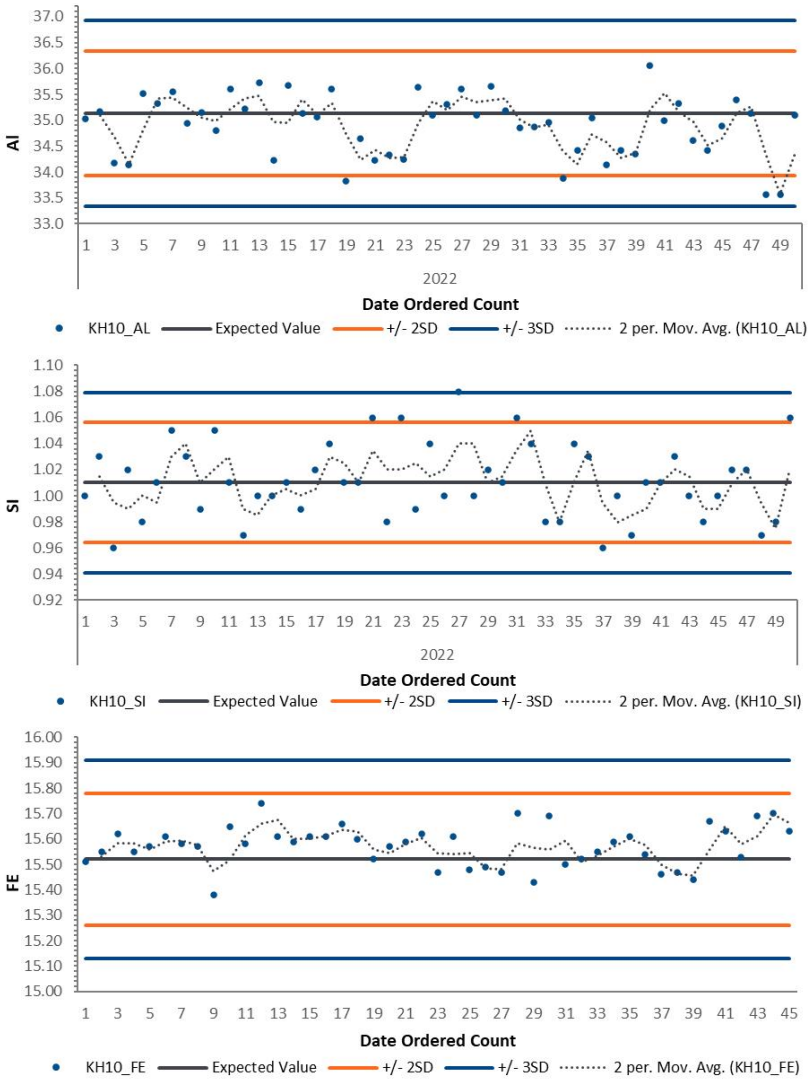


Figure 8-9: KH10 Control Chart of AL, SI and Fe from Batch P188

Historically, from October 2015 to December 2018, IRMs KH15 to KH18 were introduced by the driller at the drill rig to monitor sample preparation (grinding and cross-contamination) and assaying. This material was sourced from the Kwinana Refinery stockpile crushed to nominal 3 mm, homogenized, and split into 200 g lots by Gannet Holdings, a commercial preparer of Standards.

8.4.4 Duplicates

8.4.4.1 Measures Of Precision

There are a number of approaches to defining the repeatability of an assay result, and they are generally controlled by a framework first developed by Pierre Gy, now referred to as the Theory of Sampling. Accepted approaches used here for determining the repeatability of sampling and assay results are:

- Scatter plots with the same X and Y axes, showing the overall distribution of the paired samples, and obvious outliers, with perfect repeatability shown by the 45º line of equality.
- Measures based on the robust Half Absolute Relative Difference (HARD) bivariate statistic (Shaw, 1997; Abzalov, 2016). These include the precision (as Coefficient of Variation (CV) with a confidence interval of 68%) and the correlation coefficient.
- Other bivariate measures, that may be influenced by outliers, such as the slope of regression, variance and CV.

With all measures, trimming the data (excluding outliers, obvious errors, incorrect values, out of range values, and those near the Limit of Detection) can impact on statistical measures of precision, which is why scatter plots are helpful in interpreting results.

8.4.4.2 Field Duplicates

It is generally considered best practice to collect field duplicates in resource drill sampling programs. They should be a second split collected with the first split in exactly the same way (i.e. from the same drilled interval, using the same splitter, generally from the reject side of the splitter, sometimes by re-splitting all of the reject a second time). Alcoa discontinued the routine collection of field duplicates in January 2018 due to limitations to the benefit of collecting field duplicates because the sample splitting procedure was problematic (SLR, 2022). Therefore, no additional data is currently available to review for field duplicates. The process was superseded by the Sample to Extinction process, described in Section 8.4.4.5.

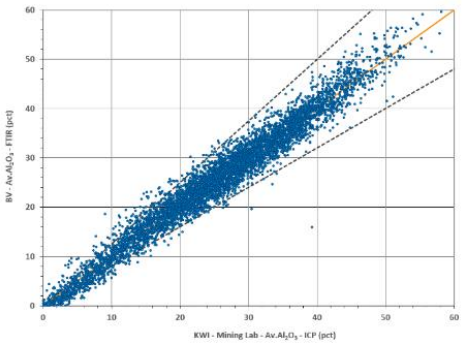
8.4.4.3 Check Assays - Umpire Laboratory Checks

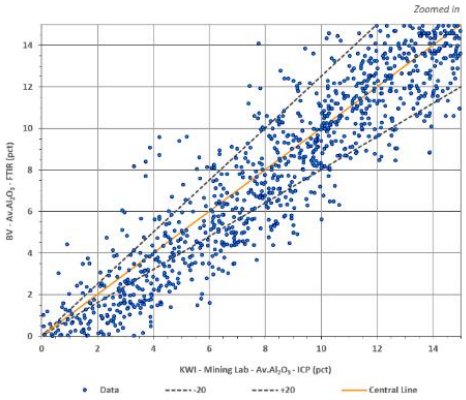
Alcoa sends checks of REF samples assayed at the KWI to an independent laboratory, Bureau Veritas Minerals (BV) in Canning Vale, Western Australia for an impartial review. BV holds NATA accreditation No.626 and it is accredited for compliance with ISO/IEC 17025 – Testing. SLR was handed out a spreadsheet to examine with a total of 6,284 samples that covered the original Bella and REF values as well as the results from the analytes re-assay by FTIR at BV. Results from the REF comparison with BV can be visualized in the form of scatter plots and quantile-quantile plots in Figure 8-10, Figure 8-11 and Figure 8-12 for A.Al2O3, R.SiO2 and Fe2O3 respectively. The associated method of analysis for each REF analytes are listed in Section 8.3.2.1.

It is apparent that there is a bias with the Alcoa KWI reporting higher for AL, notably for values found between 0% and 10% AL. Statistics indicate an overall good repeatability at Bureau Veritas with a correlation coefficient of 0.984 for 6,284 pairs. Results for SI are similar, with a low bias for Bureau Veritas at grades between 0.7% and 1.2%. The tendency changes for grades between 2% and 6% where a slight high bias is observed with the BV values. The correlation coefficient for SI is excellent, at 0.989 for 6,284 pairs. KWI REF Fe_2O_3 values between grades of 0-2.5% are reporting lower, but generally presents an excellent correlation with a coefficient of 0.985 for 6,253 pairs.

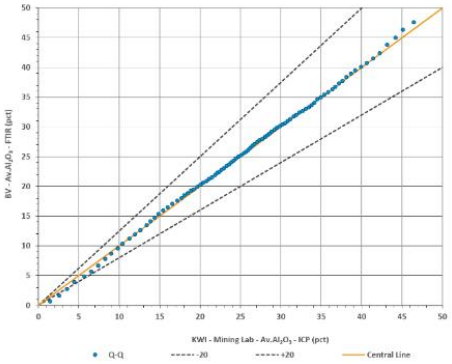
Given the good repeatability of the REF assays from KWI, the precision can be considered higher than expected, especially knowing that the KWI laboratory analytical method is better customized to the Alcoa bauxite than the umpire laboratories.

Scatter Plot – A.Al2O3





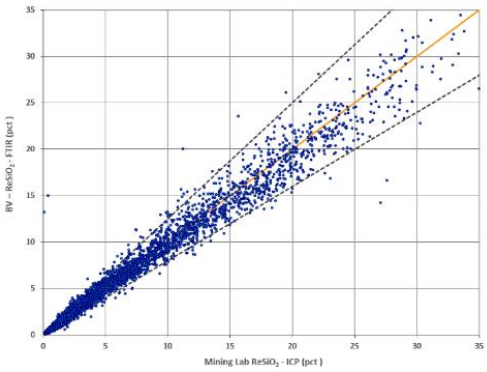
Quantile-Quantile Plot – A.Al2O3

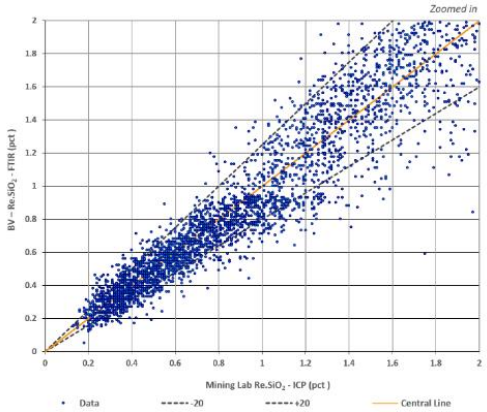


	Original	Duplicate
Number of Samples (N):	6,284	6,284
Mean (%):	23.65	23.81
Maximum Value (%):	58.20	62.84
Minimum Value (%):	- 6.51	- 1.67
Median (%):	24.76	25.01
Variance:	159.43	163.79
Std. Dev:	12.63	12.80
Co-ef. Variation:	0.53	0.54
Correlation Coefficient	0.984	
% Difference Between Means	-0.7%	

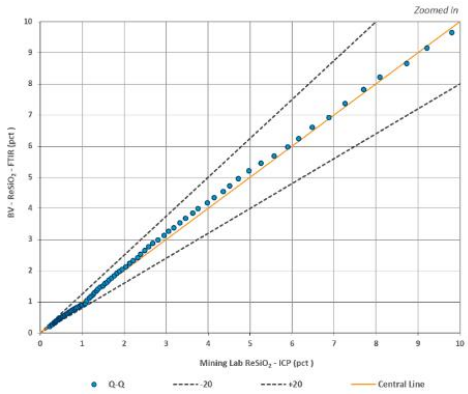
Figure 8-10: Scatter Plot, Quantile-Quantile Plot and Statistics of AL Umpire Laboratory Checks – KWI Mining Lab and Bureau Veritas

Scatter Plot – R.SiO2





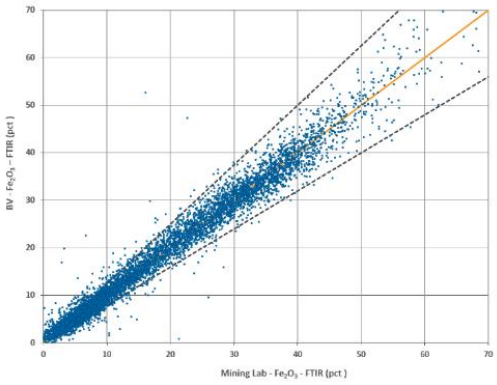
Quantile-Quantile Plot – R.SiO2

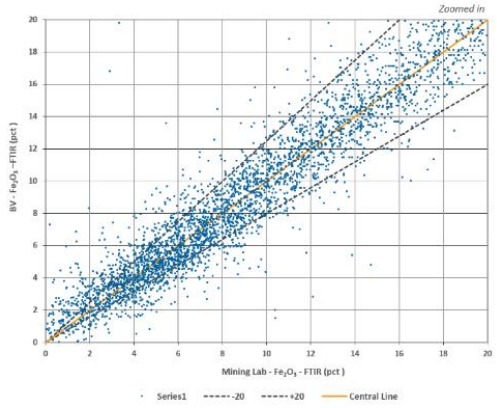


	Original	Duplicate
Number of Samples (N):	6,284	6,284
Mean (%):	4.87	4.83
Maximum Value (%):	38.50	40.72
Minimum Value (%):	0.10	0.05
Median (%):	2.04	2.12
Variance:	39.44	37.14
Std. Dev:	6.28	6.09
Co-ef. Variation:	1.29	1.26
Correlation Coefficient	0.989	
% Difference Between Means	0.8%	

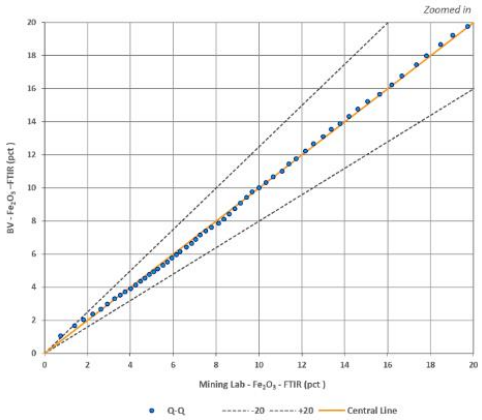
Figure 8-11: Scatter Plot, Quantile-Quantile Plot and Statistics of SI Umpire Laboratory Checks – KWI Mining Lab and Bureau Veritas

Scatter Plot – Fe2O3





Quantile-Quantile Plot – Fe2O3



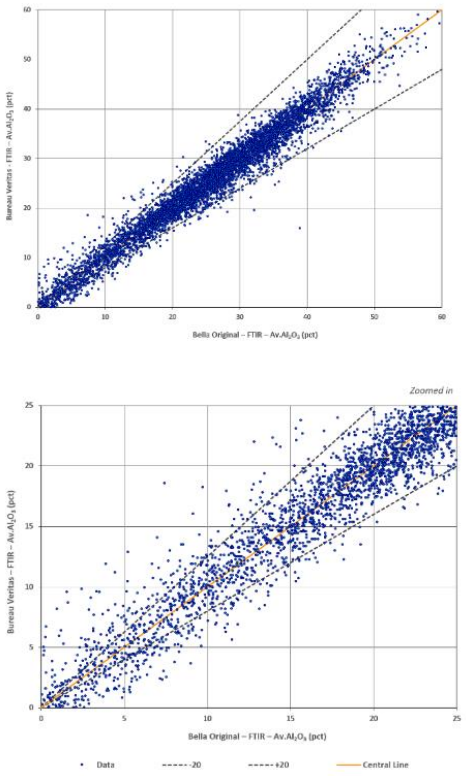
	Original	Duplicate
Number of Samples (N):	6,253	6,253
Mean (%):	19.35	19.32
Maximum Value (%):	75.80	74.87
Minimum Value (%):	-1.59	-1.55
Median (%):	16.18	16.23
Variance:	189.19	188.70
Std. Dev:	13.75	13.74
Co-ef. Variation:	0.71	0.71
Correlation Coefficient	0.985	
% Difference Between Means	0.2%	

Figure 8-12: Scatter Plot, Quantile-Quantile Plot and Statistics of FE Umpire Laboratory Checks – KWI Mining Lab and Bureau Veritas

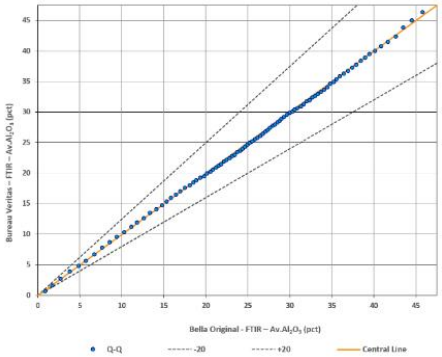
A similar comparison was also done between Bella original sample results and Bureau Veritas on A.Al2O3, R.SiO2 and Fe2O3 analytes and the outcomes are shown in Figure 8-13 to Figure 8-15. Results for A.Al2O3 present a slight low bias for the Bureau Veritas values below 2%, however the analysis shows an overall great correlation and precision between the two data set, especially with grade above 20%. The Quantile-Quantile plot suggests great grade correspondence between the original value and its checked value at BV. The coefficient of correlation is 0.985 for 6,280 pairs. The analysis of R.SiO2 showed a few acceptable biases across the population. Bureau Veritas is reporting slightly higher values between 0-0.4%, marginally lower from 0.6% to 1.2% and slightly higher between 1.5% and 5%. Another minor low bias for values above 10% is observable, but overall, the correlation is good which is reflected by a correlation coefficient of 0.989 for 6,280 pairs assessed. The results of Fe2O3 demonstrated a good

correlation, with a coefficient of 0.986 and no discernible bias. The Fe2O3 values showed that the precision is better above 10%.

Scatter Plot – A.Al2O3



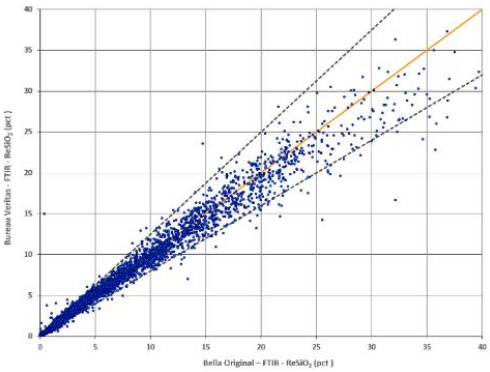
Quantile-Quantile Plot – A.Al2O3

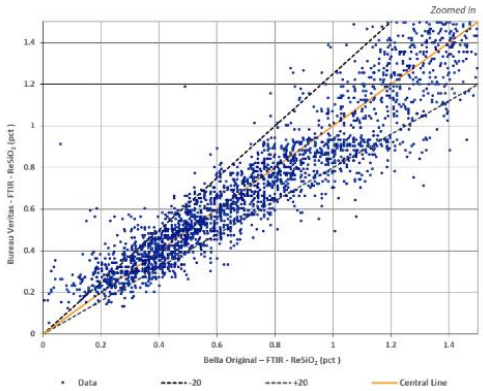


	Original	Duplicate
Number of Samples (N):	6,280	6,280
Mean (%):	23.91	23.81
Maximum Value (%):	61.89	62.84
Minimum Value (%):	-2.08	-1.67
Median (%):	25.20	25.01
Variance:	164.11	163.81
Std. Dev:	12.81	12.80
Co-ef. Variation:	0.54	0.54
Correlation Coefficient	0.985	
% Difference Between Means	0.4%	

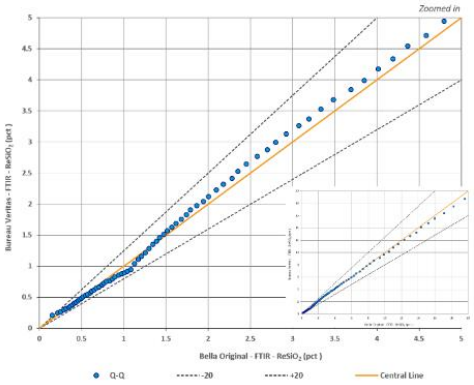
Figure 8-13: Scatter Plot, Quantile-Quantile Plot and Statistics of AL Umpire Laboratory Checks – Bella and Bureau Veritas

Scatter Plot – R.SiO2





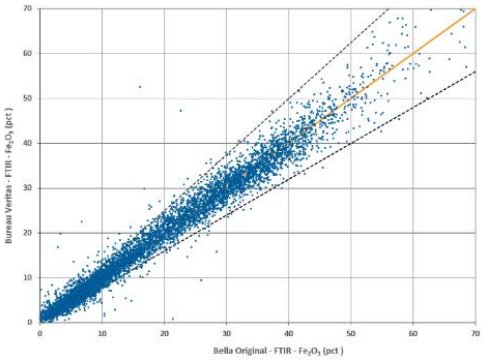
Quantile-Quantile Plot – R.SiO2

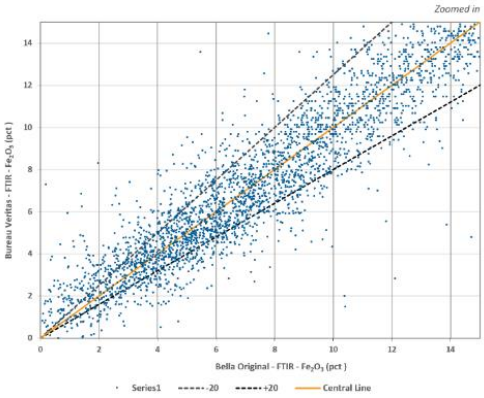


	Original	Duplicate
Number of Samples (N):	6,280	6,280
Mean (%):	4.92	4.83
Maximum Value (%):	41.56	40.72
Minimum Value (%):	- 0.11	0.05
Median (%):	2.00	2.13
Variance:	41.51	37.15
Std. Dev:	6.44	6.09
Co-ef. Variation:	1.31	1.26
Correlation Coefficient	0.989	
% Difference Between Means	1.8%	

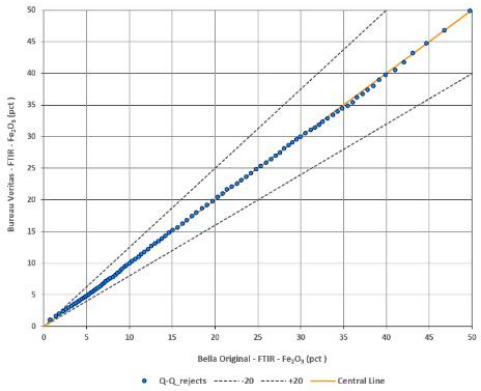
Figure 8-14: Scatter Plot, Quantile-Quantile Plot and Statistics of SI Umpire Laboratory Checks – Bella and Bureau Veritas

Scatter Plot – Fe2O3





Quantile-Quantile Plot – Fe2O3



	Original	Duplicate
Number of Samples (N):	6,280	6,280
Mean (%):	19.34	19.31
Maximum Value (%):	75.80	74.87
Minimum Value (%):	-1.59	-1.55
Median (%):	16.17	16.23
Variance:	189.26	188.79
Std. Dev:	13.76	13.74
Co-ef. Variation:	0.71	0.71
Number of Samples (N):	0.986	
% Difference Between Means	0.2%	

Figure 8-15: Scatter Plot, Quantile-Quantile Plot and Statistics of FE Umpire Laboratory Checks – Bella and Bureau Veritas

8.4.4.4 Twinned Hole Studies

Since the last report (SLR, 2022), the twin hole studies campaign has been suspended because of its limited value and therefore, no additional data is available for an updated analysis.

8.4.4.5 Sample To Extinction (STE) Samples

After a few reviews of the data sets between 2018 and 2021 by independent consultants, biases and poor repeatability were reported. The issue was investigated, and it demonstrated that perhaps the splitting at the drill rig was incorrect, and also illustrated the sampling principle that pulverizing (reducing the particle size) before splitting will always reduce the error. On the basis of these studies and external review, modifications to the splitting procedure at the rig were carried out.

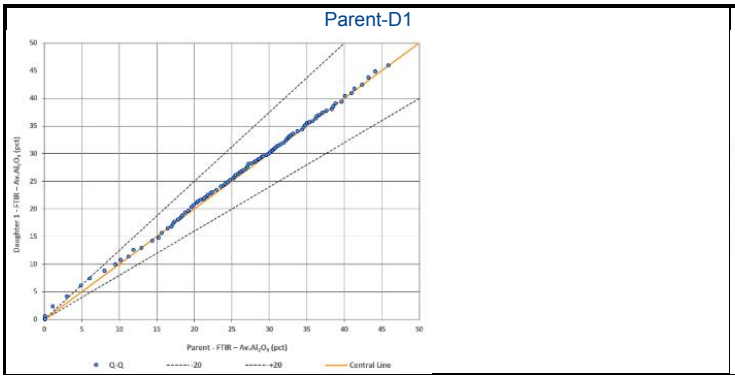
Since 2020, Alcoa refined the STE sampling procedure to now collect one sample per shift from each drill rig and assay three Daughters after pulverizing and splitting. The 2022 STE clean dataset examined by SLR contained results for 550 pairs. SLR has used this data set to prepare bivariate statistics, scatter plots and precision plots.

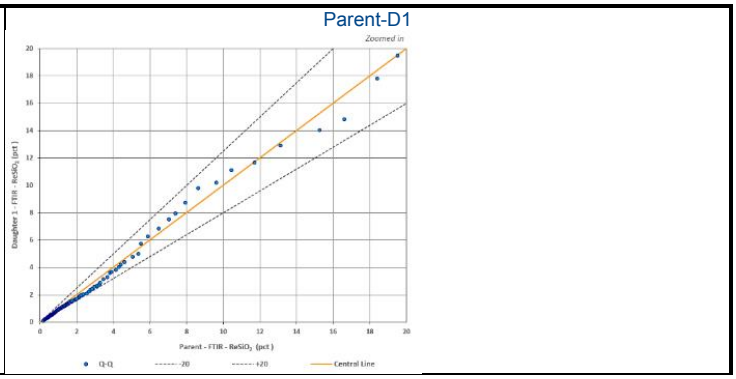
Comparisons were carried out for the analytes AL, SI, and FE between:

- Daughter 1 vs the Parent
- Daughter 2 vs the Parent
- Daughter 3 vs the Parent
- Daughter 2 vs Daughter 1
- The average of the Daughters vs the Parent

Studies of the Parent-Daughter sets showed good repeatability for the residue pulp repeats (i.e. between the Daughters) even though the correlation coefficients were relatively low, ranging between 0.921 and 0.948. The daughter values show statistical consistency with the parent, which indicates acceptable pulverizing and correct splitting of the residue offsite. The daughter analyte Al is showing higher values, or a high bias, for the three set of daughters. The biases are mostly observed at grades between 0-8% and values are more scattered in general between 0-5%. Correlation coefficient for A.Al2O3 for Daughter one (D1) is 0.937, Daughter two(D2) is 0.929 and Daughter three(D3) is 0.921. Results for R.SiO2 show an alternance of low and high bias, the first low bias ranging from 0-5%, the slight high bias from 5% to 12% and the last low bias from 12-45%. The correlation coefficient is also in the same bracket, varying between 0.93 and 0.94. As for the results of Fe2O3, a low bias was identified for each parent-daughter set but is most prominent between 0 and 10-15%. The correlation coefficients varied between 0.935 and 0.948. Examples are provided in Figure 8-16 for A.Al2O3, and R.SiO2.

As expected, similar repeatability with the individual daughter analysis was reported between the residue results (the average of the Daughters) and the normal drill sample (the Parent), with comparable bias suggestions. It is therefore reasonable to say that split taken at the drill rig (Parent, taken by splitting down to 150 g) is as good a representation of the drill interval grade as collecting the whole of the residue and carrying out pulverizing, homogenization and splitting.





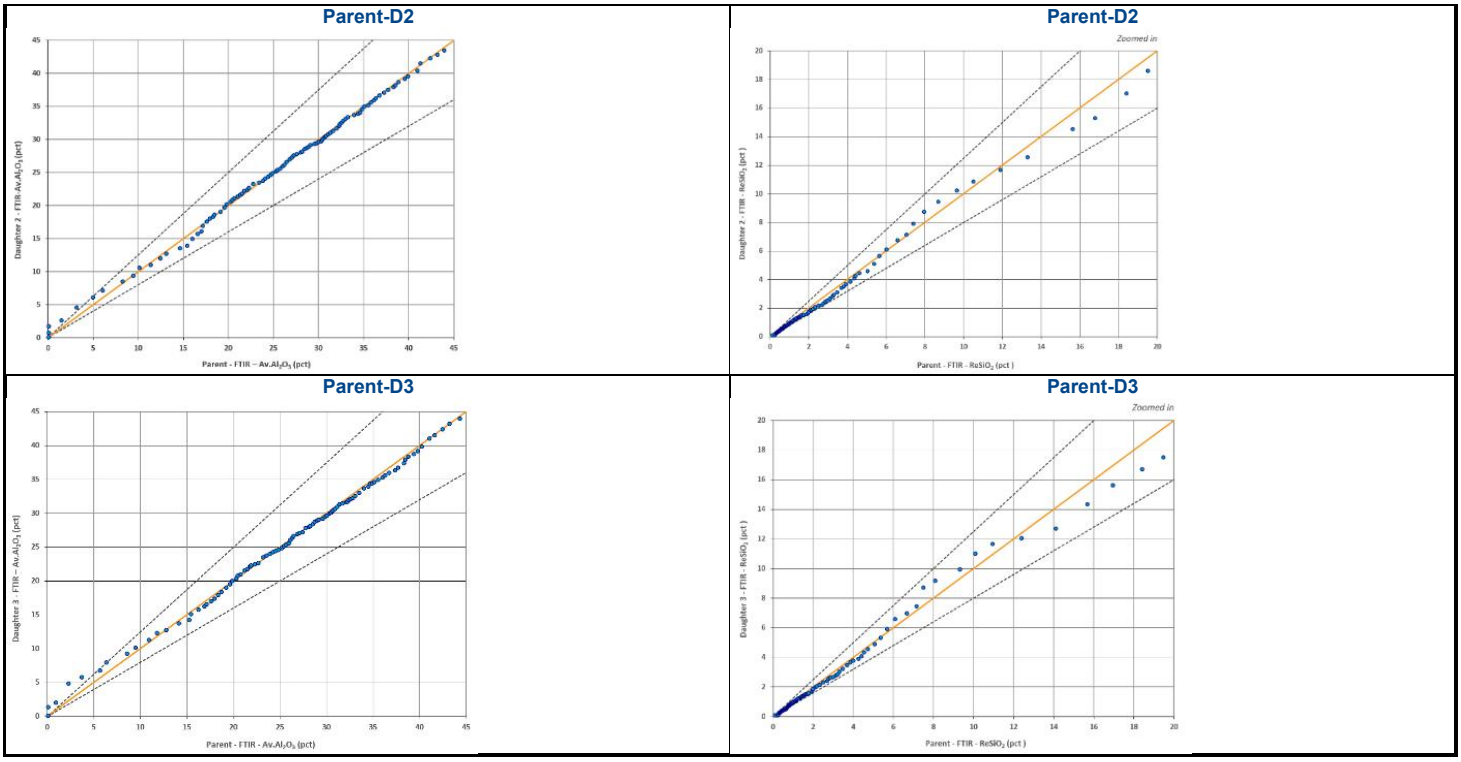


Figure 8-16: Quantile-Quantile Plot of Parent and Individual Daughters' Analysis of A.Al2O3 (on the left) and of R.SiO2 (on the right)

While the STE procedure could be retained for specific studies, in the QP's opinion, the reintroduction of field duplicates using appropriate riffle splitters under supervision should be considered.

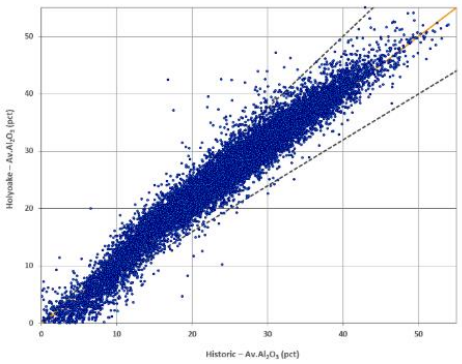
8.4.4.6 Holyoake Program

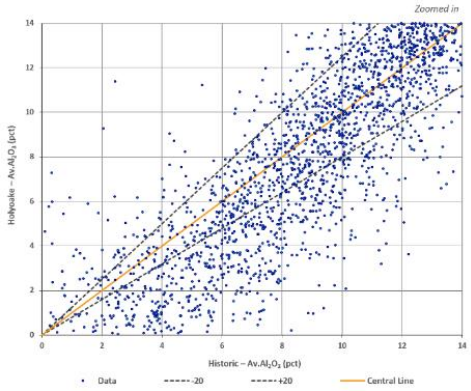
Submitting historic assays to be re-evaluated is a method that helps monitor the quality of the historical data to guide daily production. A set of 33,224 historic and recent assays was provided to SLR, which was cleaned up to produce a total of 15,412 perfectly match pairs. The QP prepared an analysis which included a comparison of the original historic FTIR Al and SI assay and recent Holyoake duplicate assay results. Alcoa implemented the Holyoake check assay in 2021.

The large pool of samples facilitated the interpretation of accuracy and precision. The analysis of both AL historic versus Holyoake results indicates clearly that recent values are higher above 10% in grade, confirming a clear high bias. Below 10%, the values are lower, showing a low bias, and mostly outside the acceptable limit of 20% difference. Both affirmations can be visualized in Figure 8-17. Values of SI are behaving similarly, as observed in Figure 8-18, with a low bias between grade of 0 and 5%, and a strong high bias for values above 5%. The percent difference between the means are quite high for both analytes, at 5.3% for Al and 13.5% for SI.

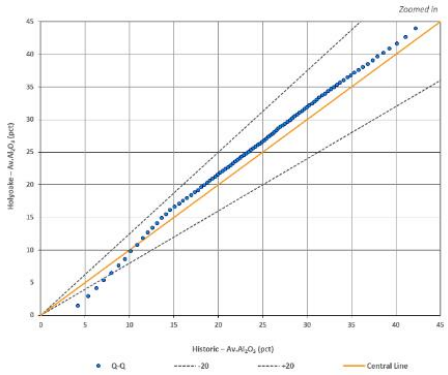
These differences can be the results of an improvement of the analysis method and procedure since 2005 reflecting a better geochemical understanding of the deposit. The QP recommends addressing these biases by limiting the use of historic data when possible and continuing the re-assay program of assays collected before 2005.

Scatter Plot – A.Al2O3





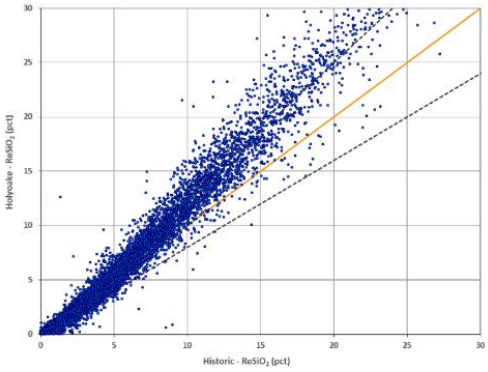
Quantile-Quantile Plot – A.Al2O3

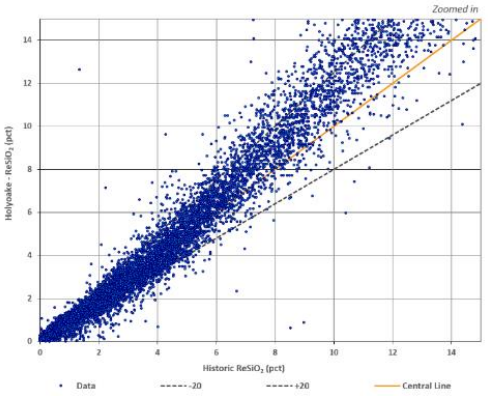


	Original	Duplicate
Number of Samples (N):	15,412	15,412
Mean (%):	23.71	24.96
Maximum Value (%):	59.00	58.60
Minimum Value (%):	-4.09	-2.08
Median (%):	24.46	26.10
Variance:	101.39	120.83
Std. Dev:	10.07	10.99
Co-ef. Variation:	0.42	0.44
Correlation Coefficient	0.975	
%Difference Between Means	-5.3%	

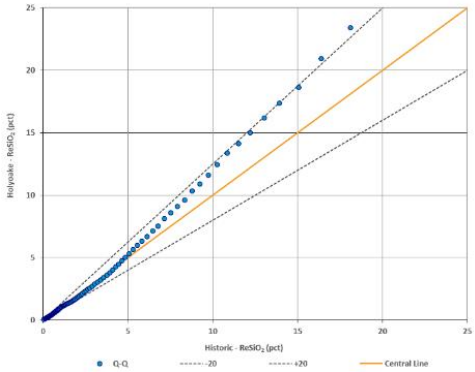
Figure 8-17: Scatter Plot, Quantile-Quantile Plot and Statistics of AL Historic and Holyoake Results

Scatter Plot – R.SiO2





Quantile-Quantile Plot – R.SiO2



	Original	Duplicate
Number of Samples (N):	15,412	15,412
Mean (%):	3.65	4.14
Maximum Value (%):	34.55	42.96
Minimum Value (%):	-0.92	-0.13
Median (%):	1.64	1.48
Variance:	21.37	34.71
Std. Dev:	4.62	5.89
Co-ef. Variation:	1.27	1.42
Correlation Coefficient	0.987	
% Difference Between Means	-13.5%	

Figure 8-18: Scatter Plot, Quantile-Quantile Plot and Statistics of AL Historic and Holyoake Results

8.4.4.7 Stockpile Feed and Sampling

Refinery feed grade is monitored at Huntly and Willowdale using material collected at the Pinjarra and Wagerup sample plants. At each operation, the sample plants are located at the refinery end of the overland conveyors, just prior to the stockpile stackers.

The stockpile area at the Pinjarra refinery is fed by two conveyor belts (SP-171 and SP-271) that derive their ore from the same crusher (currently at Myara). Prior to the ore being combined from the belts and fed to the stockpile area, it passes through a sampling tower that alternatively takes a primary cut from each belt, dries, crushes, subsamples and combines them into two parallel samples for 12 hour shifts.

A comparison of these paired samples (SLR, 2022) found no material issues and no new data was presented for this review.

8.5 Conclusions

It is the QPs opinion that the large data sets collected over a long timeframe, the satisfactory mine production shown by reconciliation results (see Section 11.12), and the QC data sets examined, all provide sufficient confidence in the available data for resource estimation.

Specifically:

- Sampling, preparation, and analyses are appropriate for the style of mineralization and are sufficient to support Mineral Resources.
- Sample and data security are consistent with industry best practices.
- There are potential biases in both reactive silica and available alumina analytical results of the check assays but given the overall decent repeatability of the REF and original FTIR assays at Bureau Veritas, the precision can be considered higher than expected, especially knowing that the KWI and Bella laboratory analytical method is better customized to the Alcoa bauxite than the umpire laboratories.
- Both available alumina and reactive silica present some minor biases in the analysis of the internal reference material (standards), while failure rates a very low and Fe is generally better behaved. Additional analysis is required to confirm these biases.
- Analytes reviewed for the Holyoake program results show poor precision between the historic and recent assay analysis.
- The STE method is as good a representation of the drill interval grade as collecting the whole of the residue and carrying out pulverizing, homogenization and splitting.

It is the opinion of the QP that the analytical procedures used for the Alcoa Mineral Resource comprises part of conventional industry practice. FTIR is not widely used yet in the bauxite industry but is becoming more widely accepted and applied to more operations. At Alcoa the method has been consistently applied successfully for a decade and is routinely validated by industry standard XRF and wet chemical procedures as discussed in Sections 8.3 and 8.4.

It is the opinion of the QP from the studies on FTIR repeatability discussed above that the overall precision and accuracy of the FTIR assaying is acceptable.

In the QP's opinion, the QA/QC program as designed and implemented by Alcoa is adequate and the assay results within the database are suitable for use in a Mineral Resource estimate.

9.0 DATA VERIFICATION

9.1 Data Structures

Wherever possible the transfer of geological, sampling and assaying data is now carried out digitally.

The use of rugged field tablets was introduced after an external review (Snowden, 2015). The data recorded at the drill rig is uploaded daily via WiFi for validation prior to importing into the acQuire database. This allows the data to be captured, checked, approved, and then loaded without any further manual keystroke entry.

The sample preparation and assaying data are all recorded at the Bella facility (see Figure 8-3) allowing all aspects of the sample preparation to be tracked and transferred to KWI through direct connection to their Laboratory Information Management System (LIMS). After calibration, validation and checking of the FTIR and REF assays they are transferred digitally to the acQuire database.

Within the database, scripts are run to prioritize the results and to define the BEST value for each analyte (e.g. AL_BEST, SI_BEST, etc.). The downhole accumulations of all grades are calculated, and the base of mineralization is determined. Other values are also calculated such as the Density using a regression equation (see Section 11.8.5).

An events table is used to change the status of each hole at all stages as it progresses through the validation process from designed, to drilled, to dispatched, to lab pending, to validated.

The various downhole geological features (LithCode, Seam, Geol Floor, etc.) are all verified spatially, validated by geologists using the vertical position and assays (e.g. Figure 7-7), and where appropriate metadata (e.g. Status Flag) is added to record the basis of the interpretation.

The required modelling files are exported from the acQuire database by the geostatisticians using queries. The final Mineral Resource models are then imported into the over-arching ArcMap environment for mine planning, and integration with the environmental and other planning protocols.



Hole ID	Project	Seam	Lithology		Samples		Best Results			Cumulatives		Lost Rods	Geological Floor	Design
		Seam	Lith Code	EOH Comment	Sample ID	Storage Status	AL	SI	FE	CAL	CSI	Gear in Hole	Status Flag	Design Fl
G39150224	My North	OVB												
		CAP	HB		F960124		30.943	2.403	29.025	30.94	2.4			
			HB		F960125		26.053	2.425	34.322	28.47	2.41			
		FRI	SB		F960126		29.921	2.326	31.308	28.88	2.39		M	
			SB		F960127		26.943	1.926	36.635	28.45	2.29			
			SB		F960128		29.404	2.881	31.579	28.63	2.39			
			CLB		F960129		19.241	3.466	41.211	27.19	2.56			
			CLB		F960130		23.109	2.896	36.435	26.64	2.58			
			CLB		F960131		20.466	4.779	34.402	25.91	2.84			
			CLB		F960132		15.539	9.204	32.95	24.82	3.51			
			CLB		F960133		6.787	15.452	32.27	23.11	4.64			
			CLB		F960134		6.751	18.012	27.664	21.69	5.8			
			BC		F960135		13.013	11.265	25.681	20.99	6.24			
			YC		F960136		12.965	12.936	25.06	20.4	6.73			

Figure 9-1: Visual Display of Hole Status (logged and assayed) for Hole G39150224 in Serpentine (Alcoa, 2021)

9.2 Data Verification Measures

The QP interrogated the data extracted from the acQuire database for two areas (Serpentine and Millars). For these two areas the count of records in each Table is summarized in Table 9-1.

Table 9-1: Count of Records by Database Table for Two Database Extracts

Data type	Table	Serpentine	Millars
Collars	*tblass*	6,362	8,298
Surveys	*tblsur*	6,362	8,298
Assays	*tblass*	59,622	70,905
REF Assays	*tblassrefs*	611	711
Lithology	*tblgeoLithology*	69,564	82,762
Geology Floor	*tblgeoGeolFloor*	69,561	82,761
Seam	*tblgeoSeam*	69,564	82,762

Extensive checks were run to validate the integrity. These included searching for duplicate records, downhole gaps, interval overlaps, missing collar or survey records, etc.

The following observations were made:

- As expected, the Validation Tables ensure that there are no anomalous codes.
- Checks for assay closure (adding all assays to 100%) are done by Alcoa when the assay data is prepared for resource estimation. The availability of total oxide assays (e.g. AT and ST) has progressively increased over time.
- In a few cases (156 for Serpentine, drilled from October 2019 to December 2019, and 114 for Millars) there were blank values for LithCode in the table *geoLithology* at the top of the hole, followed by a zero-length interval (e.g. From 1.2 m and To 1.2 m) with a valid LithCode. This is due to the practice of not sampling the overburden but instead discarding it, creating in some cases a short interval with no assay or LithCode. This type of database error is usually picked up by a validation check looking for zero length drill segments. In this deposit, because the geological logging is expected to follow a vertical sequence (which is used for some of the interpretation scripts), such zero length intervals are not uncommon to allow for pinching and swelling of some horizons.

Some calculation and range checks were run that highlighted gaps or anomalies in the scripts used to validate that data before resource estimation:

- There are 19 records with ST_BEST values greater than 100% in Serpentine and 2 in Millars. Such values should be investigated, trimmed, and flagged.
- There are a number of records (107 for Serpentine and 165 for Millars) where AL (available alumina) is greater than AT (total alumina). There are also records (1,273 for Serpentine and 2,029 for Millars) where SI (reactive silica) is greater than ST (total silica). These should be further investigated, flagged in the database, and future instances flagged during data loading so that when such results (infrequently) occur there is recognition during the data loading that

this is due to FTIR assays outside the normal calibration range, rather than due to sample mix-up or contamination.

- Checks on the regression calculation for density were run on the Serpentine database. There were 1,187 records not flagged as Seam=CAP, that had density values ranging from 2.04 to 2.28. These were either 20% or 40% CAP and had a density value reflecting the length weighted average of the two domains assigned. Of the total 6,399 records with valid seam and iron data, SLR found that 5,566 (87%) were within ±0.1 of the database density value. The remaining 833 records with Seam=CAP and an FE_BEST assay, were either 60% or 80% CAP and had a density value reflecting the length weighted average of the two domains assigned.

9.3 QP Opinion

The database extracts that were provided proved very robust to scrutiny, except for a small number of anomalies noted, none of which are considered material in view of the vast number of drill holes, assays and other records.

The QP is of the opinion that the database is adequate, and the data is appropriate for the purpose of Mineral Resource estimation.

10.0 MINERAL PROCESSING AND METALLURGICAL TESTING

Mineral processing and metallurgical test work samples representing the Darling Range operations are not available; however, this is an operating mine and consistent operating data demonstrates that the ore is directly transported to the refineries following size reduction. SLR understands that these operating data represent all material mined for ten years and sourced from four mining regions and as such represent the various types and styles of mineralization within the Darling Range operations.

It is important to note that there is no upgrading involved in the processing and therefore the processing recovery can be considered above 99% allowing for any losses in production.

The operating data between 2010 to 2021 for the Willowdale operation and 2010 to 2020 for the Huntly operations[1] indicates that the product from the Darling Range operations consisted of an average Al2O3 grade of 33% and average SiO2 grade of 20%. It is important to note that higher grades of reactive SiO2 is potentially deleterious but that remained below 1.2% throughout the 10 years of operation. SLR understands that according to the mine plan the Total SiO2 content on an annual average basis remains below 20%, and that reactive SiO2, on the same basis, remains at or below 1.25% for the next 10 years. This means there is no evidence of any deleterious elements present in the Darling Range ore within the next 10 years of production.

A summary of the product grades from the Darling Range operations are shown in Table 10-1, Table 10-2 and Table 10-3.

Table 10-1: Product Grades of Darling Range Operation (Willowdale – Wagerup refinery feed)

[1] 2022 operating data was not available for the Huntly operation at the time of the report.

Year	Moisture (%)	LOI (%)	Total Al2O3 (%)	Total SiO2 (%)	Fe2O3 (%)	TiO2 (%)	A.Al2O3 (%)	R.SiO2 (%)
2010	7.959	22.34	38.10	21.76	17.49	1.431	32.81	1.134
2011	7.930	20.89	40.57	22.28	17.64	1.466	32.75	1.141
2012	7.990	21.02	38.13	21.12	18.06	1.577	32.96	1.164
2013	7.745	21.15	36.80	18.57	19.48	1.607	32.72	1.209
2014	7.853	21.24	37.21	18.09	19.34	1.624	33.10	1.170
2015	7.484	21.48	37.01	18.01	19.03	1.719	33.16	1.112
2016	7.816	21.63	37.56	16.73	20.63	1.746	33.06	1.139
2017	7.817	21.75	37.93	16.01	21.37	1.825	33.03	1.103
2018	7.952	21.64	38.29	15.89	21.34	1.880	33.02	1.131
2019	7.611	21.28	37.33	16.76	21.34	1.851	32.29	1.153
2020	7.835	21.50	37.40	14.12	23.25	2.098	32.45	1.074
2021	8.296	21.52	37.53	17.95	21.03	1.728	32.37	1.061
2022	7.815	21.13	37.45	17.94	21.31	1.846	32.29	1.018

Table 10-2: Product Grades of Darling Range Operations (Huntly–Pinjarra refinery feed)

Year	Moisture (%)	LOI (%)	Total Al2O3 (%)	Total SiO2 (%)	Fe2O3 (%)	TiO2 (%)	A.Al2O3 (%)	R.SiO2 (%)
2010	7.4	20.8	38.6	20.8	17.4	1.34	33.1	1.05
2011	7.8	21.0	38.8	20.0	18.0	1.41	33.0	1.04
2012	8.2	21.4	39.4	20.2	17.1	1.37	33.6	1.13
2013	8.1	21.5	39.8	19.5	17.1	1.35	33.9	1.12
2014	8.2	21.5	39.6	18.6	17.7	1.45	33.8	1.16
2015	8.0	21.6	39.3	19.5	17.3	1.41	33.8	1.08
2016	8.2	21.4	39.2	20.3	17.0	1.38	33.8	1.13
2017	8.3	21.3	39.3	19.6	17.5	1.42	33.9	1.11
2018	8.3	21.4	39.1	19.5	17.6	1.42	33.7	1.07
2019	8.1	21.3	38.9	20.1	17.2	1.38	33.5	1.12
2020	8.4	21.4	39.1	18.4	18.6	1.52	33.5	1.20
2021	8.9	21.1	38.8	19.7	18.3	1.48	33.0	1.24
2022	8.5	20.8	37.9	19.3	19.9	1.62	31.9	1.31

Table 10-3: Product Grades of Darling Range Operations (Huntly– Kwinana refinery feed)

Year	Moisture (%)	LOI (%)	Total Al2O3 (%)	Total SiO2 (%)	Fe2O3 (%)	TiO2 (%)	A.Al2O3 (%)	R.SiO2 (%)
2006	7.8	21.7	39.3	18.7	18.0	1.37	33.9	1.10
2007	8.0	21.6	39.2	19.5	17.6	1.33	33.7	1.11
2008	7.9	21.3	39.1	20.1	17.3	1.34	33.8	1.09
2009	7.8	21.3	39.0	20.7	17.3	1.29	33.5	1.02
2010	7.5	21.4	38.6	20.8	17.4	1.26	33.1	1.04
2011	7.6	21.3	38.7	20.1	18.2	1.30	32.8	1.03
2012	8.2	21.5	39.4	20.3	17.0	1.25	33.5	1.13
2013	8.1	21.8	39.8	19.5	17.1	1.26	33.9	1.11
2014	8.2	22.0	39.6	18.8	17.7	1.37	33.7	1.17
2015	8.0	22.0	39.4	19.7	17.2	1.31	33.8	1.08
2016	8.2	21.7	39.1	21.3	16.1	1.32	33.8	1.03
2017	8.3	22.2	38.9	20.6	16.5	1.34	33.8	1.03
2018	8.3	22.1	38.6	20.8	16.7	1.33	33.9	1.05
2019	8.0	21.8	38.9	21.2	16.4	1.32	33.5	1.12
2020	8.4	21.7	39.1	19.8	17.6	1.44	33.5	1.16

Year	Moisture (%)	LOI (%)	Total Al2O3 (%)	Total SiO2 (%)	Fe2O3 (%)	TiO2 (%)	A.Al2O3 (%)	R.SiO2 (%)
2021	8.9	21.0	38.7	20.9	17.6	1.39	33.0	1.20
2022	8.5	20.8	37.6	20.7	18.6	1.50	31.9	1.26

10.1 QP Opinion

SLR is of the opinion that the Darling Range operation demonstrates that ore can be effectively crushed and supplied to a refinery for further upgrading to produce Alumina. The historical operational data confirms that the ore consistently meets refinery specifications without any deleterious elements. Based on this, and the additional information about the mine plan provided by Alcoa, it is reasonable to assume that the ore from Darling Range can be economically processed for the next 10 years.

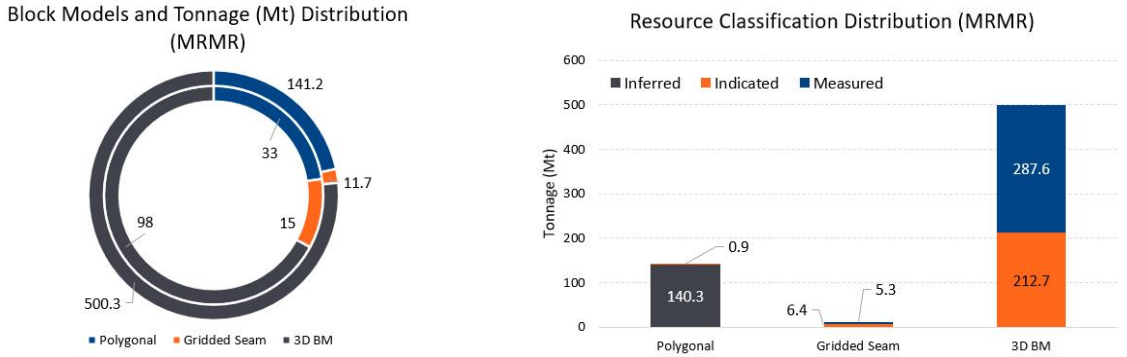
11.0 MINERAL RESOURCE ESTIMATES

11.1 Summary

The Darling Range resource comprises over 13,000 resource blocks, with a combined area of approximately 10,870 ha, averaging 50 kt of Mineral Resource per block. The lateritic bauxites occur as surficial coverings of limited thickness, typically between 4 m to 8 m, but with significant lateral extent. Historically, resource estimation was by 2D plan-polygonal methods (Polygonal) referred to by Alcoa informally as the ResTag procedure. More recently, resource estimation by Alcoa has evolved to include gridded seam (GSM) and 3D block (3DBM) models using geostatistical techniques. Mineral Resource estimates based on GSM and 3DBM models (and some Polygonal models) consider practical mining constraints.

The delineation of Mineral Resources using 3D methods has focused on well drilled areas that fall within the 10-year mine plan and approximately 76% of the total tonnage, including Mineral Resources and Mineral Reserves (MRMR), of the Darling Range project is already in 3D block models. GSM models were typically constructed in areas with 15 m spaced drilling, which comprises 10 models. Approximately 60% of the Mineral Resources are based on Polygonal (ResTag) estimates which are mostly located in areas of wider-spaced (30 m and 60 m) drilling and are of lower confidence. All new resource updates employ the 3DBM methods irrespective of drill hole spacing.

Figure 11-1 illustrates the tonnages and number of models for each model type that are being discussed in this section.



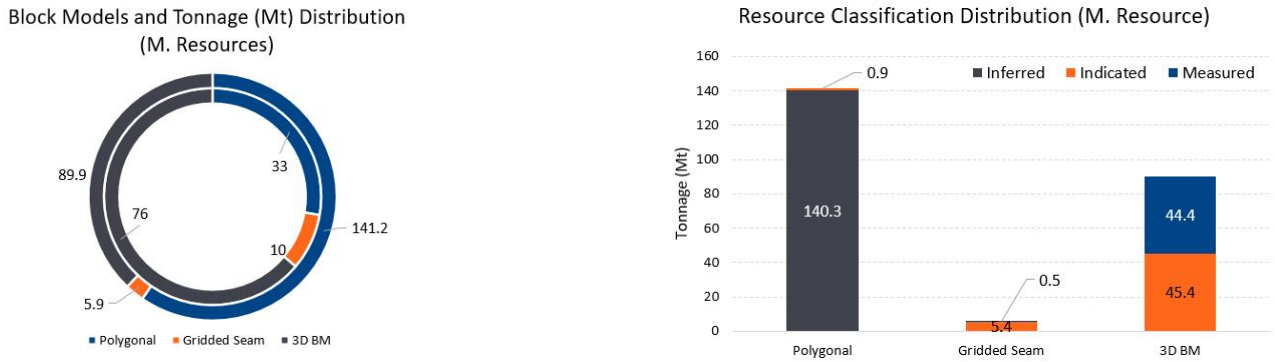


Figure 11-1: Circle Charts Showing the Tonnage (external circle) and Number of Models (internal Circle) and Bar Charts Showing the Tonnage by Mineral Resource Categories. Charts on the Top Refer to all the Tonnage of the Darling Range Project, and on the Bottom to the Exclusive Mineral Resources

Mineral Resource estimation was carried out by Alcoa and resources are defined for 92 sheets in 70 mining regions. There are 13,467 discrete zones of mineralization that comprise the resource, each split vertically into 4 domains for which 11 elements were estimated. SLR carried out audits on representative models selected in conjunction with Alcoa and comprising:

- Models to be mined in the short to medium term (less than 5 years)
- Models with significant amounts of resource material
- Models representing the three estimation methods used by Alcoa.

The models audited were:

- ResTag estimation method: Teesdale
- GSM estimation method: Larego (F54 and F55)
- 3DBM estimation method: Serpentine (R25) and Millars (R22).

The audit process by SLR comprised examination of the procedures used by Alcoa, independent review and discussion with staff, normal validation checks (e.g., statistics, swath plots, visual examination, change of support analysis and generation of grade-tonnage curves). The two 3DBM models were examined in detail. The other models were examined and interrogated to ensure that the documented procedures were followed and that results were consistent with QP expectations based on the data inputs.

The process used by Alcoa involves an integrated approach to data collection, bauxite delineation, and production planning aimed at the provision of feedstock that meets the requirements of the local alumina refineries.

For all 3 estimation methods drill holes were flagged with geological units using multi-pass geochemical scripts that included thickness constraints. The GSM flagging process incorporated some additional mining constraints. Geological interpretations in both 2D and 3D were constructed with the flagged drill hole composite data, which constrain the spatial estimation of bauxite mineralization. Subsequent to

block grade estimation, mining constraints are applied to the 3DBM models to restrict Mineral Resources to areas of potentially economic bauxite mineralization.

AL, SI, FE, ST, PT, OX, EO, CO, and SU are estimated for all models, but only AL and SI are reported for the Mineral Resource. GSM uses inverse distance weighting methods to assign grades to the bauxite profile, and 3DBMs rely on ordinary kriging block grade estimates. Validation methods differ slightly for the different model types, but all models are reported by Alcoa to validate well against the input drill hole data.

Mineral Resources have been classified in accordance with the definitions for Mineral Resources in S-K 1300, which are consistent with Australasian JORC Code (2012) and Canadian Institute of Mining Metallurgy and Petroleum (CIM) (2014) definitions in NI 43-101 and are determined primarily on drill hole spacing. Models constructed primarily with pre-2010 drill holes are downgraded as this information is considered to be of lower confidence.

Mineral Resource estimates exclusive of Mineral Reserves Darling Range deposit are shown in Table 11-1, and include a 5% reduction factor in tonnage, based on the results of annual reconciliations (see discussion on density in Section 11.13).

Table 11-1: Summary of Darling Range Mineral Resources exclusive of Mineral Reserves – 31st December 2022

Category	Tonnage (Mt)	A.Al2O3 (%)	R.SiO2 (%)
Measured	44.9	31.17	1.15
Indicated	51.8	31.40	1.17
Measured + Indicated	**96.7**	**31.29**	**1.16**
Inferred	140.3	32.93	1.26

Notes:

1. The definitions for Mineral Resources in S-K 1300 were followed, which are consistent with JORC (2012) definitions.
2. Mineral Resources are 100% attributable to AWAC.
3. Mineral Resources are estimated at a geological cut-off grade, which generally approximates to nominal cut-off grades of 27.5% A.Al2O3with less than 3.5% R.SiO2. Locally the cut-off grade may vary, dependent on operating costs and ore quality for blending. The target grade for mine planning is 32.7% available aluminum oxide (A.Al2O3) and 1.0% reactive silica (R.SiO2).
4. Mineral Resources have been estimated using a bauxite transfer price of USD16/t, as described in Section 11.11.
5. A minimum total mining thickness of 1.5 m was used.
6. In situ dry bulk density is variable and is defined for each block in the Mineral Resource model.
7. A global downwards adjustment of tonnes by 5% is made to account for density differences based on historic mining performance.
8. Mineral Resources are reported exclusive of Mineral Reserves.
9. The reference point for the Mineral Resource is the *in situ* predicted dry tonnage and grade of material to be delivered to the refinery stockpile following the application of mining design parameters.
10. Metallurgical recovery has not been directly considered in the estimation of Mineral Resources as the Darling Range operations do not include a conventional processing plant, only crushing as described in Section 14.0. The metallurgical recovery of the three refineries (Kwinana, Pinjarra and Wagerup) are beyond the boundaries of the mining operations being the subject of the TRS.
11. Numbers may not add due to rounding.

11.2 Resource Database

11.2.1 Drill Hole Data

Drill hole collar, survey, and assay data are exported from the acQuire database for resource estimation.

Data exports from acQuire currently utilize Python scripts and the Spyder open-source plugin for validation and initial processing, including:

- Assigning 999 as the Domain code where drill hole intervals lack AL, SI and Fe assays
- Removing holes from the database if located greater than 7 m horizontally from the planned location
- Identifying and removing duplicate or repeat holes based on a set of criteria
- Resetting AL to AT where AL exceeds AT
- Resetting SI to ST where SI exceeds ST
- Calculating Assay Total = AT (AL if AT absent) + ST + BO + FE + SU + CO
- Deleting assays for samples where the Assay Total is below 70% or greater than 100%.

The output is a set of CSV files for collar, survey, assay, and geology.

The validation checks have been implemented progressively over time as drill hole data for some project areas includes some samples where AL exceeds AT and SI exceeds ST.

Other than collar elevation adjustments, no further data transformations are applied prior to resource estimation.

A summary of the drillhole database is outlined in Figure 7-1.

11.2.2 Topographic Data

Digital elevations models (DEMs) were generated from (in order of priority) drill collar survey data, LiDAR survey data, and Landgate satellite data. A 7.5 m by 7.5 m mesh is used for the DEMs. Drill hole collar elevations were registered to the DEM for resource estimation.

11.3 Geological Interpretation

11.3.1 Polygonal Models

For Polygonal resource estimates, grade-based 'geological' codes are assigned to drill hole intervals. These codes are used to define the top and bottom of the 'bauxite' horizon in each hole, which is then used to estimate the bauxite volumes and average grades within polygons.

The top of the bauxite usually coincides with the base of the overburden, as defined in the drillers' logs. The base of the Bauxite Zone (termed the geological floor) is defined within the acQuire database using a multi-pass script that applies the following hierarchical set of rules to the sample grades:

Pass 1

- Uphole search for two consecutive samples with individual AL values ≥27.0%

- Record depth of the lower of the two samples
- Check that the cumulative AL at that depth is ≥27.5%
- Check that the individual SI at that depth is ≤3.5%
- Check that the cumulative SI at that depth is ≤3.0%
- Check that the cumulative OX at that depth is ≤4 kg/t
- Check that the sampled depth is ≥2.0 m, but less than hole depth (if equal, see pass 3)
- If all criteria are met, set flag to “pass”, set geological floor depth to lower sample depth
- Proceed to pass 2.

Pass 2

- Uphole search for two consecutive samples with individual AL values ≥25.5%
- Record depth of the lower of the two samples
- Check that the cumulative AL at that depth is ≥27.5%
- Check that the individual SI at that depth is ≤3.5%
- Check that the cumulative SI at that depth is ≤3.0%
- Check that the cumulative OX at that depth is ≤4 kg/t
- Check that the sampled depth is ≥2.0 m, but less than hole depth (if equal, see Pass 3)
- If all criteria are met, set flag to “pass”, set geological floor depth to lower sample depth
- If any criteria fail, geological floor defined in Pass 1 is retained.

Pass 3

- Uphole search for two consecutive samples with individual AL values ≥27.0%
- Record depth of the lower of the two samples
- Check that the cumulative AL at that depth is ≥27.5%
- Check that the individual SI at that depth is ≤3.5%
- Check that the cumulative SI at that depth is ≤3.0%
- Check that the cumulative OX at that depth is ≤4 kg/t
- Check that sampled depth = hole depth
- If all criteria are met, set flag to “pass – open”, set geological floor depth to lower sample depth.

Pass 4

- Uphole search for two consecutive samples with individual AL values ≥24.5%
- Record depth of the lower of the two samples
- Check that the cumulative AL at that depth is ≥25.0%
- Check that the individual SI at that depth is ≤3.5%

- Check that the cumulative SI at that depth is ≤3.0%
- Check that the cumulative OX at that depth is ≤4 kg/t
- Check that the sampled depth is ≥2.0 m, but less than hole depth (if equal, see pass 3)
- If all criteria are met, set flag to “marginal”, set geological floor depth to lower sample depth.

The application of these rules assigns a geological floor depth to each hole, along with a Pass, Pass-Open, Marginal, or Fail flag. Holes flagged as Marginal or Fail are inspected by Alcoa staff members, with manual adjustments applied if warranted. For areas infilled to 15 m spaced holes, the geological floor model is replaced by a mining floor model, which is discussed in the following section.

Results of geological floor flagging are used to subjectively define the lateral extents of the Mineral Resource. Outlines are manually interpreted by Alcoa geologists in ArcGIS or MineSight, and are guided by consistency in thickness, depth, and grade, minimum limits on the number of enclosed samples and the enclosed area, and local geomorphology. The polygons delineate separate areas that typically range in size from 10 ha to 100 ha, with most being around 30 ha. An example plan view is shown below.

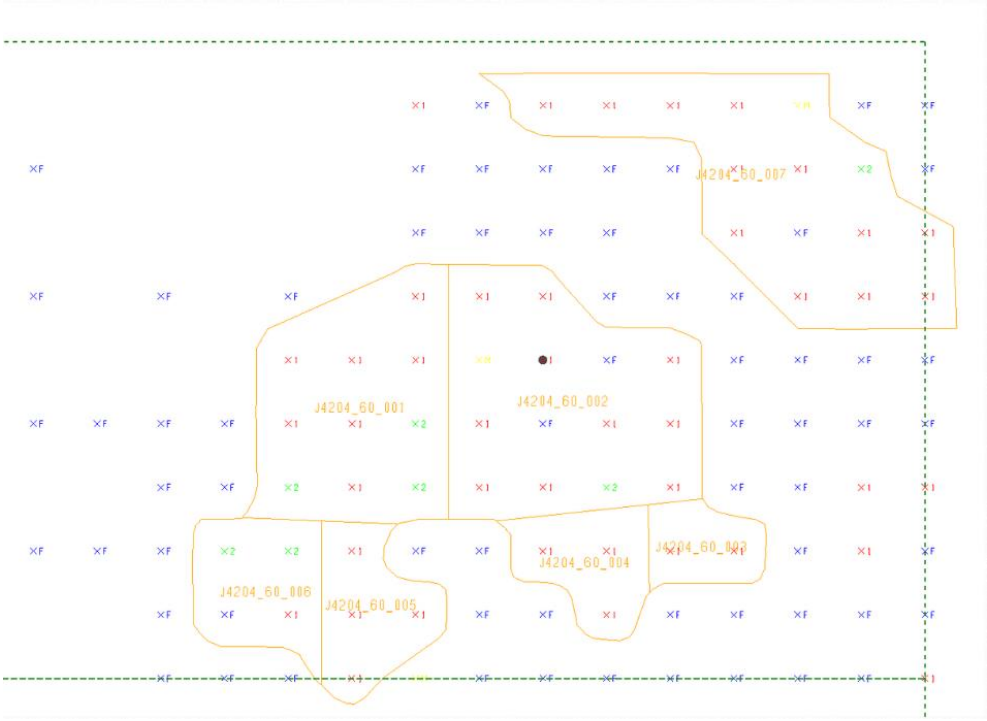


Figure 11-2: Plan View of Polygonal Approach (Pass = red, pass open = green, marginal = yellow, fail = blue) (Alcoa, 2022)

11.3.2 Gridded Seam Models

GSM models are located in areas of 15 m spaced infill drilling and include practical mining constraints as part of the 'geological' interpretation used for resource models.

The base of overburden and the base of caprock is identified in each drill hole as 3D points and wireframed as surfaces. The geological bauxite zone floor, which is defined for the wider drill spacings used for Polygonal estimates, is replaced by a mining floor for GSMs. The mining floor is interpreted directly from the drill hole data presented on the 15 m spaced east-west cross sections, digitized in MineSight as strings, then linked to form wireframe surfaces.

The interpretation of the mining floor is a manual process performed by the site geologist, with the objective of achieving acceptable grades and practical mining outlines. The mining floors are defined using a set of guidelines instead of prescribed rules, including:

- Nominal cut-off grades of ≥27.5% AL and ≤3.5% SI are used for mining floor definition;
- If the SI grade in the sample immediately below the floor exceeds 5.0%, the floor is raised 0.5 m;
- A minimum face height (distance from mining floor to the base of overburden) is targeted;
- Face heights exceeding 4 m will require multiple cuts or bench mining;
- The overburden to face height ratio should not exceed 1;
- A maximum floor gradient of 1 in 7 is required between 15 m spaced holes (the gradient can be increased to 1 in 5 for second and third cuts);
- Benching should be invoked where the gradient constraints cannot be maintained; and
- The floor interpretations should be extended laterally into at least one of the surrounding waste holes.

The base of overburden and mining floor surfaces are used to flag the drill hole samples. For each drill hole, the samples located below the base of the overburden and above the mining floor are composited into a single interval, with composite grades length- and density-weighted. Additional drill hole composites are generated for second and third pass mining floors.

The composite data are examined in plan view, and polygons are digitized around the interpreted lateral extents of the mining zones using the following guidelines:

- Nominal cut-off grades of ≥27.5% AL and ≤3.5% SI for lateral boundary definition
- The boundary is positioned at least 15 m away from holes with SI grades exceeding 5%
- Buffer zones are placed around environmental constraints, and around bedrock outcrop
- Internal waste zones should contain at least three drill holes
- Individual polygons should have an area of at least 1 ha
- A width of at least 45 m should be retained for mining equipment movement.

The resulting polygons are divided into typically smaller 'mining' blocks that each contain approximately 20 kt to 40 kt of Mineral Resource.

11.3.3 3D Block Models

Similar to the Polygon and GSM interpretation approaches, a set of rules written in Python scripts are used to assign initial domain codes to individual samples. These Domain codes are then modified in several subsequent passes that take into account the grades and coding of other intervals in the hole.

The initial script is used to assign a Domain code to each interval based on various combinations of major analyte threshold grades. A total of 6 main material type Domains (DOMAF) is defined, namely overburden (DOMAF=99), caprock waste (10), caprock bauxite (20), bauxite (30), low-grade bauxite (40), and clay (50), as shown in Figure 11. Each of these material types (apart from overburden) is divided into up to five grade-based sub-domains. Three subsequent coding passes are conducted that iteratively adjust the codes to combine the sub-domain into the 6 main Domains while ensuring that strict stratigraphic ordering is maintained. A further two passes are coded to assign Domain codes that denote whether the material is derived from granite or dolerite.

The base of each Domain is generated on a 7.5 m by 7.5 m grid using an automated modelling process in DeepLime software package. To ensure a better fit of the wireframes, when the collar of the drill holes do not match with the topography, they are adjusted according to the topography surface. Where drill holes do not penetrate the full bauxite profile or the Domain contact is not defined exactly due to missing assays, a conditional simulation algorithm is used to estimate the Domain thickness from adjacent drill holes. The simulation algorithm employs a Matern variogram and selects the average of 10 simulations for the missing data point. The grid mesh is then wireframed in MineSight to provide 3D surfaces. The base of Domain 50 (Clay) is set at 10 m below the top of that Domain.

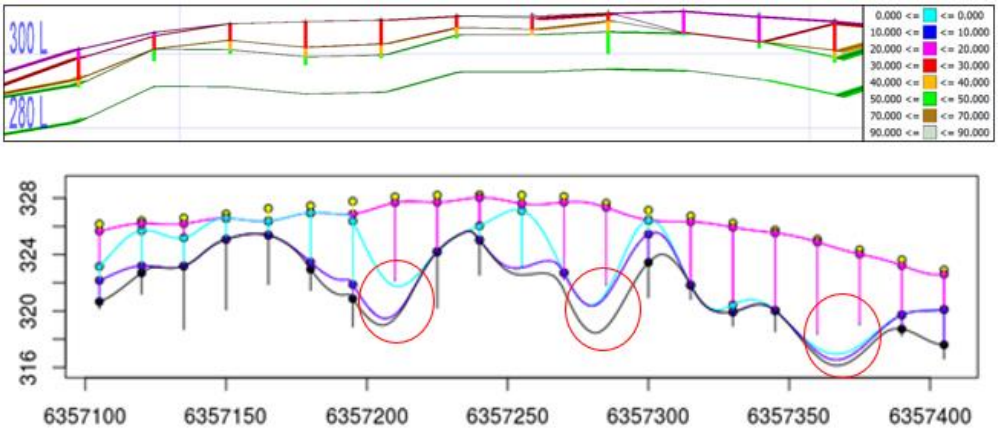


Figure 11-3: Example Section Showing Domain (DOMAF) and Wireframed Surfaces (top), and Regions where the Bauxite Layer was not Penetrated (bottom) (SLR, 2022)

Potential dolerite dyke intervals are flagged for samples where FE exceeds 25% and ST is below 10%, and the entire hole is flagged as potential dyke if 3 or more samples are flagged in this manner. The interpretation of dykes is carried out manually using local orientation trends and may be based on one or more holes (see Figure 11-4). They are assumed to be vertical, are extended laterally half-way between drill holes, and can represent up to 15% of material in some areas but unweathered material

can generally be screened out in the pit or prior to crushing as oversize boulders. The dykes tend to be well defined only when drill hole spacings are reduced to 15 m by 15 m.

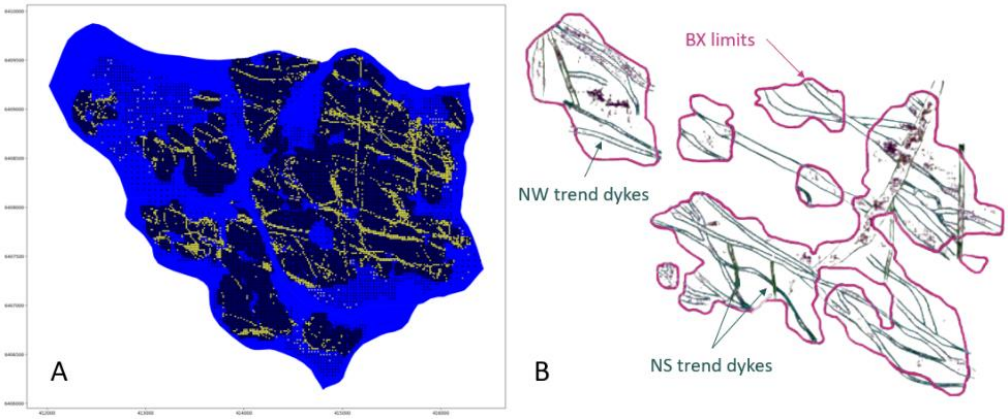


Figure 11-4: Plan View of Bauxite Zone and (A) Drill Holes Flagged as Dykes in yellow, and (B) Interpreted Vertical Dykes from the Drill Holes (Alcoa, 2022 – Modified by SLR)

While the dolerite dykes are delimitated in the geological modelling workflow and flagged in the block models, there is not a separated estimation workflow to different lithologies, being the current workflow used to the whole bauxite layer. A lateral boundary is interpreted to constrain the resource model and the 3D surfaces are extended where required. The lateral boundary, domain surfaces, and dolerite dyke interpretations are converted to wireframe solids. All the constraints where mining is not allowed (federal reserves, indigenous heritage sites, and rivers and protection buffers associated) are delimitated and removed after the geological modelling step. This way all the mineable reminiscent area is included in the final orebody perimeters.

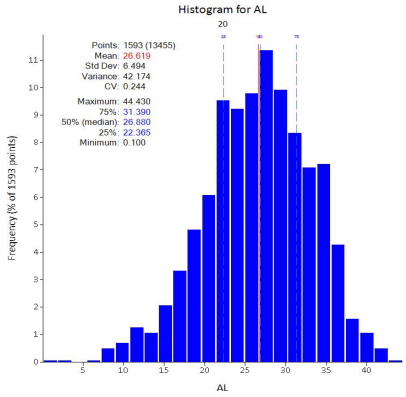
11.4 Statistical Checks

Statistical checks by Alcoa and independent reviewers are typically carried out by univariate statistical comparisons and histogram, grade trend, scatter, and cumulative log probability plots.

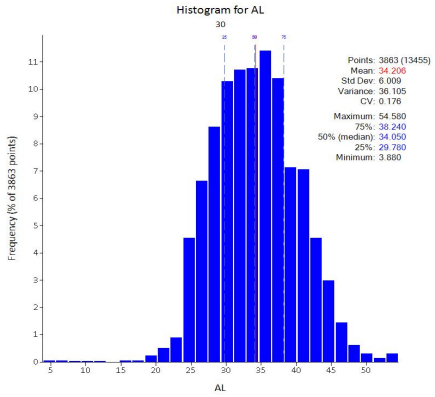
Univariate statistics by Domain are calculated pre- and post-compositing for validation, and for checks against the resulting resource models. For areas with multiple drilling campaigns carried out at significant time lags, SRK (2021a) previously noted that there were no material or unexpected differences between subsets of the dataset grouped by drilling period or drilling grid.

Histograms show that most analytes have distributions that are close to normal, as shown in Figure 11-5 for AL. The exception being SI, which is moderately to strongly positively skewed, as shown in Figure 11-6.

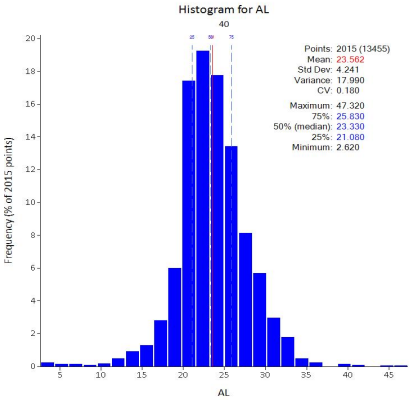
Marked grade trends with depth exist for most analytes but are consistent with the mineralization style and have been adequately accounted for by the geological interpretation and the use of unfolding methods during block grade estimation.



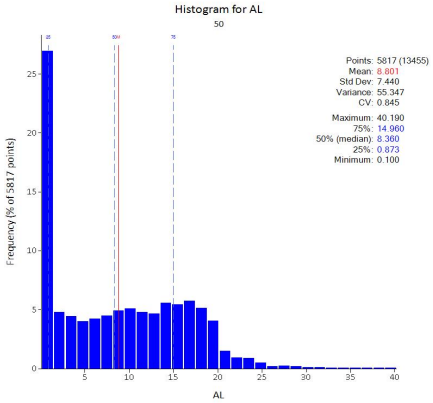
DOMAF = 20



DOMAF = 30



DOMAF = 40



DOMAF = 50

Figure 11-5: Histograms of AL by DOMAF at Serpentine

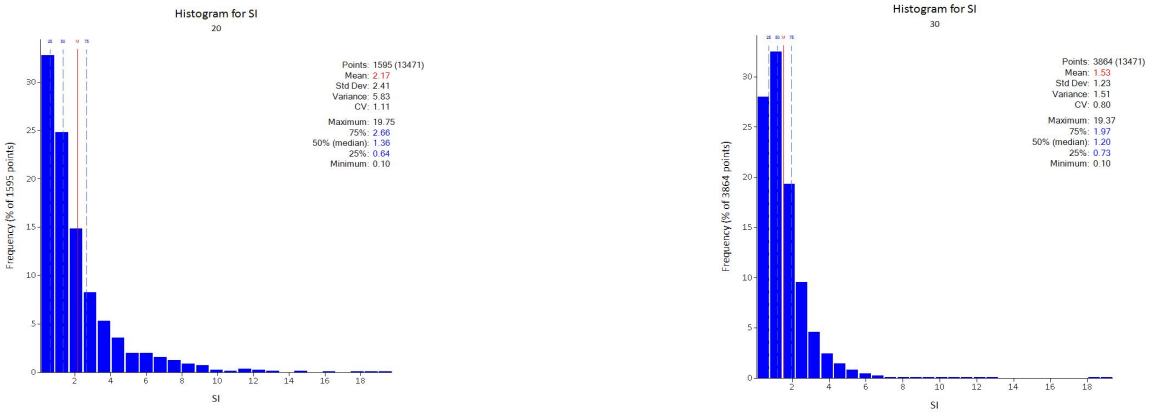


Figure 11-6: Histograms of SI by DOMAF at Serpentine

Figure 11-7 plots SI versus ST for the clay zone at Serpentine. Note that reactive silica (SI) was greater than total silica (ST) for some composites (left-hand plot), and these relationships were carried through to the block model (right-hand plot). In the datasets reviewed, this issue was most common for SI in the clay zone, but there were also small numbers of bauxite zone samples with available alumina (AL) greater than total alumina (AT). This issue is not considered to be material for the Mineral Resource estimate, and adequate checks are now in place for future resource models.

Figure 11-8 shows the relationship between AL and SI for the bauxite and clay zones at Serpentine. Note the progressive increase in SI as the bauxite profile changes with depth from Hardcap (20), through friable bauxite, and to Clay (50), which was supported by grade trend plots.

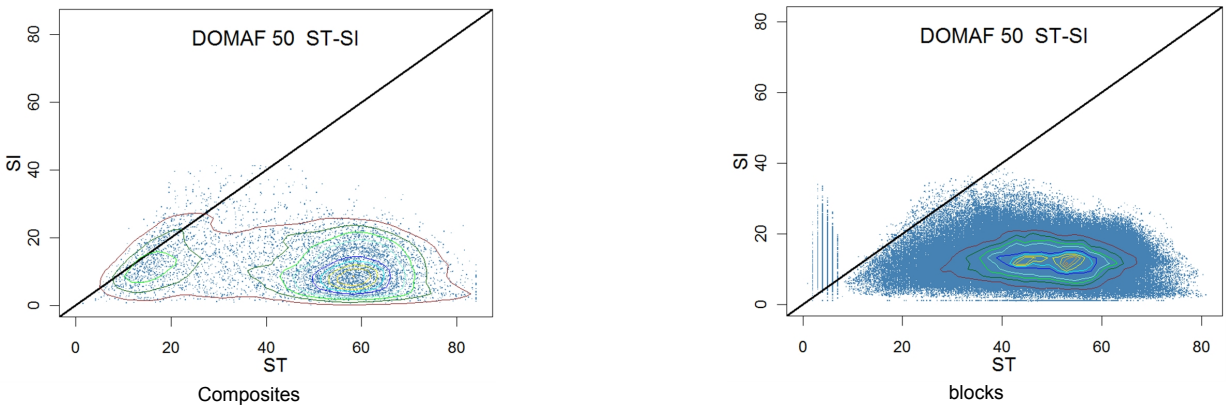


Figure 11-7: Scatterplots of SI versus ST for DOMAF 50 at Serpentine

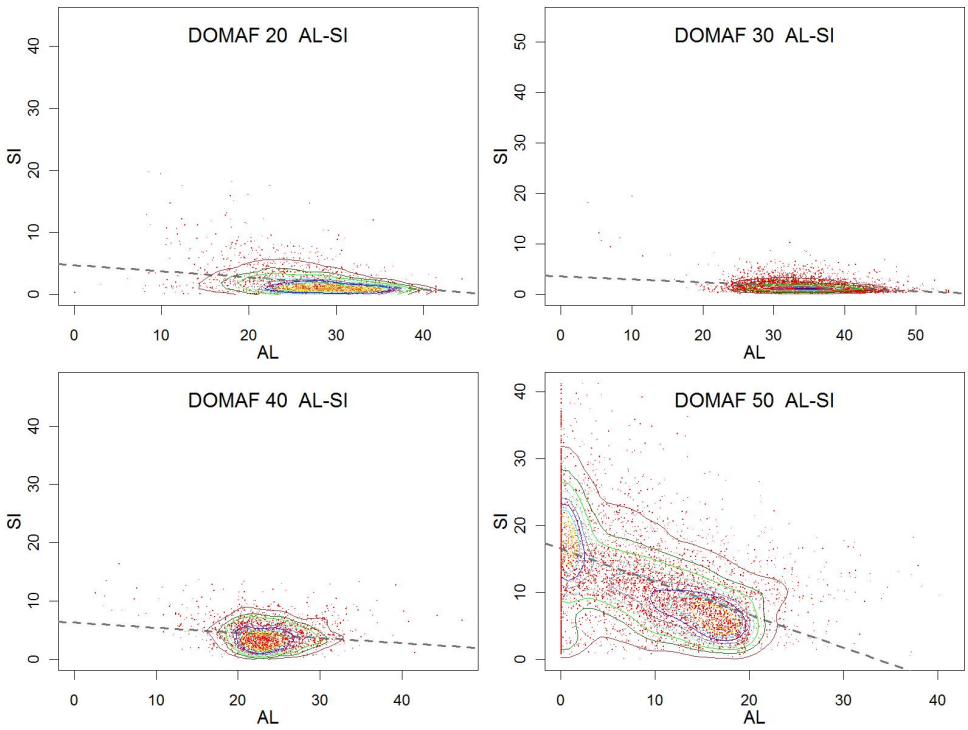


Figure 11-8: Scatterplots of AL versus SI by Domain at Serpentine

Missing values are kept as missing values in the database, as well as results below the detection limit are changed to values that are half of the detection limit.

11.5 Treatment of High-Grade Assays

High-grade caps for all analytes were applied to individual composites by Alcoa on a domain-by-domain basis following inspection of the data distribution. The QP confirmed that high-grade caps were typically greater than the 99th cumulative sample percentile, as shown by horizontal lines in the plots in Figure 11-9.

No high-grade spatial restrictions were used by Alcoa in the resource estimation process.

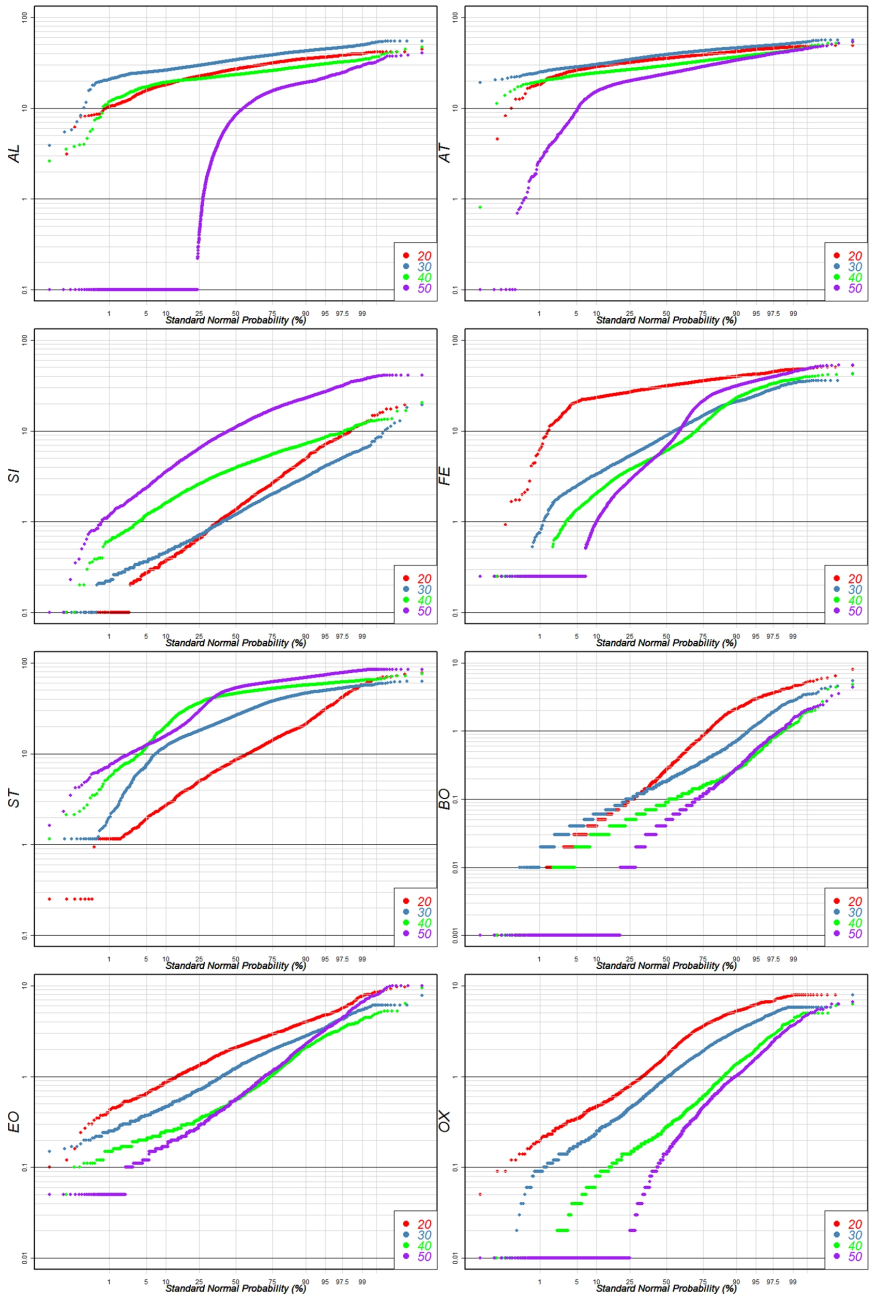


Figure 11-9: Cumulative Log Probability Plots for Serpentine Composites

11.6 Compositing

Drill holes were sampled at 0.5 m intervals in the bauxite zone below the base of the overburden, with a residual sometimes present at Domain contacts. The Polygon and GSM estimation approaches used the original drill hole data intervals. Prior to the interpretation of geological surfaces, holes used in the 3DBM resource estimates were composted to 0.5 m with residuals calculated to ensure their length was 0.25 m to 0.75 m.

Following the interpretation of geological surfaces, drill holes used for Polygonal and GSM resource models were composited to:

- Polygonal – a single interval for samples located below the base of the overburden and above the geological floor.
- GSM - a single interval for samples located below the base of the overburden and above the mining floor. Additional composites were generated in areas where second and third pass mining floors were identified.

All grade compositing for drill holes employs length-weighted linear averages.

11.7 Trend Analysis - Variography

Only some variogram analysis was carried out for Polygonal and GSM models as variogram parameters were not required to generate the resource models. Variogram analysis is routine for 3DBMs. Experimental variograms are calculated in unfolded space, with bauxite Domains 20, 30 and 40 unfolded to the 10/20 Domain contact and the clay Domain (50) unfolded to the 40/50 Domain contact.

Experimental variograms are calculated for AL, SI, ST, and FE for the bauxite zone, standardized to a sill of one, and modelled with 3-structure spherical models, as shown in Figure 11-10. A single variogram model is selected that provides a best fit to these four variables. Variogram models tend to display nugget values of less than 20% and total ranges of several hundred meters, but 80% of the sill is generally reached within 100 m laterally. As expected, horizontal to vertical anisotropy ratios are high (typically exceeding 50:1), but there is little lateral anisotropy. Only minor differences in Huntly and Willowdale variogram models were noted by SRK (2021a). This good definition of continuity compared to the 15 m drill spacing is considered by SLR to be a benefit of the unfolding approach.

Independent variogram models for each bauxite domain and analyte are not used for grade estimation to enable correlations between analytes to be maintained during the change in support from drill hole samples to blocks, which is important for mine planning considerations.

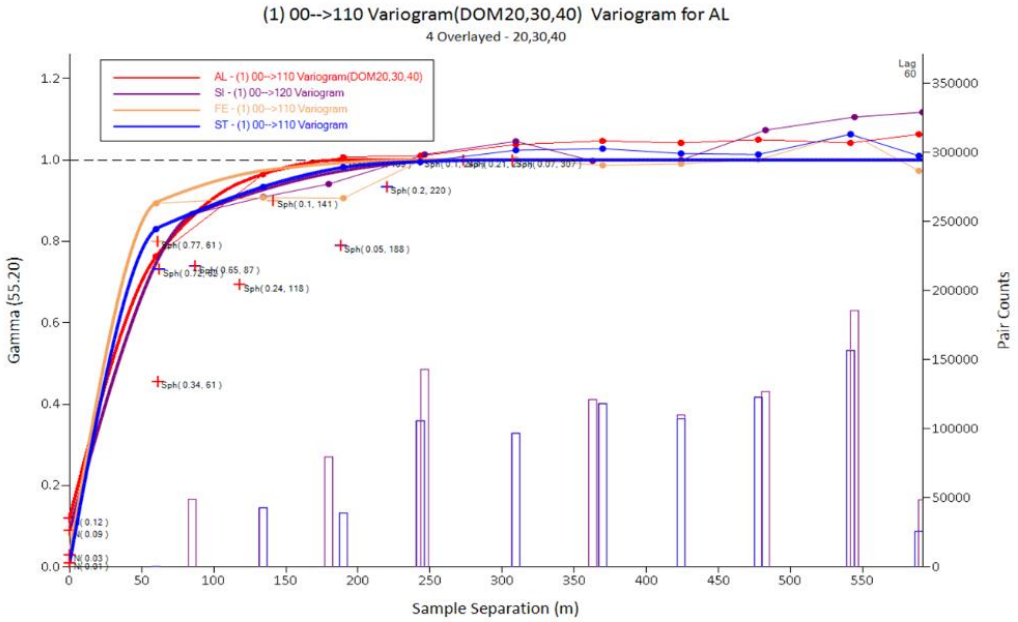


Figure 11-10: AL, SI, FE, and ST Directional Variogram Models at Serpentine

11.8 Bulk Density

For Mineral Resource estimation purposes, density can be regarded as another analyte, and tests can be evaluated for repeatability (precision) and accuracy (bias). The determination of the metal content of a specified volume of ore is as sensitive to density as it is to grade, and this is certainly the case for gold mining with high value, low concentration assays. For bulk commodities there is usually much more emphasis on grade since product tonnages are measured by weightometer.

Alcoa does not routinely collect density data but relies on production records to define averages. This is due to the broad geological consistency of the ore zones and the local chemical and physical nature of the lateritized ore. Porosity and permeability in particular show high lateral and vertical variability, rendering repeatability of density test work meaningless. Even if large numbers of data points were available (for example by developing a density algorithm from the FTIR assaying of every drill sample, and then modelling it) the resulting model would still need to be factored by the actual mining results for local porosity.

For 3DBM resource estimation, each drill hole bauxite composite is assigned a dry *in situ* bulk density (DIBD) value based on the logged material type and the FTIR iron grade using the regression equation defined below in Section 11.8.5.

The available density test work data is summarized as follows.

11.8.1 1980 to 1992

Senini (1993) collated and reviewed all previous bauxite density data, including that by Sadleir done in 1986, and modified Sadleir's algorithm used for computation of density from individual 0.5 m sample assays of Fe_2O_3. Results are summarized in Table 11-2.

Table 11-2: Summary of Density Test Data (t/m³) from 1980 to 1992 (Senini, 1993)

Year	Source	Material	Count	Mean	Min	Max	Fe Mean	Regression On Fe2O3 Slope	Regression On Fe2O3 Intercept
1980	DOSCO	Hardcap	18	2.200	1.98	2.52	19.35	0.0089	2.032
1986	Sadleir (in Senini)	Hardcap	14	2.364	2.08	2.75	20.88	0.0092	2.172
1992	Senini	Hardcap	67	2.409	1.81	3.10	21.00	0.0103	2.192
1986	Sadleir (in Senini)	Friable	11	1.846	1.64	2.12	8.80	0.0015	1.830
1992	Senini	Friable	27	2.225	1.88	2.79	14.30	0.0045	2.289
1980 - 1992	reported above	Granitic	67	2.327	1.81	3.10	16.71		
1980 - 1992	reported above	Doleritic	32	2.444	2.07	2.96	28.96		

While the approach used has merit, there are some obvious challenges:

- There are very few data points, unevenly distributed by material type and mining area
- Methodologies for collecting and testing the samples varied (sand replacement method for Hardcap, driven cylinder for Friable, water displacement are all noted)
- There is some lack of clarity on moisture, but it is assumed that the values are all *in situ* dry bulk density reported as t/m³.

The differences between hardcap (caprock) and friable (other material) and between granitic or doleritic derivation are however clear.

Senini (1993) concluded that the dry *in situ* bulk density (DIBD) should be estimated using a regression equation which is still used.

11.8.2 2013 to 2018 Drill Samples

Various further test programs have been attempted including collection of all material from drill samples (assuming the drill hole volume is constant) and then taking wet and dry weights and assaying for iron. There were 51 samples from 8 holes at Huntly and 93 samples from 24 holes at Willowdale. Scatter plots produced by SRK 2021a showed significant scatter of all available data for both Hardcap and Friable (other) material.

11.8.3 2016 to 2017 Pit Samples

Alcoa collected 2 kg to 5 kg grab samples from 16 Huntly pits (76 samples) and 10 Willowdale pits (41 samples). Water immersion density testing was done by Bureau Veritas. The average of 2.01 t/m³ is significantly lower than that from the 2015 study of 2.23 t/m³. The drill samples did not account for porosity and voids and were not adequately sealed.

FTIR assays for Fe2O3 were compared to sealed and unsealed density estimates and it was found that Senini's regression equation better predicted the unsealed densities. Thus, it appears that the current regression equation based on Fe2O3 assays overestimates the in situ dry tonnage.

11.8.4 2018 Downhole Density Estimates

In December 2018 Alcoa contracted downhole geophysical measurements in 54 aircore holes drilled in the Larego area. The data from this study is still being evaluated and is not used for Mineral Resource estimation.

11.8.5 Density Estimation

Ore grades range from 28 to 38% A.Al2O3 for paired belt sample data (see Section 8.5.3.8) whereas test work densities range from 1.5 t/m³ to 3.2 t/m³, but the data is sparse and unreliable.

For resource estimation, each 0.5 m drill hole sample is assigned a dry in situ bulk density (DIBD) value based on the logged material type and the FTIR iron grade, using Senini's 1993 regression equation:

*Hardcap (caprock) = 2.19 + 0.0103*Fe*

Friable (other) = 2.00 (used for all non-Hardcap material)

If the sample is logged as comprising a mix of Hardcap and Friable, the assigned value for that 0.5 m interval represents a volume-weighted average. There is no differentiation between granitic and dolerite derived bauxite, due to the relatively small proportion of the latter (less than 15%).

In resource estimates prior to 2017 a moisture content of 9% was assumed and used to estimate wet tonnes. Since the implementation of 3D block modelling in 2018, densities are assigned after grade estimation, based on the regression equation and Fe grade of Hardcap, and using 2.0 t/m³ for all other material, weighted by the proportion of Hardcap or other material.

11.8.6 Reconciliation of Density

Alcoa uses comparisons between the As Mined tonnages and the sampling tower weightometers to apply adjustment factors to mine design estimates, scheduling and stockpile planning. Such adjustments are not applied directly to the Mineral Resource estimate as they vary locally.

Reconciliation of Huntly and Willowdale mined production (see discussion on density in Section 11.13) indicates that the density estimates are biased, with the long-term average As Mined tonnages being approximately 5% higher than the actual production measured on calibrated weightometers.

11.8.7 Density Conclusions

The density data is limited in coverage and there is significant uncertainty regarding the methodology used for some sampling programs. A simple regression algorithm is used to estimate the DIBD for Hardcap from the FTIR assays of Fe2O3. This does not account for voids or porosity, nor does it

differentiate between Hardcap derived from granitic or doleritic material. All other material is assigned a density of 2.0 t/m³. A constant moisture content of 9% is assumed for wet tonnages.

11.8.8 QP Opinion

In the QP's opinion the dry bulk density data is less well controlled than other analytes, but the long history of mining production and stockpile reconciliation means that the assumed values are adequate for resource estimation.

11.9 Resource Models

11.9.1 Polygonal

For each drill hole contained within a polygon, the samples located below the base of the overburden and above the geological floor are composited into a single interval. The following quantities are assigned to each polygon:

- Thickness = average length of contained composites
- Grade = length-weighted average grade of contained composites (density weighting is not applied)
- Density = average density of contained composites
- Volume = Polygon area by Thickness
- Tonnage = Volume by Density.

11.9.2 Gridded Seam Modelling

GSM employs 15 m by 15 m cells centered on the nominal drill hole locations. Separate seams are created for overburden, and for the interpreted Bauxite Zone (BXZ) between the overburden and the mining floor. BXZ is subdivided into separate seams where second and third mining cuts have been interpreted. Interpreted wireframe surfaces are used to assign a seam thickness to each cell (effectively the seam thickness of drill hole at the cell centroid).

Cell grade estimation used inverse distance weighting (IDW) techniques as follows:

- Hard boundaries, with each seam cell only estimated using nearby composite drill hole data within the corresponding seam
- IDW weighting factor of 1.2 for SI and 2 for all other variables
- 1 by 1 by 1 cell discretization
- Isotropic search distance of 180 m
- Minimum of 2 and maximum of 8 composites with a maximum of 2 composites per quadrant

Where drill holes are located at the centroid of cells the resulting cell grade estimates are essentially nearest neighbor estimates. In other words, the GSM outcomes are equivalent to 2D polygon estimates, with the usual constraint of that method, i.e. that the block variances are not smaller than the composite variances.

The GSM is constrained to the interpreted lateral extents of the mining zones. For each mining zone the following attributes are determined:

- Seam Thickness = average seam thickness of the contained GSM cells
- Grade – weighted average grade of contained cells (density weighting is not applied)
- Density = average density of contained cells
- Volume = mining zone area by Seam Thickness
- Tonnage = Volume by Density

11.9.3 3D Block Modelling

In 2019, Alcoa commenced preparing Mineral Resource estimates using 3DBM techniques, with the aim to progressively replace all Polygonal and GSM models. To date, Alcoa has prepared a total of 98 3DBM representing around 76% of the Mineral Resource and Mineral Reserves (MRMR) tonnage.

This section describes the current 3DBM procedures, which have evolved over time, with some parts now automated or semi-automated. Changes in the 3DBM procedures have generally been minor and are not considered material to the resulting resource models.

Block models are initially generated:

- using the ML1SA lease area grid
- with an origin that ensures that the majority of the drill holes are located nearer to the block corners rather than the centroids
- with a parent block size of 15 m by 15 m by 0.5 m and a sub-block size of 3 m by 3 m by 0.25 m (XYZ)
- flagged with a Domain (DOMAF) code based on the domain surface interpretations.

Block grade estimation:

- includes estimation of AL, SI, ST, FE, EO, PT, CO, SU, OX, BO, and AT
- is done by ordinary kriging (OK) for parent blocks, with parent grade estimates assigned to all sub-blocks within the parent block
- uses the same unfolding surfaces as used for variogram analysis
- hard boundaries between the bauxite domains (DOMAF 20, 30 and 40) started to be implemented in 2022. The previous block models were estimated using soft boundaries between the bauxite domains.
- uses a 3-pass search strategy for bauxite Domains and only one pass for the clay zone (parameters listed in Table 11-3), with:
    - the major and semi-major orientations in the unfolded horizontal plane
    - a minimum of 4 or 12 samples and a maximum of 27, with a maximum of 3 samples from any one drill hole. Thus, a minimum of 4 holes is required for Pass 3 and 2 holes for Passes 2 and 1
- uses the same variogram for all analytes

- DIBD (density) is not estimated into individual parent and sub blocks but is a post-estimation calculation based on the block domain compositions (see 11.8.5).

The OK estimation approach is designed to maintain correlations between analytes and assist in ensuring that estimation totals are consistent with the input drill hole data.

Table 11-3: Ordinary Kriging Search Parameters

Domain	Pass	Search Distance (m)			Number of Samples		
		Major	Semi-major	Minor	Min	Max	Max Per Hole
20, 30, 40	3	300	300	50	4	27	3
	2	100	100	20	4	27	3
	1	55	55	20	12	27	3
50	1	300	300	50	4	27	3

A set of wireframe solids representing the mining outlines are generated using a similar grade accumulation and threshold approach to those used for the GSM model, as shown in Figure 11. The sub-block model is then regularized to the parent block size (15 m by 15 m by 0.5 m), with blocks located within the mining solids flagged for reporting Mineral Resources. Block tonnages are factored to reflect the proportion of the block contained below the topographic surface and within the mining solid.

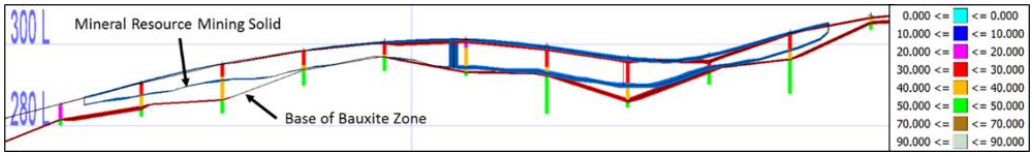


Figure 11-11: Example Section showing Bauxite Zone and Mining Solid (SLR, 2021)

Notes:

1. Vertical to horizontal exaggeration is 3:1
2. Drill holes colored by DOMAF variable

The QP summarized the information of 10 block models, showed in Table 11-4, where there is available the comparison between the estimation using soft and hard boundaries for the bauxite layer. In overall, the AL grades increased 7% and SI grades decreased 23%, and the tonnage is higher in most of the cases, reflecting the additional drilling.

Table 11-4: Tonnage and Grade Information Between the Original Resource Model and the 3D Block Model

Model	Original Resource Model			3DBM - Resource Model			Difference		
	Tonnage ('000 t)	A.Al2O3 (%)	R.SiO2 (%)	Tonnage ('000 t)	A.Al2O3 (%)	R.SiO2 (%)	Tonnage ('000 t)	A.Al2O3 (%)	R.SiO2 (%)

Model	Original Resource Model			3DBM - Resource Model			Difference		
	Tonnage ('000 t)	A.Al2O3 (%)	R.SiO2 (%)	Tonnage ('000 t)	A.Al2O3 (%)	R.SiO2 (%)	Tonnage ('000 t)	A.Al2O3 (%)	R.SiO2 (%)
Holyoake Central	25,211	31.97	1.94	25,919	34.12	1.23	3%	7%	-36%
Windsor	8,935	32.82	2.67	8,798	33.69	2.38	-2%	3%	-11%
Cooke	15,421	30.85	2.22	18,976	31.99	1.95	23%	4%	-12%
Serpentine	16,444	32.00	1.96	20,299	32.75	1.72	23%	2%	-12%
Gleneagle	26,333	31.58	1.67	35,144	34.69	1.14	33%	10%	-32%
Buckley	17,998	33.74	1.68	27,435	35.39	1.27	52%	5%	-24%
Cobiac	23,498	31.15	1.70	30,865	34.81	1.18	31%	12%	-31%
Frollett	12,556	30.07	1.68	18,587	33.59	1.31	48%	12%	-22%
Yarri	10,044	30.90	2.04	30,362	32.51	1.62	202%	5%	-20%
Millars	26,156	30.64	2.21	24,987	32.32	1.88	-4%	5%	-15%
Total	**182,596**	**31.55**	**1.93**	**241,372**	**33.71**	**1.48**	**32%**	**7%**	**-23%**

11.10 Block Model Validation

11.10.1 Polygonal and Gridded Seam Modelling

Alcoa uses a similar general approach to validate both the Polygonal and GSM resource models which includes:

1. Visual validation of cell estimated grades versus seam composited data
2. Comparison between composite and block model global statistics
3. Swath plots comparing cell grades against seam composite grades
4. Comparison between models when upgraded with new information.

Estimated cell grades were compared visually to the drill hole composite grades to ensure that the cell grade estimates appeared consistent with the drill hole seam composite data.

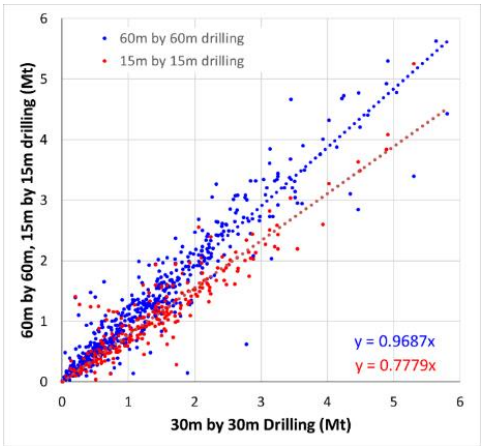
As GSMs were effectively nearest neighbor estimates, checks by SRK (2021a) on several GSM models indicated excellent global and local correlation between the estimated cell grades and the input seam composite grades.

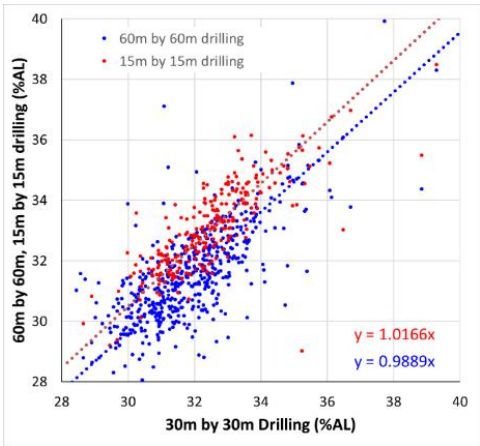
The QP undertook some independent checks on datasets and GSMs for the F54 and F55 blocks to confirm that the modelling procedures had performed as intended. Results were consistent with those observed by SRK (2021a) and no material issues were noted.

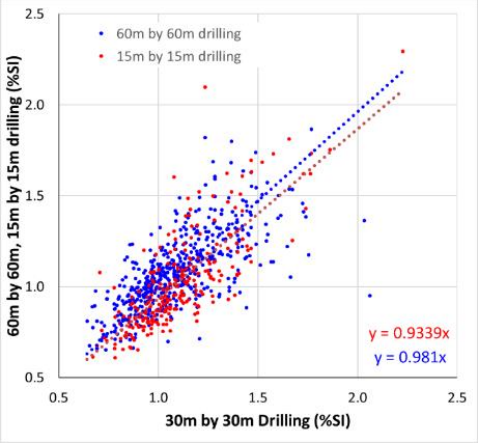
Polygonal resource models were updated by Alcoa when drill hole data is infilled from 60 m and 30 m spacings, and then GSM models were previously produced by Alcoa after 15 m infill drilling (3DBM models are now produced routinely at this stage). Changes in tonnages and average grades (AL, SI, OX) are presented as scatterplots in Figure 11-11 for map sheets at Huntly where such infill drilling has occurred. It is noted that:

- material differences in tonnages are evident for individual map sheets, represented by the scatter around the 45º line in the top left-hand plot in Figure 11-11
- globally, there is only a 3% change in resource tonnage when infilling from 60 m to 30 m, but a 22% drop in tonnage when the deposit is further infilled to 15 m drill centers. The latter is mainly due to a change in the geological interpretation from a geological to a mining floor
- decreasing the drill spacings from 60 m to 15 m results in an average reduction in SI of 10%, an increase in OX of 5%, but little change to AL. These grade changes are likely due to the preferential loss of deeper DOMAF 40 material that is high-in SI and low in OX when mining constraints are considered (see Figure 11-10)
- similar grade-tonnage relationships related to infill drilling were noted at Willowdale by SLR.

Applying a global correction factor to Polygonal resource model tonnages generated from 30 m and 60 m spaced drill hole datasets is not considered appropriate as local differences are highly variable and not considered to be predictable, as shown by the red dots in the top left-hand plot in Figure 11-12.







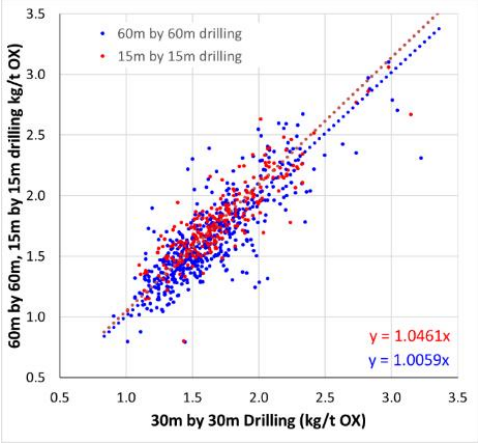


Figure 11-12: Resource Comparison Scatterplots for Huntly (Tonnage, AL, SI, OX) (SLR, 2021)

11.10.2 3D Block Modelling

Model validation checks by Alcoa include:

1. Volume checks between the geological interpretation solids and sub-block model
2. Visual validation of block model coding and estimated grades versus composite data
3. Comparison between composite and block model global statistics
4. Swath plots comparing block grades against composite grades.

SLR undertook some independent checks on datasets and block models for Serpentine and Millars and obtained results that were consistent with those provided by Alcoa. Example screen captures of coded block models and AL and SI block estimates are shown in Figure 11-13.

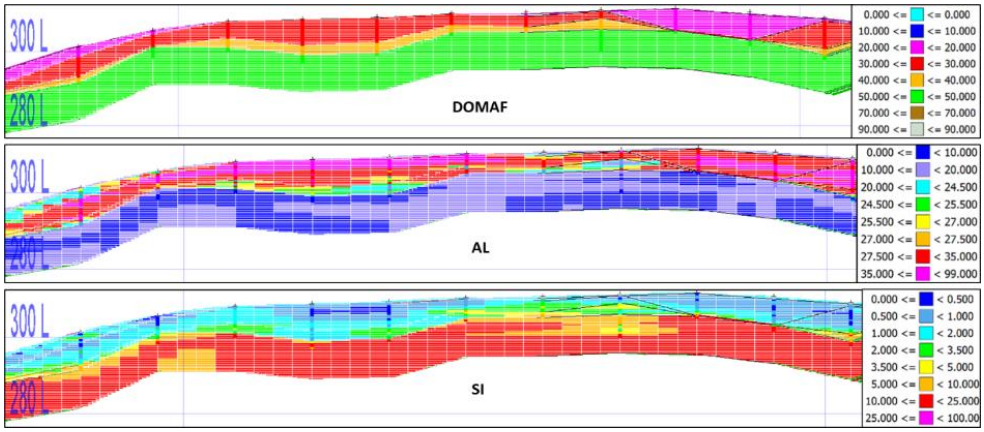


Figure 11-13: Example Sections showing DOMAF, AL, and SI Block Estimates (SLR, 2021)
3:1 vertical to horizontal exaggeration

Most global checks indicate generally good correlation between the estimated model grades and the input composite grades. However, Domain swath plots suggest that the use of a single unfolding surface and soft boundaries for the Bauxite Zone (DOMAF 20, 30, and 40) has led to grade smoothing. For example, Figure 11-14 indicates overestimation of DOMAF 20 and 40 for AL, and underestimation for DOMAF 30. As Alcoa generally mines the majority of the bauxite profile this issue is not considered material and any estimated bauxite that is left behind would likely be DOMAF 40 (low-grade bauxite). Consequently, the impact of grade smoothing for AL would introduce some conservatism into the model. Bauxite Zone block estimates could be improved by unfolding each Domain independently and using semi-soft boundaries.

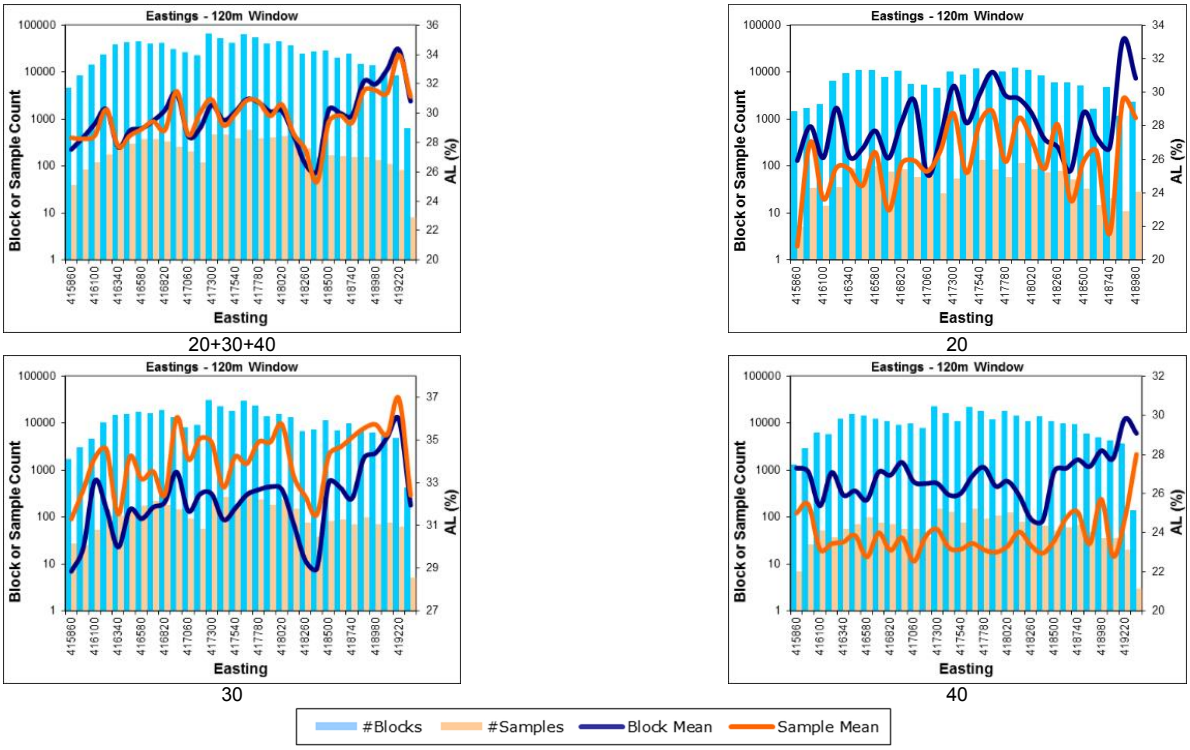


Figure 11-14: AL Swath Plots by DOMAF at Serpentine (SLR, 2021)

As discussed previously, the inequality constraint AL ≤ AT and SI ≤ ST was not met for all blocks due to:

- the inequality constraints not being honored in the input data
- incomplete assaying of AT and ST.

Scatterplots for some key analytes were spot checked by SLR to ensure that correlations identified for composite data were maintained during block grade estimation. In most instances there was good reproduction of the correlations during the change in support from 0.5 m composites to 15 m by 15 m by 0.5 m blocks. However, there were commonly artefacts related to a small number of blocks that were generally located in the periphery of the deposit. These are shown as vertical lines in Figure 11.

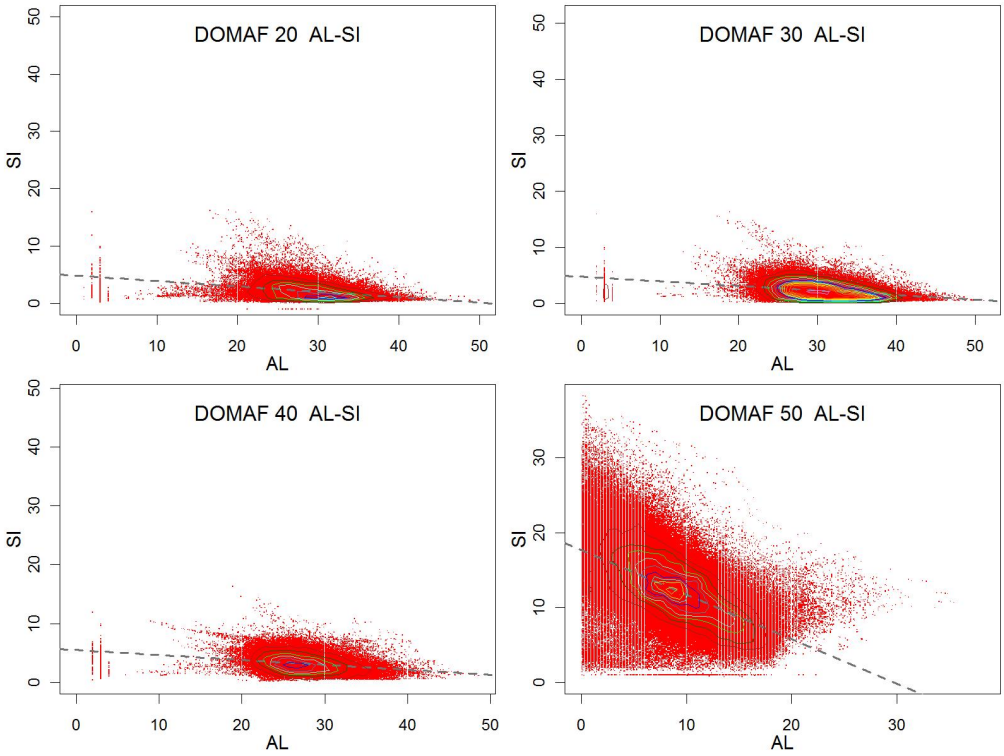


Figure 11-15: Scatterplots of AL versus SI by DOMAF at Serpentine (SLR, 2021)

A discrete Gaussian (DG) change-of-support check is appropriate to assess smoothing in resource estimation models. A range of variance reduction F factors from 0.20 through to 0.7 in 0.1 increments were also chosen to represent the results that may be achieved through various mining selectivities. Higher F values result in grade-tonnage distributions that could be achieved through more selective mining and high-quality grade control practices. Conversely, lower F values result in grade-tonnage distributions that would result from less selective mining and/or poorer-quality grade control practices.

The DG approach was used by SLR to determine the theoretical AL grade-tonnage curves for the Bauxite Zone at Serpentine by considering various F factors for the 0.5 m composite data (Figure 11-16). This Figure also shows the actual grade-tonnage curve for the Serpentine 3DBM resource model. The resource model tonnage curves are consistent with the F=0.4 DG curves for all cut-offs likely to be considered at Serpentine for open pit mining. This provides further support that any grade smoothing present in the Serpentine model is unlikely to be material to the Mineral Resource estimate.

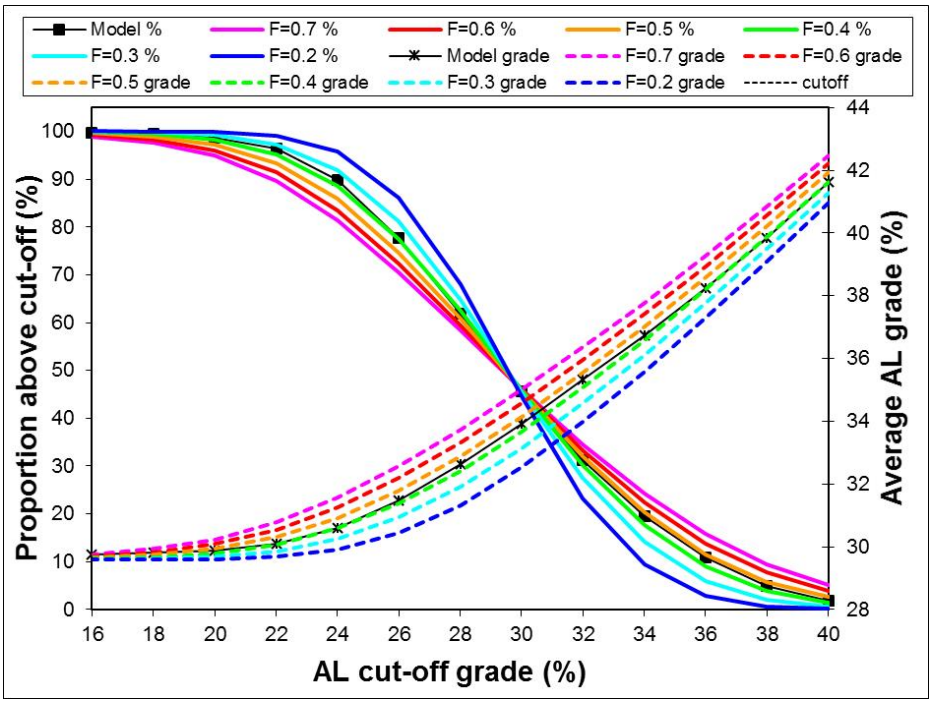


Figure 11-16: AL Grade-tonnage DG Curves versus Serpentine Block Model

11.11 Cut-off Grade and Mining Constraints

Darling Range uses a historically accepted economic Mineral Resource cut-off grade of ≥27.5% A.Al_2O_3, ≤3.5% R.SiO_2, and ≤4kg/t OX, that is implicit in the delineation of the bauxite layer in the geological modelling stage. A minimum thickness of 2 m is also used to improve the Mineral Resource definition.

In addition to the geological modelling cut-offs criteria, the constraints described below are applied to the GSM and 3DBM Mineral Resource definition:

- a minimum area of 1 ha.
- a minimum face height of 1.5 m (distance from mining floor to the base of overburden).
- face heights exceeding 4 m are treated as multiple benches.
- an overburden to face height ratio ≤1.
- a maximum floor gradient of 1 in 7 over a minimum of 15 m for the first cut, and 1 in 5 for second and third cuts.
- a minimum access corridor of 45 m for mining equipment.

However, bauxite resources can include material outside the geological modelling grade cut-offs that may also be considered as mineable, and a cut-off depth basis is used when A.Al_2O_3 grade is lower to define whether or not a block is economic. Mineral Resources have been estimated using a LOM price of

$21/t representing an average arms-length sale of bauxite from Darling Range. The price that constrains the estimate for optimization was discounted to exclude export logistics costs, i.e. the base price was $21/t, and the discounted price was $16/t.

The grade cut-off criteria to report the Mineral Resources is a common approach to the bauxite mines, and the QP is of the opinion that to improve the recoverable resources reporting, a reblocked block model to a minimum practical mining scale or single mining unit should be considered. Economical parameters considering more flexible costs and bauxite prices related to the Mineral Reserves can also be implemented in the Mineral Resources workflow, aiming to optimize the bauxite mineable portion including potential marginal grades.

11.12 Reconciliation

11.12.1 Sampling Tower Data

Refinery feed grade is monitored for the Huntly and Willowdale mining regions using material collected just prior to the stockpile stackers at the Pinjarra and Wagerup sampling towers respectively.

Alcoa mine planning personnel rely upon historical comparisons between the As Mined estimates and the sampling tower data to apply adjustment factors to mine design estimates, to assist with scheduling and stockpile planning activities. The adjustments are not applied to the reported global Mineral Resource estimates as they are considered to be local factors.

Sampling tower performance was discussed in SLR, 2022.

11.12.2 Resource to Sampling Tower Comparison

Alcoa reconciles the resource (mine design) estimates with the sampling tower estimates once mining is completed for each mining zone. It is important to note that the majority of the Mineral Resources are prepared using 30 m or 60 m spaced data, whereas As Mined to sampling tower reconciliation is based on mine planning models constructed from 15 m spaced data that include additional mining constraints.

Figure 11-16 and Figure 11-17 show the annual relative grade differences for both Huntly and Willowdale respectively. These plots indicate:

- A clear reactive silica trend from higher differences (above 20%) to lower differences (around 10%) from 2011 to 2021 and 2011.
- The most variable pattern of reactive silica compared with the other elements.
- That most As Mined grades are currently within 10% of the sample grades.

The sources of the reconciliation differences shown in Figure 11-17 and Figure 11-18 are not known, but the following factors could contribute:

- Resource models were prepared using FTIR assay data, whereas the sampling tower samples are assayed using the same techniques as the REF Method (see Table 81 in 8.3.2.1) but with BD rather than MD. Alcoa assumes that this is more accurate, but that is difficult to confirm for partial digestion methods such as AL, SI, and OX.
- Changes in the resource modelling procedures from Polygonal, to GSM, to 3DBM. The latter method has only recently been introduced and represents limited material processed in recent years.

- The As Mined grades and tonnages could include some additional dilution and ore loss relative to the planned mine design.
- Differences between the Pinjarra (inspected and validated by SLR, see Section 8.5.3.8) and Wagerup sampling towers.

Incremental reconciliation improvements appear to have commenced around 2010, which may reflect an improvement in data quality (drilling and assaying procedures) around this time. Consequently, Mineral Resources using data collected prior to approximately 2010 are considered to be of lower confidence and the classification of resource models constructed from this data has been downgraded accordingly.

Reconciliation data in recent years falls within acceptable limits on an annual basis to support the classifications used for reporting of Alcoa's Darling Range Mineral Resource.

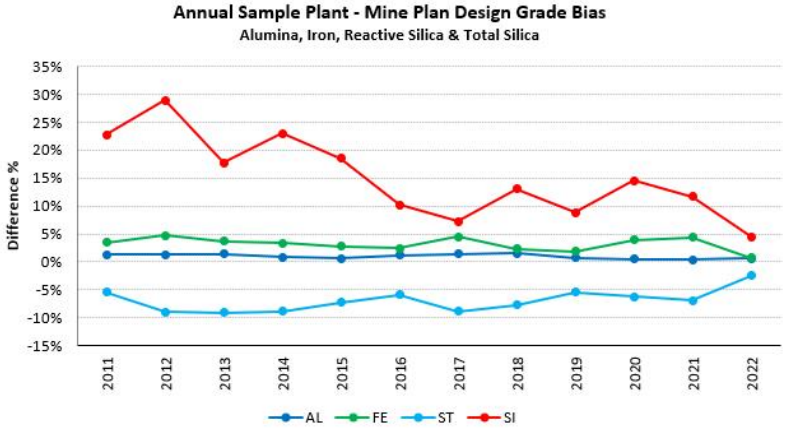


Figure 11-17: Resource versus Sample Plant Reconciliation – Huntly (SLR, 2022)

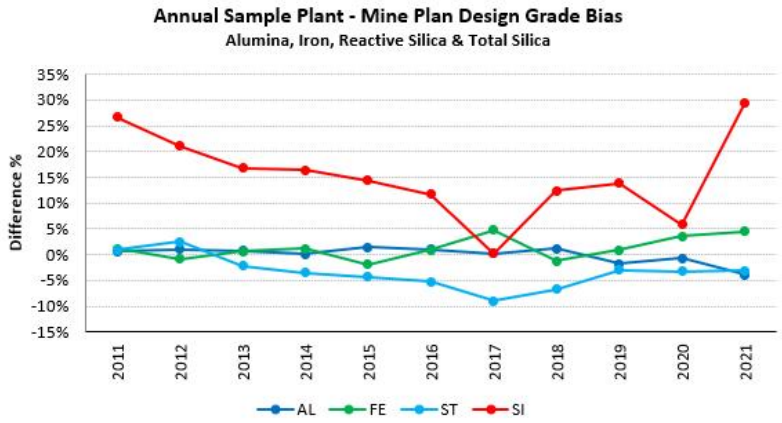


Figure 11-18: Resource versus Sample Plant Reconciliation – Willowdale (SLR, 2022)

11.13 Mineral Resource Estimation Risk

The estimation of Mineral Resources for any commodity, including bauxite, is subject to significant risks, including those described below and elsewhere in the discussion of risks associated with mining and processing of bauxite to produce alumina (see Section 12.8). An investor should carefully consider these risks. If any of the described risks occur, the Darling Range bauxite mining and processing business, financial position and operational results could be materially affected adversely.

The purpose of Technical Report Summaries issued under S-K 1300 and other similarly purposed International Codes (JORC, 2012; NI 43-101, 2014) is to ensure that known risks are disclosed by the QP subject to expectations of Transparency, Materiality and Competency. This Technical Report Summary addresses the technical risks associated with the Geology, Sampling, Assaying, Data Management in Sections 6.0 to 9.0 and Mineral Resource Estimation in Section 11.0. The QP considers that no material technical risks are identified in those Sections.

The risks described below are not comprehensive and there may be additional risks and uncertainties not presently known, for example due to market or technology changes, that are currently deemed immaterial but may also affect the business. The QP considers that the following risks specifically pertain to the Mineral Resources declared for Alcoa's Darling Rang operations.

11.13.1 Specific Identified Risks

- Continuous improvement of all aspects of Alcoa's resource delineation programs means that, changes have been incremental as refinement to previous procedures. Thus, estimates for the majority of the Mineral Resources are essentially variants of those devised in the late 1980s and early 1990s and are not consistent with current conventional practices. This is reflected in the large tonnage of Inferred Resources declared. The demonstrated successful operation of the Alcoa operations over an extended period indicates that it is unlikely that any aspects of the data collection and resource delineation process are significantly flawed, although there are recognized shortcomings.

- Drill sampling is essentially the extraction of small volumes of material taken to be representative of the large tonnages being estimated. There are always local errors of precision and may be bias that is not recognized. Robust sample preparation and geostatistical estimation are used to identify and overcome these errors, backed up by closed-loop reconciliation with the stockpile tower samplers. These systems may not identify changes in the underlying geology or other data as the area to be delineated expands over time.

- The Mineral Resource estimates may not contain adequate or relevant data if the bauxite is supplied to other refineries, or if processing methods change, or some new analyte is required.

- The older ResTag and GSM estimation procedures, which represent the bulk of the Inferred Mineral Resources, are relatively inflexible, and may not contain the level of detail necessary to adequately support mining optimization studies. This has been largely addressed by the recent move to 3DBM resource estimation techniques, which more easily enable the preparation of models that contain sufficient resolution and detail to support conventional mining optimization studies. These models will allow incremental improvements to address any challenges in meeting target grade specification, resolving reconciliation issues, or tailoring the estimation

parameters and procedures to prepare models that better reflect local changes in mineralization characteristics. The 3DBM modelling procedures offer more flexibility in moderating any adverse effects of sampling imprecision compared to the older procedures and in producing grade tonnage curves to meet various impurity constraints (when modelled).

- Further advances in geostatistical estimation may be expected including more use of directional anisotropy (through variograms), and conditional simulation to quantify estimation risk and optimize drill sampling grids.

- A comprehensive program is required to resolve the issue of density estimation. Estimates in the resource models use a simplistic linear regression algorithm for iron rich material based on very few data, and otherwise assumed values. This deficiency is overcome by reconciliation of tonnages of material fed to stockpiles and the subsequent adoption of a downgrading factor (currently 5%) to account for differences to the model estimated density. Technology now becoming available, including volume surveys using drones and truck gantry scanning, wet mass measurement using weightometers on conveyors and LoadRite sensors on mining equipment, and infra-red moisture determination, mean that better *in situ* dry density estimation may become possible if the operation requires it for better refinery feedstock control.

- The grade characteristics of the bauxite profile could be reproduced in the model, enabling optimization techniques to be used for the definition of mining floors and boundaries, better support for ore loss and dilution studies, and more accurate reconciliation studies.

- There is currently significant reliance upon the sample plant results for production scheduling and blending, as well as for assessing the reliability of the Mineral Resource estimates.

The current drill sampling methods have been improved over time, based on independent review, and the requirements for minimum impact on the Darling Range. The assaying methods, including the use of FTIR, have been comprehensively reviewed and validated. The geostatistical estimates of in situ dry tonnages and grades are reasonable and validated by comprehensive reconciliation. The SLR QP considers that these methods are appropriate to produce the declared Mineral Resources and Mineral Reserves.

11.13.2 Generic Mineral Resource Uncertainty

- Estimates of Measured and Indicated Mineral Resources are uncertain. The volume and grade of ore actually defined from these as Mineral Reserves is not predictable until mine planning is done to account for all the identified Modifying Factors. Forecasts based on the current transfer price of bauxite, current interpretations of geological data obtained from drill holes, and other information regarding the Modifying Factors, may not necessarily be indicative of future results. A significantly lower bauxite transfer price as a result of a decrease in aluminum prices, increases in operating costs, reductions in metallurgical recovery, or other changes to the Modifying Factors, could result in material write-downs of the value of the Darling Range mines.

- Should changes be required due to exigent circumstances, it may take some years from exploration until commencement of production, during which time the economic feasibility of production may change.

- Alcoa cannot be certain that any part or parts of a deposit or Mineral Resource estimate will ever be confirmed or converted into Regulation S-K Subpart 1300 compliant Mineral Reserves or that mineralization can in the future be economically or legally extracted.

To ameliorate such risks the Mineral Reserves declaration is limited to material for which extraction is currently planned within the next ten-year planning cycle. The Mineral Resources excluding Mineral Reserves indicate the likely potential beyond that time frame, given all the limitations on future knowledge outlined above.

11.14 Classification

11.14.1 Consideration of Classification by the QP

Definitions for resource categories used in this report are those defined by the SEC in S-K 1300. Mineral Resources are classified into Measured, Indicated, and Inferred categories.

Mineral Resource classifications have been applied to the various resource models based on consideration of the quality and quantity of the input data, confidence in the geological interpretation, and confidence in the outcomes from the various estimation methods. Factors that impact the Mineral Resource classifications are summarized below.

- Sampling: Alcoa has introduced incremental improvements to their drilling, sampling, sample preparation and assaying procedures since 2015. The sample collection procedures are efficient and optimized to routinely produce large numbers of drill samples and assays consistently that are considered to be fit for purpose.
- Sample preparation: routine sample preparation using a robotic facility which routinely provides an appropriate grind size for samples.
- Assays: the FTIR spectral method is routinely used for all analytes, calibrated and validated with wet chemical Reference Method samples at a frequency of 1:100. The QP has investigated this procedure and considers that appropriate assays and controls are used for the purpose of Public Reporting of a Mineral Resource estimate.
- QA/QC: Quality assurance and quality control procedures have been incrementally improved since 2015. Further systematic refinements of these are expected to enable more data to be routinely collected, but the accuracy and precision demonstrated in Sections 8.5.2 and 8.5.3 respectively are not expected to change.
- Density data: The dry *in situ* bulk density test work data is sparse and not appropriate for the reliable estimation of tonnages. Based on test work from 1992 a simple algorithm using the Fe_2O_3 grade for Caprock and an assumed value of 2.0 t/m³ for all other ore fed to the refineries has been used. Reconciliations have determined a consistent overestimation of 5%, and a moisture content of 9% provide reliable predicted tonnage estimates over an extended period of operation. In the opinion of the QP the variable nature of the bauxite, especially the porosity, means that any alternative sampling method is unlikely to produce better estimates. Accordingly, the density values applied are not considered a limiting factor for resource classification.
- Drill spacing: Drill hole spacings in the Darling Range vary from 15 m by 15 m up to 120 m by 120 m, with Mineral Resources only declared where drill hole spacings are ≤60 m by 60 m.
- Geological interpretation: The regional geology of the Darling Range project is well understood with bauxite mineralization supporting mining and processing operations since the 1960s. Controls on the mineralization and the mineralogical and physical properties of the Bauxite Zone

are well understood and have been adequately incorporated into the Mineral Resource modelling procedures.

- Grade continuity: Grade and lithological continuity studies are routinely conducted by Alcoa for the 3D block models. Variography studies conducted by Alcoa were supported by independent review (Xstract, 2016; SRK 2021a) and indicate that grade and lithological continuity can be demonstrated at the drill spacings supporting the Mineral Resource classification.

- Grade estimation: 64% exclusive Mineral Resource has been defined using polygonal techniques that can be prone to estimation bias. Consequently, irrespective of the drill hole spacing all estimates based on the Polygonal Method are considered to be of low confidence for local estimates and have been downgraded relative to 3DBM estimates. GSMs are only constructed using 15 m by 15 m spaced drill hole data, and although previously used to support Measured Mineral Resources, has been replaced by the 3DBM method, which as implemented by Alcoa aligns with industry best practice.

- Reconciliation data: Annual reconciliation between mined ore based on the Mineral Resource estimates and received material on the refinery stockpiles (sampled by the sampling towers) show relative differences for both Huntly and Willowdale of within ± 15% for tonnes and all analytes (except SI) since 2010. Reconciliation performance prior to 2010 for some analytes exceeded ± 15%, casting doubt on the reliability of some data and models prior to that date. It is not possible to reconcile blended production data to individual resource models.

- Production history: The integrated bauxite mining and alumina refining is based on appropriate data to ensure long-term supply and short-term management of the ore feed to the mine mouth refineries. The long production history demonstrates effective prediction and control of refinery performance.

The QP considers the primary controlling factors for the classification of the Mineral Resource estimates for the Darling Range Bauxite to be drill hole sample spacing, the quality of data collected, and the resource modelling technique. A 5% tonnage reduction factor is used in the reporting of Mineral Resource tonnages to account for the consistent annual reconciliation outcomes.

11.14.2 Methodology

The primary consideration for classification is confidence in the resource estimate. The Mineral Resource estimate for Darling Range is produced by aggregating many different models, produced using data of different qualities at different drilling densities, modelled using different estimation procedures.

A drill hole spacing study aimed at quantifying the differences in the reliability of local estimates with different drill spacings was undertaken by SRK (2019a) using a similar approach to Alcoa's 3DBM procedures. The SRK study concluded that drill spacings of 30 m by 30 m and 60 m by 60 m were adequate to support the delineation of Measured and Indicated Resources respectively, provided that none of the other limiting factors discussed above were applicable.

The QP considers, on the basis of the previously discussed acceptable sampling and assaying quality, that this drill hole spacing study and other knowledge justifies:

- The classification of Measured where such data is on a 30 by 30 m grid. However where the estimation method is gridded seam modelling (GSM) rather than current industry standard 3D block modelling (3DBM) the Measured material is downgraded to Indicated, unless it is on a tighter drilling grid of 15 by 15 m. The additional data density overcomes any deficiency of the

GSM method. Some of the defined Measured material estimated using a significant amount of older (pre-2010) drill sampling was also downgraded to Indicated, reflecting the lower confidence in that older drilling data, since data quality (due to drilling, sampling and assaying procedures) has been upgraded since then.

- Furthermore, based on the same principles (data quality, drilling study, estimation procedures), 60 by 60 m drilling and 3DBM estimation is the basis for classification as Indicated. Estimation using the GSM or Polygonal method was allowed as Indicated where the drill spacing was on a tighter grid of at most 30 by 30 m. The additional data density is considered to overcome the similar deficiency of both these estimation methods, which because of the data configuration are similar to a nearest neighbor estimate.

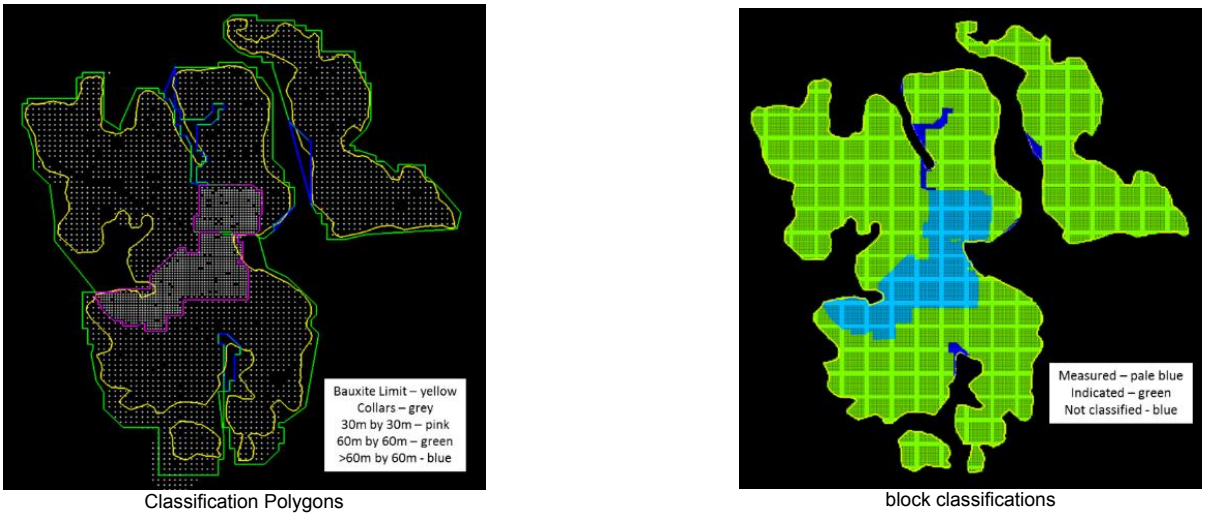
- All Measured and Indicated material already has mining constraints applied, effectively ensuring that reasonable prospects for economic extraction are assured should other required economic viability constraints obtain.

- Where the data spacing is 60 by 60 m and the estimation method is Polygonal the resource estimate is classed as Inferred.

There is a large tonnage estimated of Inferred Resources, partly due to the sufficiency of the current Proven and Probable Mineral Reserves for the ten year mine planning horizon and the immediate availability of additional Measured and Indicated Mineral Resources (reported exclusive of Reserves) to replace them. Further Measured and Indicated Resources may be defined when required from the established Inferred Resource in time, given more closely spaced drilling, estimation using 3DBM techniques, and the further application of cut-off grade and mining criteria.

Resource classification criteria are applied in the horizontal plane and so are consistent for the entire Bauxite Zone vertical profile. Thus, interpretation of the roof and floor of the Bauxite Zone are implicitly assumed to be of similar confidence. In some areas the geological floor may be erratic for Polygonal models and of lower confidence than the roof, but these areas are typically excluded when mining constraints are applied to the GSM and 3DBM resource models.

An example of the resource classification approach is shown in Figure 11-19. Resource classification polygons are created for areas of 15 m, 30 m, 60 m and >60 m parts of the deposit. Note that these polygons can include small areas where the gaps between drill holes are at the next spacing increment. These polygons are then used to assign resource classifications for the full vertical profile of the Bauxite Zone.



Classification Polygons

block classifications

Figure 11-19: Plan View of Resource Classification (SLR, 2021)

11.14.3 Application of Classification Criteria by the QP

The following classification criteria have been applied to the Mineral Resource estimates:

- **Measured Resources** - areas estimated using:
  - 15 m by 15 m drill data and GSM or 3DBM estimation procedures; and
  - 30 m by 30 m drill data and 3DBM estimation procedures.
- **Indicated Resources** - areas estimated using
  - 30 m by 30 m drill data and estimated using GSM, or Polygonal procedures;
  - 60 m by 60 m drill data and estimated using 3DBM procedures; or
  - meeting the Measured criteria but estimated using a significant amount of pre-2010 drilling data.
- **Inferred Resources** - areas estimated using:
  - 60 m by 60 m drill data and estimated using Polygonal procedures.

11.15 Mineral Resource Reporting

Key refinery target grade requirements for AL, SI, and OX along with practical mining considerations have been taken into account when defining resource blocks using GSM and 3DBM modelling methods. Polygonal resource models do not account for mining constraints other than a 1.5 m minimum thickness.

ML1SA contains some sub-regions for which mining permission has not been granted, due to forestry, environmental, social or other constraints, and Mineral Resources have not been defined in these areas by constraining the Mineral Resource model using the ArcGIS system.

For Mineral Resource reporting, the block tonnage estimates have all been reduced by 5% on the basis that:

- the reconciliation data at both Huntly and Willowdale indicate that the As Mined tonnage estimates over the past 20 years have been consistently higher than the stockpile received tonnages after the sampling tower by approximately 5%; and
- the stockpile estimates are derived from weightometer readings, and the weightometers are regularly checked and calibrated.

11.15.1 Mineral Resource Estimation

A summary of the Mineral Resource estimates (exclusive of Mineral Reserves) for the three ML1SA mining regions is shown below.

Table 11-5: Summary of Darling Range Mineral Resources exclusive of Mineral Reserves by Mining Region – 31st December 2022

Category	Mine	Tonnage (Mt)	A.Al2O3 (%)	R.SiO2 (%)
Measured	Huntly	26.2	30.48	1.19
	North	0.0	0.00	0.00
	Willowdale	18.7	32.15	1.09
	Sub-total	**44.9**	**31.17**	**1.15**
Indicated	Huntly	44.4	31.59	1.16
	North	0.8	32.26	1.38
	Willowdale	6.6	29.95	1.25
	Sub-total	**51.8**	**31.40**	**1.17**
Measured + Indicated	**Huntly**	**70.6**	**31.18**	**1.17**
	North	**0.8**	**32.26**	**1.38**
	Willowdale	**25.2**	**31.58**	**1.13**
	Sub-total	**96.7**	**31.29**	**1.16**
Inferred	Huntly	44.5	34.74	1.39
	North	15.1	31.62	1.00
	Willowdale	80.6	32.17	1.24
	Sub-total	**140.3**	**32.93**	**1.26**

Notes:

1. The definitions for Mineral Resources in S-K 1300 were followed, which are consistent with JORC (2012) definitions
2. Mineral Resources are 100% attributable to AWAC
3. Mineral Resources are estimated at a geological cut-off grade, which generally approximates to nominal cut-off grades of 27.5% A.Al2O3 with less than 3.5% R.SiO2. Locally the cut-off grade may vary, dependent on operating costs and ore quality for blending. The target grade for mine planning is 32.7% available aluminum oxide (A.Al2O3) and 1.0% reactive silica (R.SiO2)
4. Mineral Resources have been estimated using a bauxite transfer price of USD16/t, as described in Section 11.11.
5. A minimum total mining thickness of 1.5 m was used
6. *In situ* dry bulk density is variable and is defined for each block in the Mineral Resource model
7. A global downwards adjustment of tonnes by 5% is made to account for density differences based on historic mining performance
8. Mineral Resources are reported exclusive of Mineral Reserves

9. The reference point for the Mineral Resource is the *in situ* predicted dry tonnage and grade of material to be delivered to the refinery stockpile following the application of mining design parameters
10. Metallurgical recovery has not been directly considered in the estimation of Mineral Resources as the Darling Range operations do not include a conventional processing plant, only crushing as described in Section 14.0. The metallurgical recovery of the three refineries (Kwinana, Pinjarra and Wagerup) are beyond the boundaries of the mining operations being the subject of the TRS.
11. Numbers may not add due to rounding.

Compared with December 31, 2021, the Measured and Indicated Mineral Resources (exclusive of Mineral Reserves) increased 17%, from 82.8 Mt, and the Inferred Mineral Resources decreased 56%, from 320 Mt. Changes from 2021 are due to the migration from polygonal and GSM models to the 3D block models, which upgraded the Resources category from Inferred to Measured and Indicated, and consequently it was converted to Reserves by the mine planning work. The A.Al2O3 average grade decreased 4% to the Measured and Indicated Resources and had a slight decrease for the Inferred Resource. R.SiO2 increased 4% and 5% in the Measured and Indicated Resources, and in the Inferred Resource, respectively.

11.16 QP Opinion

In the opinion of the QP the Mineral Resource classification scheme adopted by Alcoa and accepted by the QP is appropriate in defining expected relative confidence of the Mineral Resource in compliance with the S-K 1300 definitions as follows:

- All sampling, sampling preparation, assaying and database management practices are compliant with current industry good practice and no fatal flaws were identified for all material classed as Mineral Resource
- Appropriate industry good practice geological modelling techniques and variography are used to establish geological and grade continuity from appropriately spaced drill holes
- Industry standard estimation techniques (3D block modelling or seam block modelling) are used for all Measured and Indicated Mineral Resources using appropriate drill spacings
- Appropriate drill spacings, grade continuity and geological continuity are used to define higher confidence material as Measured Mineral Resource.

In the QP's opinion the modelling work completed to date is appropriate for purpose, and that following consideration of various technical and economic factors the conditions of Reasonable Prospects For Economic Extraction are met, including in particular through constraining the Mineral Resource model using the ArcGIS system, by ensuring that the model defines key parameters for the refinery, and by sound reconciliation practices reincorporating feedback into the geological model.

12.0 MINERAL RESERVE ESTIMATES

12.1 Summary

A Mineral Reserve has been estimated for Alcoa's Darling Range bauxite mining operations in accordance SEC S-K 1300 definitions which are consistent with the guidelines of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Mineral Reserves (The JORC 2012 Code).

The QP inspected the Alcoa Huntly operations on October 28th, 2022 and Willowdale on November 1st, 2022. Alcoa's Mine Planning department was visited November 2nd, 2022, interviewing relevant personnel on these dates and on other occasions. A full account of the site visit to the mines, offices and the refineries is provided in Section 2.1.

The Mineral Reserve is classified with reference to the classification of the underlying Mineral Resource and with reference to confidence in the informing Modifying Factors. The QP considers the Proven and Probable classification to be appropriate to the deposit and associated mining operations.

The reference point for the Mineral Reserve is prior to the processing plant at the refinery.

The Proven Mineral Reserve is a subset of Measured Resources only. The Proven Mineral Reserve is within a current mining region and is included in the Ten-Year Mine Plan.

The Probable Mineral Reserve is estimated from that part of the Mineral Resource that has been classified as Indicated or from Measured Resources that are outside the current mining regions.

Variable cut-off grades are applied in estimation of the Mineral Reserves, and these are related to operating cost and the nature of the Mineral Resource in relation to blending requirements. The Mineral Reserve estimate is expressed in relation to available aluminum oxide (A.Al2O3) and reactive silica (R.SiO2), this being the critical contaminant in relation to the Refinery.

Table 12-1: Summary of Darling Range Mineral Reserves – Effective 31st December 2022

Region	Class	Tonnage (Mt)	A.Al2O3 (%)	R.SiO2 (%)
Huntly	Proven	71.2	30.0	1.36
	Probable	180.3	32.4	1.20
	Total	251.5	31.7	1.25
Willowdale	Proven	74.7	32.7	0.98
	Probable	75.4	32.5	1.02
	Total	150.1	32.6	1.00
Total	Proven	145.8	31.4	1.17
	Probable	255.8	32.4	1.15
	Total	401.6	32.1	1.15

Notes:

1. The definitions for Mineral Reserves in S-K 1300 were followed, which are consistent with JORC definitions.
2. Mineral Reserves are stated on a 100% ownership basis for AWAC although Alcoa Corporation's share is 60%.

3. Mineral Reserves are estimated at variable cut-off grades, dependent on operating costs and ore quality for blending. The target grade for mine planning is generally 32.7% available aluminum oxide (A.Al2O3) and around 1.0% reactive silica (R.SiO2) but this may vary locally.
4. Mineral Reserves have been estimated using a LOM price of $21/t representing an average arms-length sale of bauxite from Darling Range. The price that constrains the estimate for optimization was discounted to exclude export logistics costs, i.e. the base price was $21/t, and the discounted price was $16/t.
5. Minimum mining widths are not used due to the surficial nature of the Mineral Resource, rather a minimum mining block size of 15m by 15m by 1m deep is applied.
6. The reference point for the Mineral Reserve is the refinery processing plant gate, with crushing, washing (as applicable), and transportation being the only process employed. As such metallurgical recovery factors are not applicable to the Mineral Reserve estimate.
7. Bulk density is variable, dependent on the nature of the Mineral Resource and is separately estimated in the Mineral Resource model.
8. Numbers may not add due to rounding.

The QP is not aware of any risk factors associated with, or changes to, any aspects of the Modifying Factors such as mining, metallurgical, infrastructure, permitting, or other relevant factors that could materially affect the Mineral Reserve estimate.

The QP considers that the accuracy and confidence in the Mineral Reserve estimate to be appropriate for the classification applied, which is supported by both the conservative operational processes and the long operational history.

The Modifying Factors are summarized as follows:

- Only Measured and Indicated Mineral Resources are considered.
- Only mineralization defined in mine planning work has been considered. This includes Measured and Indicated material, subject to the application of mining Modifying Factors.
- Mineral Resources not scheduled for mining in the current Ten-Year Mine Plan are not considered.
- Indicated Mineral Resources are classified as Probable Mineral Reserves, subject to the Modifying Factors and mine scheduling constraints.
- Measured Mineral Resources are classified as Proven Mineral Reserves or Probable Mineral Reserves, subject to the Modifying Factors and mine scheduling constraints.

12.2 Modifying Factors

A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by application of Modifying Factors that demonstrate that, at the time of reporting, extraction could reasonably be justified.

- Mining – Alcoa's Darling Range mining operations are conventional open pit mines and have been operating for a long time. The practicalities of mining and associated sustaining capital and operating costs are well understood and have been incorporated in Alcoa's technical assessments to the satisfaction of the QP. For a more substantive description of Alcoa's Darling Range mining operations, refer to Section 13.0. The mining schedule is discussed further in Section 12.5.

- Processing – This Mineral Reserve is stated with reference to the refinery processing plant gate, with crushing and conveying being the sole processes employed. Bauxite is refined to alumina in the refinery using the Bayer process, which has been employed at the Darling Range operations for many years and a transfer price is used by Alcoa in its assessment of its mining operations. The QP is satisfied that the transfer price reasonably incorporates the costs associated with processing of the bauxite ore. For a more substantive description of Alcoa's Darling Range processing operations, refer to Section 14.0.

- Metallurgy – The mining operations are given an ore specification by the sole customers, the refineries. Blending is undertaken at the pit, before the crusher, to ensure that these specifications are met. The QP is satisfied that the procedures employed by mining technical staff have been developed over a lengthy period and are appropriate for the suppression of metallurgically deleterious material in ore sent to the refineries. For a more substantive description of Alcoa's Darling Range metallurgy, refer to Section 10.0.

- Infrastructure – The QP has observed the Darling Range infrastructure to be well established, maintained and to a high standard. The operations are located near a major city, with excellent transportation, facilities, and workforce. Provision is made in Alcoa's Life of Mine (LOM) plans for sustaining capital for infrastructure replacement. For a more substantive description of Alcoa's Darling Range infrastructure, refer to Section 15.0.

- Economic – Revenue for the mines is premised on a transfer price for bauxite ore at the refinery gate. Mining costs are well understood, as the mines have been operated for a long time. The QP is satisfied that the pit optimization, scheduling, and analysis undertaken by mine technical staff is appropriate to the operation and that the costs are well understood. For a more substantive description of Alcoa's Darling Range economics, refer to Section 19.0.

- Marketing – All bauxite is sold to Alcoa's Darling Range refineries, the sole customer for the mines. The refineries produce alumina, which is variously further refined into aluminum metal at Alcoa's aluminum plants or exported. Alumina and aluminum are internationally traded commodities and subject to normal market forces and cycles. For a more substantive description of Darling Range's market aspects, refer to Section 16.0.

- Legal – The QP observes that the Darling Range operations have been in operation for a long time and are licensed in relation to obligations under Western Australian legislation. Mining approval for the Darling Range operations is given by the statutory Mining and Management Program Liaison Group (MMPLG). The MMPLG consists of representatives from across government and is responsible for reviewing mine plans and associated activities and making recommendations to the Western Australian Minister for State Development.

- Environmental - The QP observes that the Darling Range operations have a long history of progressive rehabilitation of mined-out areas. There are restrictions placed on some mining areas that are related to proximity to water catchments, places of social importance and fauna habitat. Operation under these conditions is by approval of the MMPLG. For a more substantive description of Alcoa's Darling Range environmental obligations, refer to Section 17.0.

- Social – The QP observes that the Darling Range operations have long been a major employer and economic contributor to the region and that the operations have numerous well-established community and social initiatives. A skilled workforce resides in the area, as do many

service industries. The QP does not consider social risk to be material to the Darling Range operations.

- Governmental – Western Australia and Australia in general are stable, developed democracies with an advanced economy. Governmental relations with the Darling Range operations are managed by the MMPLG, which has representation from the relevant government departments. The QP does not consider governmental risk to be material to the Darling Range operations.

12.3 Basis of Estimate

Historically, Alcoa did not report material in the Measured Mineral Resource category, reporting mineralization in areas of 15 m by 15 m spaced drilling as Mineral Reserves reported to the prior SEC standard. Alcoa has subsequently incorporated S-K 1300 and JORC Modifying Factor considerations into its mine planning processes and this was observed and confirmed on site.

The QP has used the December 31, 2022 Mineral Resource estimate as the basis for its Mineral Reserve estimate. The bauxite operations are operating mining projects with a long history of production for which establishment capital has been repaid and for which sustaining capital and supported operating costs have been observed to be applied in economic analysis. Consequently, the QP considers that support by a Feasibility Study is demonstrated by the demonstrable history of profitable operation and the level of technical support for the Modifying Factors and Front-End Loading (FEL 2), or pre-project planning study, for the recent major Myara capital crusher move. The QP has reviewed the operating and planning procedures and parameters for the operations, and considers that the work completed is sufficient to allow definition of Mineral Reserves.

Proven Mineral Reserves are derived from scheduled Measured Mineral Resources which are located within the current mining regions of Myara and Larego. Probable Mineral Reserves are derived from scheduled Measured Mineral Resources which are located outside the current mining regions, or from scheduled Indicated Mineral Resources. The Mineral Resource estimate reported in this document (Section 11.0) is exclusive of the Mineral Reserve.

Consequently, Modifying Factors that relate to community and environmental considerations are formally assessed. The QP considers that as a result there is low risk to not establishing Proven Reserves relating to the project.

The Probable Mineral Reserve has been defined by 15 m by 15 m drilling. Application of the Modifying Factors is consistent with Proven Reserves.

The QP has formed an independent view of the Modifying Factors applied in the estimation of the Mineral Reserve. This view is supported by examination and verification of mine planning data and procedures and historic reconciliation information. The QP has interviewed technical staff responsible for Alcoa's operations and reviewed the operating, planning and forecast reports for the operations supplied by Alcoa.

The mine planning process excludes mineralization that is not considered recoverable due to various constraints, defining no Mineral Resource or Mineral Reserve within these zones. Such constrained zones include Aboriginal heritage sites and old-growth forest; however, are proactively and dynamically updated by Alcoa through engagement with stakeholders, such as the community, and in response to government requests.

12.4 Dilution and Ore Loss

Dilution and ore loss are not reported separately to the Mineral Reserve. Internal and edge dilution is modelled at the mine planning stage through the application of 15 m by 15 m mining blocks to the Mineral Resource model. These regularized blocks contain proportional estimates of ore and contaminants and are optimized through the application of a Lerchs-Grossman algorithm developed specifically for the operation. This variation of the conventional Lerchs-Grossman algorithm is applied vertically, given that the shallow nature of the mineralization precludes geotechnical considerations. Blocks that do not satisfy grade and contaminant parameters against revenue are thus excluded from the mine plan.

Mining dilution is controlled by excavation of dilution at the top of the mineralization (a source of oxalate or organic contamination) and the pit floor (R.SiO2 contamination). The upper contact is a sharp geological contact on an undulating surface. GPS-controlled machinery is used to locate these intersections.



Figure 12-1: Undulating Hanging Wall Hardcap Surface; and Footwall (white clay, lower right in the floor) (Left: Pearman, 2015 & Right: SLR, 2021)

Organic material reacts with sodium hydroxide in the refinery to form oxalate, which is considered to be a contaminant. Alcoa has developed a process known as Secondary Overburden Removal (SOBR) whereby the soil and clay on top of the hardcap that covers the mineralization and contains this organic material is removed by either scraper, surface miner or small excavator. This removes as much carbonaceous material overlying the undulating hardcap layer as possible. Further description of SOBR is given in Section 13.1.

A surface miner is employed as required at the Huntly mine to cut highly contaminated overburden to the hardcap contact. Historically, this results in a 2.9% ore loss, which is considered in the Mineral Reserve estimation.

The lower mineralization contact is gradational, and dilution is minimal on contaminants other than R.SiO2. This contact is defined through drilling and chemical analysis and excavation is controlled by GPS to modelled surfaces.

The Grade Control process checks the accuracy of excavation and assesses adherence to excavation of the target floor.

12.5 Extraction and Mine Planning

12.5.1 Ten-Year Mine Plan

Alcoa prepares a Ten-Year Mine plan annually. The first five years of this plan is submitted to the statutory MMPLG for approval of mining areas. The Ten-Year Mine Plan includes a mine production schedule that demonstrates scheduling of mineralization classified as Mineral Resources for estimation as Mineral Reserves. This schedule contemplates higher confidence Mineral Resources during the early production periods, with lower confidence mineralization planned in subsequent periods (Figure 12-2 and Figure 12-3).

The schedule has several operational parameters in addition to statutory limitations (refer Section 12.2 above):

- The mineralization lies under haul roads and extraction is delayed until the road is no longer required.
- Mineralization is near a planned crusher location and mining has been delayed until the crusher is installed.
- Contaminants exclude a parcel from blending in the schedule.
- The mining areas are small and demonstrate low mining efficiency and mining has been delayed.

Confidence in the Mineral Reserves is predicated on confidence in the underlying Mineral Resources in the mining schedule. Continuous Mineral Resource definition drilling maintains an inventory of sufficient confidence to maintain Mineral Reserves.

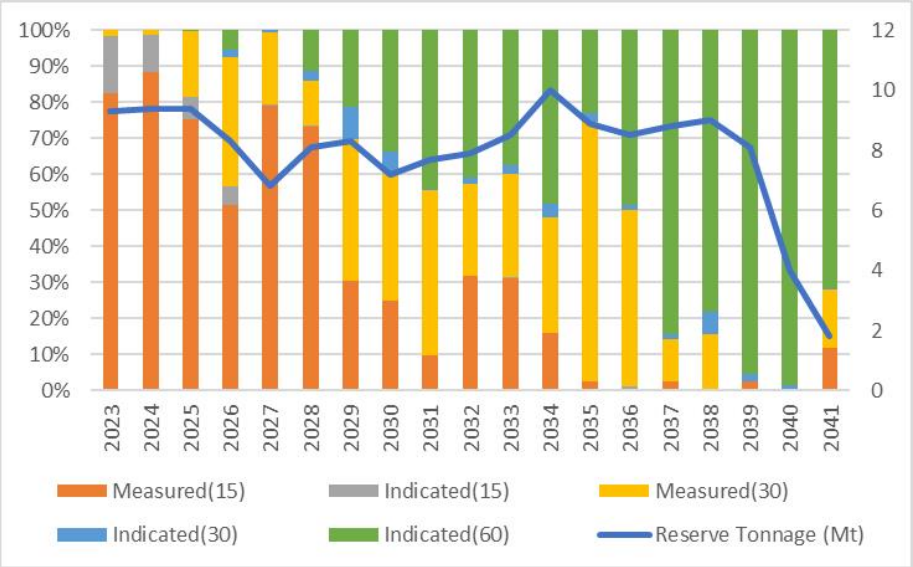


Figure 12-2: Willowdale Fifteen-Year Mine Plan Resource Confidence (drill hole spacing in meters shown in brackets) (Alcoa, 2022)

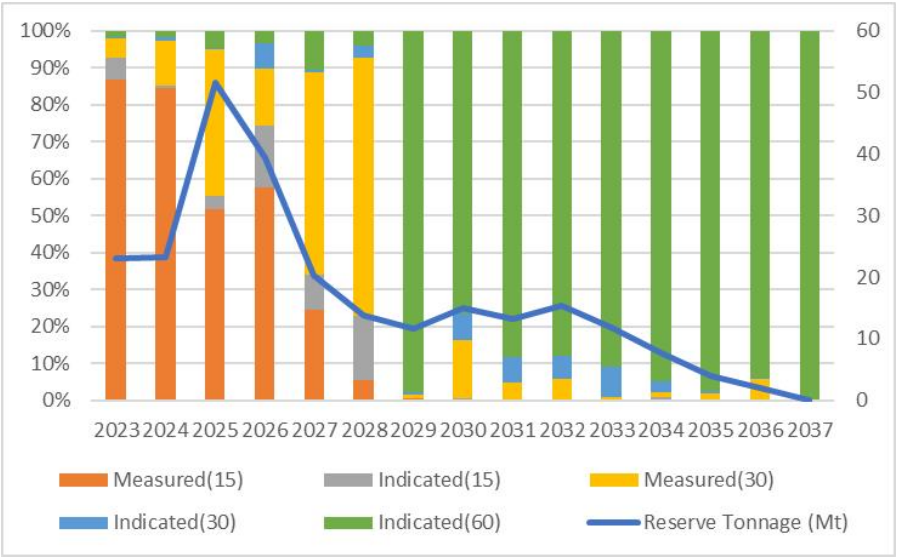


Figure 12-3: Huntly Fifteen Year Mine Plan Resource Confidence (drill hole spacing in meters shown in brackets) (Alcoa, 2022)

12.5.2 Mine Planning

Alcoa has been actively refining the mine planning process in such a way that the Mineral Resource and Mineral Reserve Models are updated continuously using various scripts and a rationalizing of computer software. This process is mostly complete, the QP observed its progress both on the mine sites and at the Booragoon mine planning office.

The mine planning process commences with receipt by the mine planning department of the regularized and classified electronic Mineral Resource model from the geologists. The regularization process sees the Mineral Resource blocks agglomerated into blocks of 15 m by 15 m by 0.5 m vertically. Grade, bulk density and contaminant parameters are estimated into the model, which is expressed as a percentage model. This model is then manually checked and validated.

Electronic files are centrally stored, and the master versions are copied by relevant personnel for manipulation.

Optimization of the pits is undertaken using a bespoke variant of the Lerchs-Grossman algorithm designed to operate vertically. The algorithm accumulates blocks vertically on 0.5 m increments to find the pit floor.

The optimization is driven by Net Present Cost (NPC), rather than the conventional Net Present Value (NPV) due to the presence of a flat transfer price for product at the refinery gate.

Geotechnical constraints are not relevant, given that the pits are generally around 4 m in depth and placed on gently undulating country (Section 7.9). Contour mining is applied in areas of greater topographic relief, whereby mining progresses across the contour, maintaining as consistent a pit floor as possible.

Optimization parameters are calculated for each block, including costs associated with drilling, blasting and ripping and haulage cost, which is estimated from major haulage roads and minor pit access roads against gradient. Electronic surface models are prepared to constrain the optimization; these are informed by LiDAR radar surveys and model the topography, the base of overburden and the base of mineralization, derived from chemical analysis of resource definition drilling samples. Caprock requires drilling and blasting, and modelled surfaces are contoured for thickness, which is derived from examination of drill logs and high-Fe assays.

Pit shells are visually assessed for practicality and minimum mining widths and any impractical pit shells removed. Minimum mining widths vary according to topography and material type.

Individual areas are optimized separately, and the resultant pit shells are combined to provide grade and contaminant specifications for Life of Mine (LOM) scheduling. Haul roads are divided into 50 m segments with appropriate cost increments applied to each segment using commercial haul road optimization software. This process electronically tags each block with haulage cost information as a function of distance of the relevant node (haul road) from the nearest crusher. The software then normalizes the data by calculating the equivalent flat haul distance, maintaining a gradient of less than 8% for all nodes.

The model is then depleted for mined material and blocks that have been otherwise committed for development or have been mined out and also for environmental constraints.

Environmental constraints include proximity to streams, designated heritage areas (both Aboriginal and European) and the water catchment offset. GIS software is used to continuously generate electronic

shape files that are converted daily to string files for import into the mine design software. These are then used to deplete the model in relation to environmental constraints.

Mineralization that has been identified as being under infrastructure is scheduled for mining only after that infrastructure has been removed in the LOM plan.

Noise zones are those where noise from the mining operations will potentially exceed allowable levels and the operation actively seeks to maintain lower noise levels than those mandated. Mining in these areas is undertaken by contract miners using smaller equipment on day shift only and attracts higher costs than conventional owner-operator mining, which is applied to most of the operation.

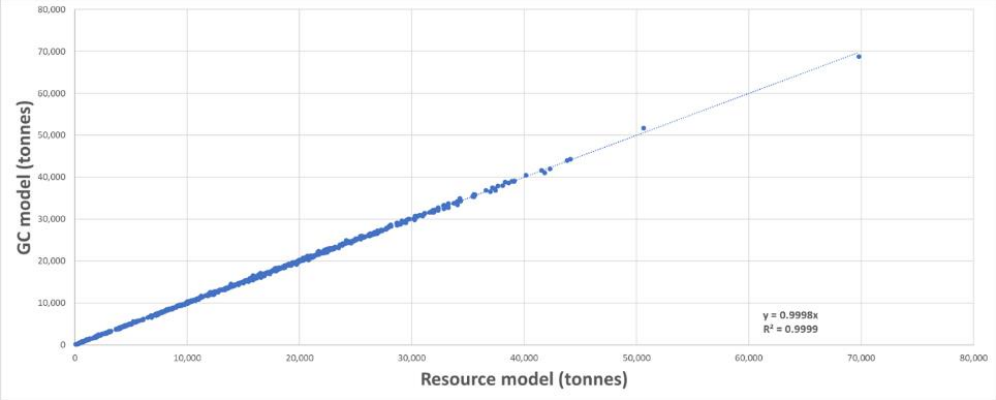
The regularized model is then coded for the above parameters and checked. All the above processes are logged, checked and validated both electronically and visually. Electronic scripts are then run in the mine planning software, resulting in the reporting of Mineral Reserves.

Revenue for the Lerchs-Grossman optimization is applied as a transfer price obtained from Alcoa's Financial Department. This revenue is related to the export price gained for refined alumina and is related to penalties for reactive silica content. Current revenue is around $21/t. The optimization uses $0.48 per unit alumina based on the average grades that are agreed with the refineries. A discount rate of 12.25% is mandated by the Finance Department and applied to the NPV scheduler during the mine planning process. The price that constrains the estimate for optimization was discounted to exclude export logistics costs, i.e., the base price was $21/t (updated annually to reflect a reasonable market expectation of arms-length sales of bauxite from Darling Range), and the discounted price was $16/t.

The QP notes that costs and revenues used in this process demonstrate a slow movement over time and that revenue has remained constant over the past year.

In practice, the Grade Control Model is used to direct mining at the bench scale, because it has more up-to-date drilling data than the Mineral Resource Model. Reconciliation is undertaken between the Mineral Resource, Mineral Reserve and Grade Control Models, with the QP observing the reconciliations between Mineral Resource and Grade Control Models to be within acceptable parameters. Reconciliation of the Mineral Reserve model has not been regularly undertaken in the past and this process was observed to be in development.

Figure 12-4 shows an example of the reconciliation between Resource and Grade Control models undertaken regularly by Alcoa.



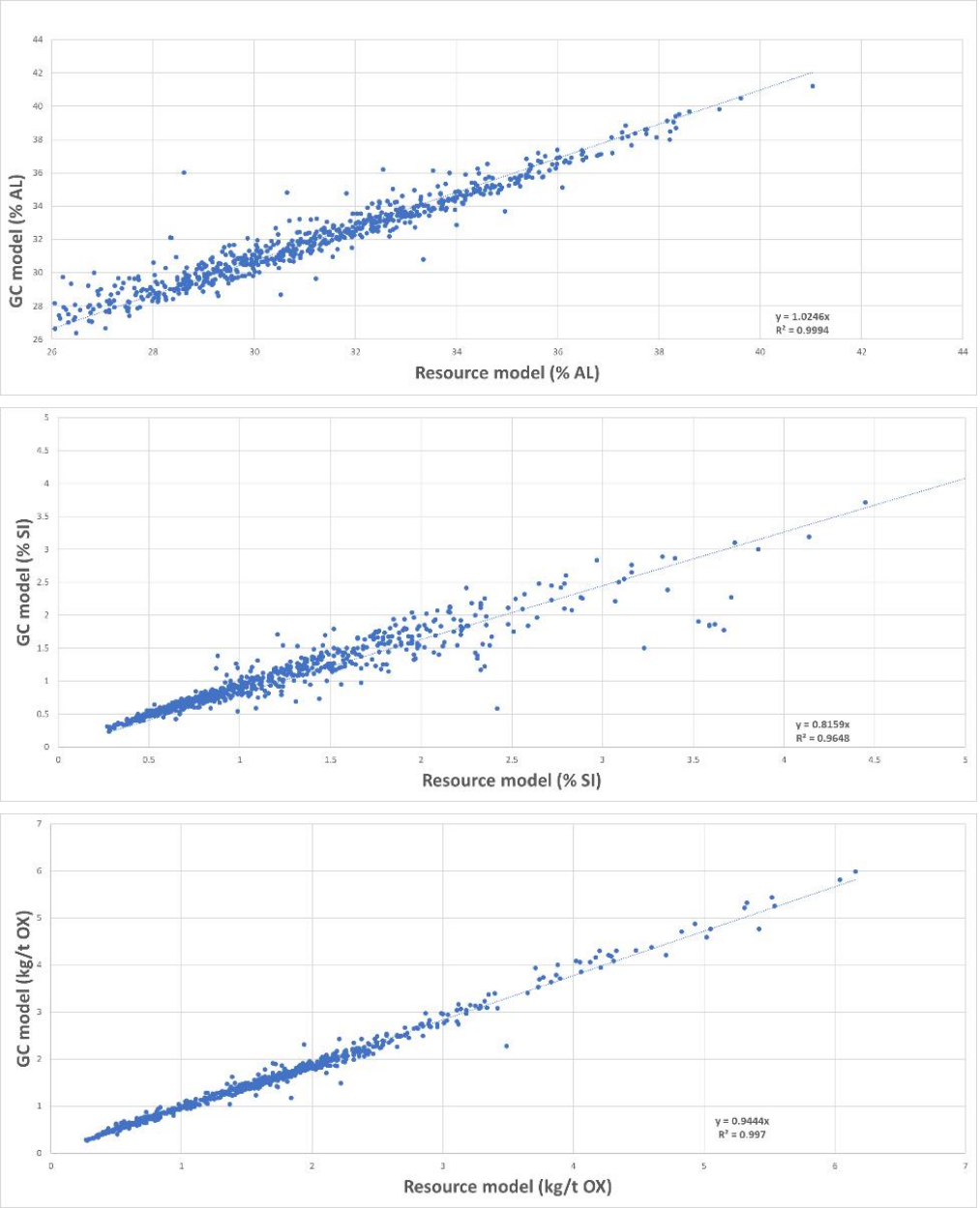


Figure 12-4: Example of Reconciliation Between Mineral Resource and Grade Control Models for Tonnage, Al, Si, and OX (Alcoa, 2022)

The resultant pit shells are scheduled using specialist automated mine scheduling software. A text file containing the model and its parameters is exported to the scheduling software, which is programmed with current wait times and the current mining capacity of 26.5 Mtpa (Huntly) & 11 Mtpa (Willowdale). The software calculates and defers, as much as possible, capital haul road development costs for each block and identifies an optimal schedule.

Sustaining capital is calculated and added for haul road maintenance and equipment replacement. Not all machinery is capitalized, some being leased, and this is included the operating cost. Review of ownership costs against leasing is constant and appropriate factors applied to the model.

The resultant model is coded for grade and contaminants and blocks are flagged with the appropriate mining sequence. Mineral Reserve blocks are contained within the ten-year schedule. The model is then re-exported as a text file to the mine planning software and distributed to the relevant mine planning departments and mine closure engineers for detailed planning.

12.5.3 Abandoned Resources

Some planned mining areas that are included in the schedule are unable to be totally mined for a variety of operational reasons. These reasons usually relate to issues with rock outcrops, hard ground, contamination and access difficulties that are encountered when developing a new mining area. This process drives the continuous development of new mining areas to maintain production capacity.

Alcoa's recorded average abandoned mineralization between 2016 to 2019 (inclusive) is estimated at an average of 1.5% of Huntly and 2.0% of Willowdale planned production but can vary materially. These factors are applied to forecast production in the Mineral Reserve estimation process.

12.6 Cut-off Grade

The cut-off grade used for mine production planning is a floating cut-off grade, dependent on capital and operating costs against a fixed product revenue at the refinery gate. These revenues are updated at least annually by Alcoa's Finance Department and are observed by the QP to be updated annually to reflect a reasonable market expectation of arms-length sales of bauxite from the Darling Range.

The cut-off grade is thus cost-driven rather than revenue driven. Operating costs are observed to be driven by haulage distance and the use of contract mining in areas where mining is undertaken on day shift only due to environmental restrictions. Haulage distance is related to the presence or absence of capital haul roads and their maintenance costs.

The current nominal cut-off grades for Alcoa's Darling Range operations are 27.5% for A.Al2O3 and 3.5% for R.SiO2. Commodity pricing is described previously in Section 12.5.2.

12.7 Metallurgical Factors

The Huntly and Willowdale Darling Range mining operations feed three refineries: Kwinana, Wagerup and Pinjarra. The Huntly mine provides feed for the Kwinana and Pinjarra refineries and the Willowdale mine provides feed for the Wagerup refinery. Ore is transported via conveyor belt from the relevant crushers, and the battery limit for the mining process is the refinery gate. All three refineries are established, mature and use the conventional low-temperature Bayer refining processes.

The refineries are designed to accommodate long-term average bauxite and impurity grades from the mines. Internal Alcoa specification contracts are established between the refineries and each of the

mining operations and these contracts are updated annually and contemplate a five-year mine plan. These contracts set impurity targets, the key impurities being R.SiO2, oxalate and iron. Mineral processing testing is discussed in Section 10.0, and processing and recovery in Section 14.0.

The internal LOM (nominally 2045) specification for bauxite is based on a 27.5% A.Al2O3 cut-off grade, which has not been optimized but is supported by the extensive operating history at the three refineries.

Deleterious elements are managed within contracted limits by blending at each mine, with the aim of minimizing variation. The refineries conduct metallurgical test work to ensure that any potential effects of variance caused by new mining areas are understood.

Geometallurgical analysis is conducted on drill hole samples using FTIR analysis as a primary method. A subset of the samples is assayed using conventional analytical procedures, with the results used for FTIR batch calibration and quality assurance purposes. The Mineral Resource model is coded for geometallurgical grades for available alumina and reactive silica. This information is reported in the Mineral Resource estimate as well as the Mineral Reserve estimate.

The Mineral Reserve is based on geometallurgical criteria that have been set by the refineries as suitable for producing alumina to agreed product marketing specifications.

12.8 QP Opinion

The QP considers that, because of the integrated process by which Measured and Indicated Mineral Resources translate to Mineral Reserves for Alcoa's Darling Range operation, there are no foreseeable risks associated with Modifying Factors (mining, processing, metallurgical, infrastructure, economic, marketing, legal, environment, social, or government) that materially affect the Mineral Reserve estimate at 31 December 2022.

At the time of the review there was no adverse operational risk associated from the COVID-19 pandemic. The mines were operating at full capacity.

The operations are sensitive to actual mined grade, as such lower alumina or higher reactive silica grades remain a risk to the overall economics. Alcoa have demonstrated through their Grade control program an effective control to minimizing the dilution and mining at their forecast grades. The grade control is particularly important along ore-waste boundaries to maintaining expected mined grades, Alcoa demonstrate processes to handle and define boundaries to mitigate these risks.

Haul distance is considered a risk factor due to the hauling cost making up a significant portion of the mining cost. Hauling is also directly linked to fuel cost and maintenance, the combination of an increased hauling distance as well as an increase in fuel cost and maintenance would result in a significant impact on the operational costs. Haul distances to Reserve blocks typical increase over time until such time there is a plant relocation and so there is an expected increase in hauling distance in the medium term. Alcoa manage such risks by defining when then major plant needs to be relocated.

Alcoa may be unable to obtain or retain necessary permits, which could adversely affect its operations. The Darling Range operation is subject to extensive permitting requirements. The requirements to obtain and/or achieve or maintain full compliance with such permits can be costly and involve extended timelines and possible delays. Alcoa strives to obtain and comply with all required permits but there can be no assurance that all such permits can be obtained and/or always achieve or maintain full compliance with such permits.

13.0 MINING METHODS

13.1 General Description of Operations

The Huntly and Willowdale mines employ conventional open pit mining practices and equipment. The fleet is mixed between contract and owner-operator, depending on the nature of the task at hand. Owner operator equipment is used for mining the bulk of the Mineral Reserve, operating in areas away from those subject to environmental restrictions. Contract mining operates smaller equipment, day shift only, in environmentally (noise) sensitive areas and at the perimeter of the mining area.

The Huntly mine currently operates at a nominal mining capacity up to 27 Mtpa. In recent years, licenses were gained for the export of a proportion of the bauxite produced. The Willowdale mine operates at a nominal production rate of 11 Mtpa.

The Darling Range operations currently have a nominal expected mine life until 2045 (when ML1SA expires), although provision exists for Alcoa to apply for a further mineral lease (Section 3.2). Mine Plans for 10 years of scheduling of mineralization classified as Mineral Resources for estimation as Mineral Reserves (Section 12.5.1). Mining units of 15 m by 15 m by 0.5 m vertically are in use at the operations (Section 12.5.2).

Dilution and ore loss are not reported separately to the Mineral Reserve (Section 12.4). Internal and edge dilution is modelled at the mine planning stage through the application of 15 m by 15 m mining blocks to the Mineral Resource model. These regularized blocks contain proportional estimates of ore and contaminants and are optimized through the application of a Lerchs-Grossman algorithm developed specifically for the operation. This variation of the conventional Lerchs-Grossman algorithm is applied vertically, given that the shallow nature of the mineralization precludes geotechnical considerations. Blocks that do not satisfy grade and contaminant parameters against revenue are thus excluded from the mine plan.

Mining recovery from Huntly and Willowdale are estimated to be 96% and 98%, respectively.

Figure 3-3 shows the outlines of mined areas, Mineral Resources, and Mineral Reserves, which are collectively taken as representing the final pit outline, as currently understood. This does not account for any required extensions or additional licenses and assumes that all Mineral Resources and Mineral Reserves are ultimately mined.

13.1.1 Clearing

Following definition of Mineral Reserve blocks, vegetation is cleared ahead of mining by the Western Australian State Forest Products Commission (FPC), saleable timber being harvested for use. Clearing approval is sought ahead of mining allowing time for harvesting of saleable timber before vegetation clearing.

13.1.2 Stripping

On receipt of clearance to proceed from the FPC, Alcoa operations commence stripping topsoil and Secondary Overburden Removal (SOBR) using small excavators, scrapers, and trucks. Soil is stockpiled at the site, away from the proposed pit, for rehabilitation purposes. Soil is stockpiled in windrows in such a manner that it maintains its organic viability.

The dieback fungus (*Phytopthora spp*.) is endemic in parts of the mining areas, which are flagged by Alcoa and precautions are taken to contain the fungus, which is lethal to the eucalyptus forest. The QP observed these precautions, which include separation of machinery fleets in areas where dieback is present and washing of machinery before entry into different areas. This represents a minor short-term scheduling challenge, though it is well managed.

13.1.3 SOBR

The SOBR process is specialized and aims to remove as much overburden and organic material from the top of the mineralization as possible. This organic material reacts with NaOH in the refinery to produce oxalates, which are deleterious to the process. After scrapers have removed the topsoil and overburden, two small (60t class) excavators equipped with swivel buckets are used to scrape clay containing organic material from the undulating surface of the hardcap that sits on top of the mineralization. This is later used to backfill mined out areas.



Figure 13-1: SOBR (SLR, 2022)

The SOBR process is applied to those areas where hardcap has been identified by Resource definition drilling, using the drillers' logs. The hardcap is drilled and blasted before mining with the rest of the bauxite sequence.

In areas without hardcap, wheel tractor-scrapers of 24 m³ capacity remove soil overburden, scraping directly to the top of the mineralization model surface, being controlled by GPS. This material is similarly stockpiled for rehabilitation or used as backfill in exhausted mining areas.



Figure 13-2: Topsoil Removal (Background), Blasting of Hardcap and Marking of Ore (foreground) (SLR, 2021)

A surface miner is employed in limited areas of hardcap in the vicinity of blasting-sensitive infrastructure such as power lines. The surface mining is also employed in lieu of SOBR where appropriate, for example, where there are high levels of contaminants in the hardcap. During the 2022 visit the surface miner was not operational.

13.1.4 Mining

Mining progresses on 4 m benches, utilizing a contour-mining sequence, cutting benches across the topography, working from top to bottom, maintaining the flattest floor obtainable to a maximum gradient of 1:7. Most of the mineralization lies beneath a gently undulating topography and contour mining is minimal.



Figure 13-3: Contour Mining (SLR, 2021)

On completion of overburden removal, the exposed surfaces are sheeted with 0.25 m of suitable mineralized material taken from the dozed second cut in adjacent pits. Where hardcap is present, a drill rig is mobilized, and the hardcap drilled and blasted on an appropriate pattern to fragment the hardcap.

Trucks haul the mined ore to fixed crushers, which crush the material to varying sizes (refer to Section 14.0) before conveying down the escarpment to the refinery where it is stockpiled to give surge capacity.

No visual grade control is applied, the ore contacts being gradational. Grade control is achieved by mining to electronic ore surfaces derived from drill assays, control being achieved using GPS equipped equipment, the GPS being regularly calibrated.

Blending takes place at the pit face, before which the crushed ore from different pits is assessed using specialist short-term mine planning software and pit production is scheduled to achieve the desired blend.

The QP is of the opinion that considering the style of mineralization, the average depth of the deposit, and the material characteristics of the overburden material whereby it is amenable to ripping / excavation using conventional earth-moving equipment, the open pit mining method adopted at Darling Range is the most appropriate method for the Mineral Reserves.

13.2 Haul Roads and Infrastructure

13.2.1 Haul Roads

Haul roads are the limiting factor to the mining operations. Major haul roads are established to each mining area, honoring the topography at the least possible gradient. Roads are unsealed and formed by conventional bulldozer and grader and sheeted with appropriate material. Once established, haul road maintenance was observed to be continuous and forms part of the operating cost for each mining area. Haul roads are observed by the QP to be treated as sustaining capital in an appropriate manner.



Figure 13-4: Truck on Haul Road (SLR, 2021)



Figure 13-5: Haul Roads with Berms (SLR, 2021)

Secondary haul roads to individual mining areas are formed in the same manner, with provision for rehabilitation once mining is complete.

The Darling Range climate is subject to wet winter months and trafficability of haul roads during these months is included in mine planning. Redundancy during wet months is planned for, allowing well drained areas to be mined in the wet.

There are some restrictions to the establishment and operation of haul roads, and these are incorporated into the road design and operation:

- Water runoff from the roads is impounded in sumps and these were observed to be well formed and appropriate, being regularly dewatered, emptied of sediment and cleaned. This water is either re-used for dust suppression or road-forming purposes or is decanted for release in an approved manner.
- Dieback control necessitates separation of machinery between that which operates in dieback-prone and dieback-free areas. This presents short-term scheduling challenges that were observed to be well controlled.
- Proximity to a major water catchment restricts the volume of hydrocarbons that may be taken into particular areas around the catchment. This was observed to be adhered to, with particular road rules and scheduled delivery of approved volumes of hydrocarbons along haul roads that are specially formed with impoundments in the event of spillage.

The QP has observed that Alcoa's Darling Range operations have a well-established system for haul road design, construction, maintenance and regulation and that this does not present a major impediment to mining efficiency.

13.2.2 Infrastructure

The main elements of infrastructure at Alcoa's Darling Range mining operations are the location of crushers and conveyors to the refineries. These crushers form hubs for the mining operations, connected by the primary haul roads and are scheduled to be moved every ten years or so, in accordance with the requirements of the mining schedule and the location of ore as the mines progress. This crusher movement is planned well in advance and is treated as sustaining capital expenditure.

The crushers see relatively light duty for a mining operation and are well maintained. Similarly, the conveyors, which operate all year round and are covered, negating any potential effect of weather.



Figure 13-6: Covered Conveyor (SLR, 2021)

Both the crushers and conveyors were observed to be in excellent condition and subject to scheduled maintenance, including replacement of conveyor belts.

Other ancillary equipment includes offices, ablutions, crib-rooms, and workshops, all of which were observed to be in excellent condition.

13.3 Geotechnical and Hydrogeology Considerations

Mining at Alcoa's Darling Range operations is very shallow, pits being an average of 4 m deep. Consequently, geotechnical considerations are negligible other than immaterial localized batter failures. Similarly, the mining areas are elevated and well drained and groundwater and surface water hydrology is not material in these areas other than the catchment, impoundment, and decantation of runoff during the wet winter months. No drainage diversion occurs or is necessary because the mineralization sits between the stream beds and the bauxite occurs above the groundwater table. Deeper bauxite may be seasonally affected by the water table and is scheduled to be mined in summer. Backfilling of these places occurs before the rain raises the water table.

Contour mining (Figure 13-7) is practiced in areas of relatively steep topography, maintaining access ramps at less than 1:8 gradient and mining across the contour and downwards, creating a flat working floor. Hydrological considerations in these areas include management of runoff during the wet winter months and trafficability.



Figure 13-7: Contour Mining (SLR, 2021)

Mine overburden is progressively backfilled into adjacent exhausted pits (Figure 13-8), topsoiled, landscaped (Figure 13-9), and rehabilitated by re-establishment of native vegetation (Figure 13-10), creating a stable post-mining landform that replicates the pre-existing environment.



Figure 13-8: Soil Being Returned for Backfilling and Landscaping the Pit (Alcoa, 2018)



Figure 13-9: Landscaped Mining Area, Prior to Replanting of Forest (SLR, 2021)



Figure 13-10: Rehabilitated Pit Through Re-plantation of Native Vegetation (SLR, 2021)

13.4 Mine Equipment

Mining is undertaken by 300 t and 200 t-class excavators top-loading 190 t capacity rigid-bodied mining trucks (Figure 13-11). This fleet was observed by the QP at Huntly to be aged. The equipment has undergone relatively light duties for a mining fleet, which prolongs its life. Sustaining capital is being invested in equipment replacement and modernization at Willowdale, progressively working toward Huntly. New equipment includes 250 t-class excavators and 190 t-class trucks.

A full list of equipment at Darling Range is provided in Table 13-1.



Figure 13-11: Ore Mining at Darling Range (SLR, 2021)

Table 13-1: Darling Range Operations Equipment List

Location	Classification	Type	No. Units
Huntly	Primary	Excavator	4x CAT 336D 2x Komatsu PC3000 3x Hitachi 2600-7
		Haul truck 1	8x CAT 789C (190T) 9x CAT 789D (190T) 1x Komatsu 730E (190T)
		Haul truck 2	1x HD1500 (150T)
	Ancillary	Bulldozer / Loader	3x CAT D11R 1x CAT 992K 2x CAT 993K 2x CAT 980 Loaders
		Grader	2x CAT 16M 1x CAT 24M
		Scrapers	5x CAT 637G
		Low Loaders	1x CAT 785C (250T) 1x CAT 777G (150T)
		Water truck	3x CAT 785C
		Drills	3x Atlas Copco L6 (Blast) 5x WB93 (Exploration)
Willowdale	Primary	Excavator	2x Hitachi ZX360 2x Komatsu PC2000
		Haul truck 1	12x Komatsu 730E (190T)
		Haul truck 2	1x HD1500 (150T)
	Ancillary	Bulldozer / Loader	3x CAT D11T 1x CAT 993K 1x CAT 992G 1x Komatsu WA320
		Grader	1x CAT 16H 1x CAT 18M
		Scrapers	3x CAT 637K 1x CAT 637G 1x CAT 637E
		Low Loaders	1x CAT 785D (220T)
		Water truck	2x CAT 777F 2x Komatsu 730E
		Drills	2x Epiroc D50 (Blast)

13.4.1 Contractors

Alcoa's practice in noise sensitive areas such as the perimeter of the operation near residents is to engage contractors. These areas operate on day shift

only and attract higher operating costs than the main production areas. The flexibility required in these areas precludes the use of the primary owner-operator fleet and equipment is dry or wet hired or mining takes place under conventional schedule of rates contracts.

Alcoa also engages contractors for aspects of haul road construction services, in select areas of pit development, and during landscaping activities for rehabilitation after mining.

This practice has led to the establishment of a secondary contracting industry around the Darling Range operations. Contractors are overseen by Alcoa personnel.

13.4.2 Ancillary Equipment

Ancillary equipment at Alcoa's Darling Range operations includes a fleet of bulldozers, graders and loaders that are primarily used for haul road formation, pit development (for the removal of overburden and blasted caprock) and ground preparation for digging, landscaping, clean-up, and road maintenance.

The SOBR process requires small excavators, articulated trucks, scrapers, and specialist skills to grub organic-containing clay from the top of the mineralization.



Figure 13-12: Blasthole Drill Working on Hardcap (SLR, 2021)

All ancillary equipment was observed to be in good and well-maintained conditions, the conditions being relatively light duty in comparison to other Western Australian mining operations. The current mining areas are shown in Figure 3-2.

13.5 Personnel

The main production mining operations are primarily Owner-operated using Alcoa equipment and employees. Contractors are also used for certain activities on site.

Three unions are recognized at the operations:

- The Australian Workers Union (AWU), which covers most of the operations workers
- Australian Metal Workers Union (AMWU), which covers the metal trades, being fitters, boilermakers and mechanics
- Electrical Trades Union (ETU), which covers the electricians

Lost time during strikes is generally uncommon. The Enterprise Agreements (EA) have varied timing for expiration. Currently the AWMU are negotiating a new agreement, the ETU EA was negotiated at the end of 2021, with a 4 year term. The AWU Agreement expires at the end of 2023.

Alcoa's Darling Range operations were observed to have a stable workforce, drawn from the surrounding areas. The location is highly desirable in the Western Australian mining context and skilled personnel are readily attracted to the operations. Primary haul roads are named after personnel with greater than forty years' service and there are many of these.

The recent increase in metals prices has driven higher than usual turnover across the industry, which has impacted on the traditionally low turnover. It is still below industry standard, as the drive in, drive out nature of the work attracts many to work at Alcoa.

As of December 2022, the Huntly and Willowdale operations together employ a total of 887 employees consisting of 48 technical, 77 management and 762 operations employees. Additionally, 67 employees are centrally employed on the combined operations.

A breakdown is shown in Table 13-2 (current vacancies not accounted for).

Table 13-2: Darling Range Personnel

Location	Classification	No Personnel
Huntly 611	Technical	37
	Management	50
	Operations	524
Willowdale 276	Technical	11
	Management	27
	Operations	238
Central 67	Technical	18
	Management	8
	Operations	41
	Total	**954**

14.0 PROCESSING AND RECOVERY METHODS

14.1 Process Description

The process plant for the Darling Range operations consists of two separate crushing facilities at the Huntly and Willowdale mines. Both facilities crush the ROM and convey the crushed ore to three separate refineries.

The Willowdale operation consists of a single stage crushing flowsheet and includes a series of conveyors to transport the crushed ore at an annual throughput of 10 Mtpa. The ROM is discharged from trucks on a dump hopper. An apron feeder transfers the ore from the dump hopper to a vibrating grizzly with an aperture of 180 mm. The grizzly oversize is discharged into a single toggle jaw crusher which crushes the ore to a top size of 180 mm. A hydraulic rock breaker is installed at the crusher to break the larger rocks that do not pass through the crusher opening. The crushed product and the grizzly undersize are discharged on to a discharge conveyor and subsequently discharged on to an overland conveyor. The discharge conveyor is fitted with a tramp magnet to remove any metal that is present along with the crushed ore product. The overland conveyor, which is 9.4 km long, transports the crushed ore to an intermediate transfer station. The ore is then transported by a second overland conveyor, 8.8 km long, to the transfer station located at Wagerup. An apron feeder is used to transfer the crushed ore from the Wagerup transfer station on to a stockpile conveyor and subsequently discharge on a stacker conveyor. The stacker conveyor discharges the ore into two separate stockpiles. The crushed ore is then reclaimed from there for processing in the Wagerup refinery. The total capacity of the stockpiles is approximately 0.7 Mt and sufficient for three weeks of feed to the refineries.

A simplified block flow diagram of the Willowdale operation is shown in Figure 14-1.

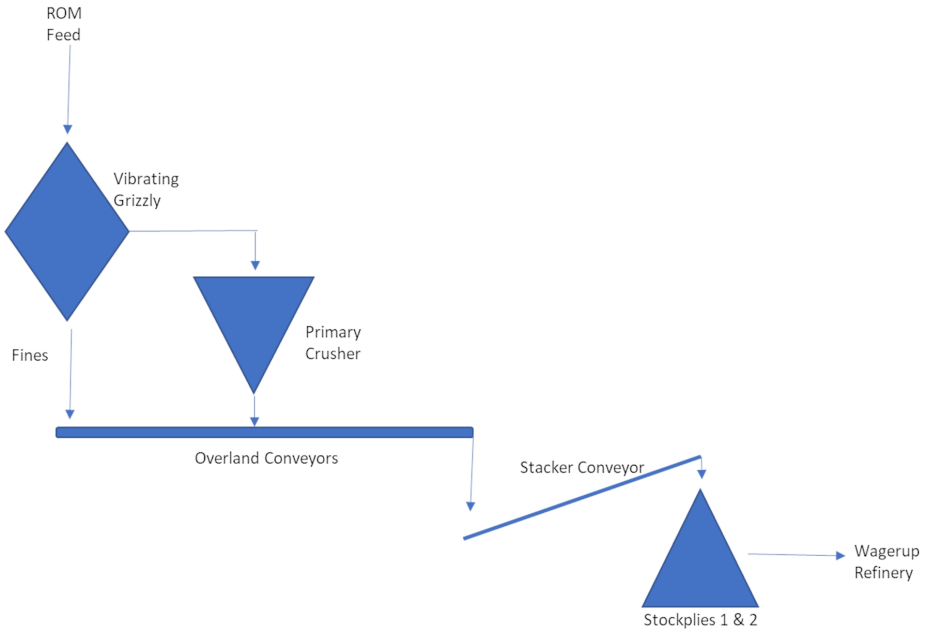


Figure 14-1: Simplified Block Flow Diagram of the Willowdale Operation

The Huntly operation consists of multiple stages of crushing and includes a series of conveyors to transport the crushed ore to the refineries at an annual throughput of 25 Mtpa. The primary crushing is achieved by two similar crushing circuits operating in a parallel configuration. The ROM is discharged from trucks on dump hoppers. Apron feeders transfer the ore from the dump hopper to vibrating grizzlies with an aperture of 180 mm. The grizzly oversize fractions are fed to jaw crushers which crush the ore to a top size of 200 mm. The crushed product and the grizzly undersize are discharged on to discharge conveyors and transferred to the secondary crushers (sizers). The discharge conveyors are each fitted with a tramp magnet to remove any metal that is present in the crushed ore. Secondary crushing is achieved in sizers with the objective of reducing the ore particle size to a top size of 100 mm. The secondary crusher product is transported by three overland conveyors (operating in series with two intermediate transfer stations in between) to a transfer station and randomly split into two by a splitter bin.

One fraction from the splitter bin is transferred by another overland conveyor and discharged into a stockpile conveyor via an apron feeder. The stockpile conveyor transfers the ore and subsequently discharges onto a stacker conveyor. The stacker conveyor discharges the ore into two separate stockpiles identified as Stockpile 1 and Stockpile 2. The crushed ore is then reclaimed from there for processing in the Pinjarra refinery. The second fraction of the ore is transported by an overland conveyor to an apron feeder, to a transfer conveyor and then split again to two fractions by a splitter chute located at a separate transfer station. One of the splits from the splitter chute is destined for Kwinana refinery and the other split is destined for Pinjarra refinery.

The fraction for the Pinjarra refinery is transported by stockpile conveyor and subsequently discharged on to two sperate stockpiles (identified as Stockpile 3 and Stockpile 4) via a stacker conveyor. The ore is then reclaimed from the stockpiles for processing in Pinjarra refinery along with the ore from Stockpile 1 and Stockpile 2.

The split for Kwinana refinery is transported by a conveyor and processed by a tertiary crushing circuit consisting of two roller crushers operating in parallel configuration. The tertiary crusher product with a top size of 25 mm is transferred by a stockpile conveyor and discharged into two separate stockpiles identified as Stockpile 5 and Stockpile 6 via a stacker conveyor. The crushed ore from Stockpiles 5 and Stockpile 6 is reclaimed and transferred by a reclaim conveyor to a surge bin for subsequent loading and transport to the refinery by train. A simplified block flow diagram of the Huntly operation is shown in Figure 14-2.

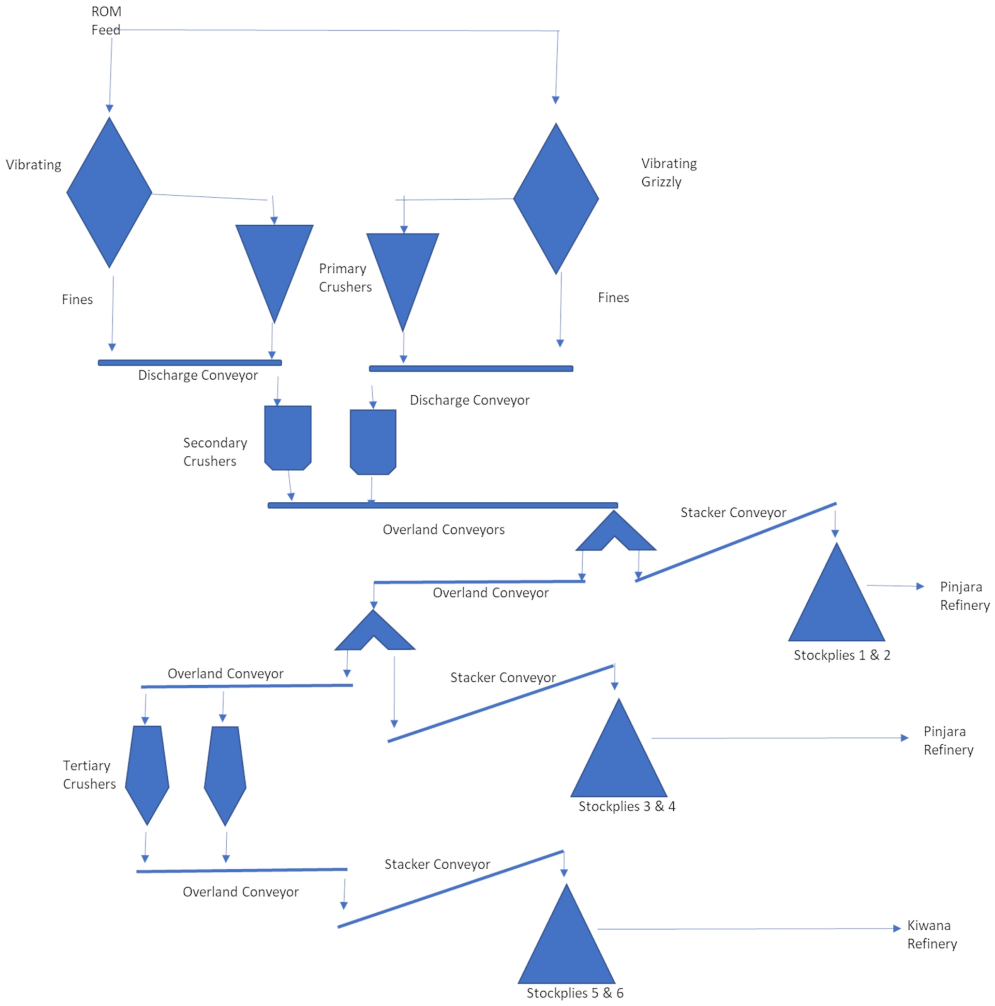


Figure 14-2: Simplified Block Flow Diagram of the Huntly Operation

14.2 Primary Equipment List

The primary equipment lists of the Willowdale, and Huntly operations are shown in Table 14-1 and Table 14-2.

Table 14-1: Primary Equipment List (Willowdale)

Equipment	Quantity	Installed Power (kW)
Apron feeder	1	264
Vibrating grizzly	1	75
Primary Crusher	1	355
Discharge conveyor	1	132
Overland conveyor	1	2500
Overland conveyor	1	1800
Apron feeder	1	75
Stockpile conveyor	1	300
Stacker boom conveyor	1	110

Table 14-2: Primary Equipment List (Huntly)

Equipment	Quantity	Installed Power (kW)
Apron feeder	1	260
Vibrating grizzly	1	55
Primary Crusher	1	250
Discharge conveyor	1	140
Secondary crusher	1	1000
Apron feeder	1	260
Vibrating grizzly	1	75
Primary Crusher	1	250
Discharge conveyor	1	140
Secondary crusher	1	1000
Overland conveyor	1	7500
Overland conveyor	1	5000
Overland conveyor	1	6100
Apron feeder	1	75

Equipment	Quantity	Installed Power (kW)
Overland conveyor	1	1500
Apron feeder	1	55
Apron feeder	1	75
Overland conveyor	1	1350
Apron feeder	1	110
Stockpile conveyor	1	225
Stacker boom conveyor	1	110
Yard conveyor	1	250
Stockpile conveyor	1	150
Stacker boom conveyor	1	110
Conveyor	1	250
Apron feeder	1	75
Tertiary crusher	1	370
Apron feeder	1	75
Tertiary crusher	1	370
Stockpile conveyor	1	300
Stockpile boom conveyor	1	110
Bucket wheel reclaimer	1	264
Reclaim bridge conveyor	1	110
Transfer conveyor	1	280
Reclaim conveyor	1	280
Reclaim conveyor	1	900

14.3 Consumables and Power

The power consumption of the Huntly operation is approximately 8,000 MWh to 9,000 MWh per month. The Willowdale power consumption is approximately 2,000 MWh per month.

The process plant is a dry crushing operation and therefore water is only required for dust suppression and is included as part of mine water consumption. Water is not required as a consumable for the plant.

Other consumables of the process plant include crusher liners, screen panels and spares for feeders and conveyors. These are kept on site and replaced as part of the routine maintenance schedule according to manufacturer's guidelines.

Personnel requirements for the operation and maintenance of the plant as described are included in Table 13-2.

14.4 QP Opinion

The QP is of the opinion that the selected processing method and the flowsheet are suitable for Darling Range operations. It is important to note that the ore head grades meet the refinery specifications for processing in terms of Al2O3 grades and SiO2 grades, this means the ore can be directly shipped to the refinery for further processing without any upgrading in the mineral processing plant. The crushing circuit reduces the particle size suitable for conveying as well as to meet particle size specified by the refinery.

15.0 INFRASTRUCTURE

The infrastructure for the mining operations is established and operational. In 2021, the infrastructure hub for Willowdale was relocated 16 km southwards from Orion (after having been based there for 21 years) to the Larego Hub which is located about 20 km north-east of the town of Harvey. The hub hosts administrative offices, as well as crushing facilities and maintenance facilities. The Orion Hub site is currently being rehabilitated with infrastructure decommissioning planned for 2024.

The mining hubs are relocated periodically as production moves away from the hub and thus transportation costs increase. Alcoa plans for the Larego Hub to be in place for approximately 20 years, though this is the 4th relocation since the mines opened in the 1970s/80s (approximately 13 years on average). The mining hub relocations are well-understood with planning and associated budgeting occurring well in advance of relocations; production restarted seven days after the shutdown.

An extensive haul road network, rail, and overland conveyors transport crushed bauxite from the Hub to the refineries on the coast (namely Kwinana, Wagerup and Pinjarra). Bauxite is transferred from each mine to the refineries primarily via long distance conveyor belt, apart from the Kwinana refinery which receives bauxite via railway. The Alumina produced by the three refineries is then shipped to external and internal smelter customers through the Kwinana and Bunbury ports.

The infrastructure layout for the Darling Range operations is shown below (Figure 15-1).

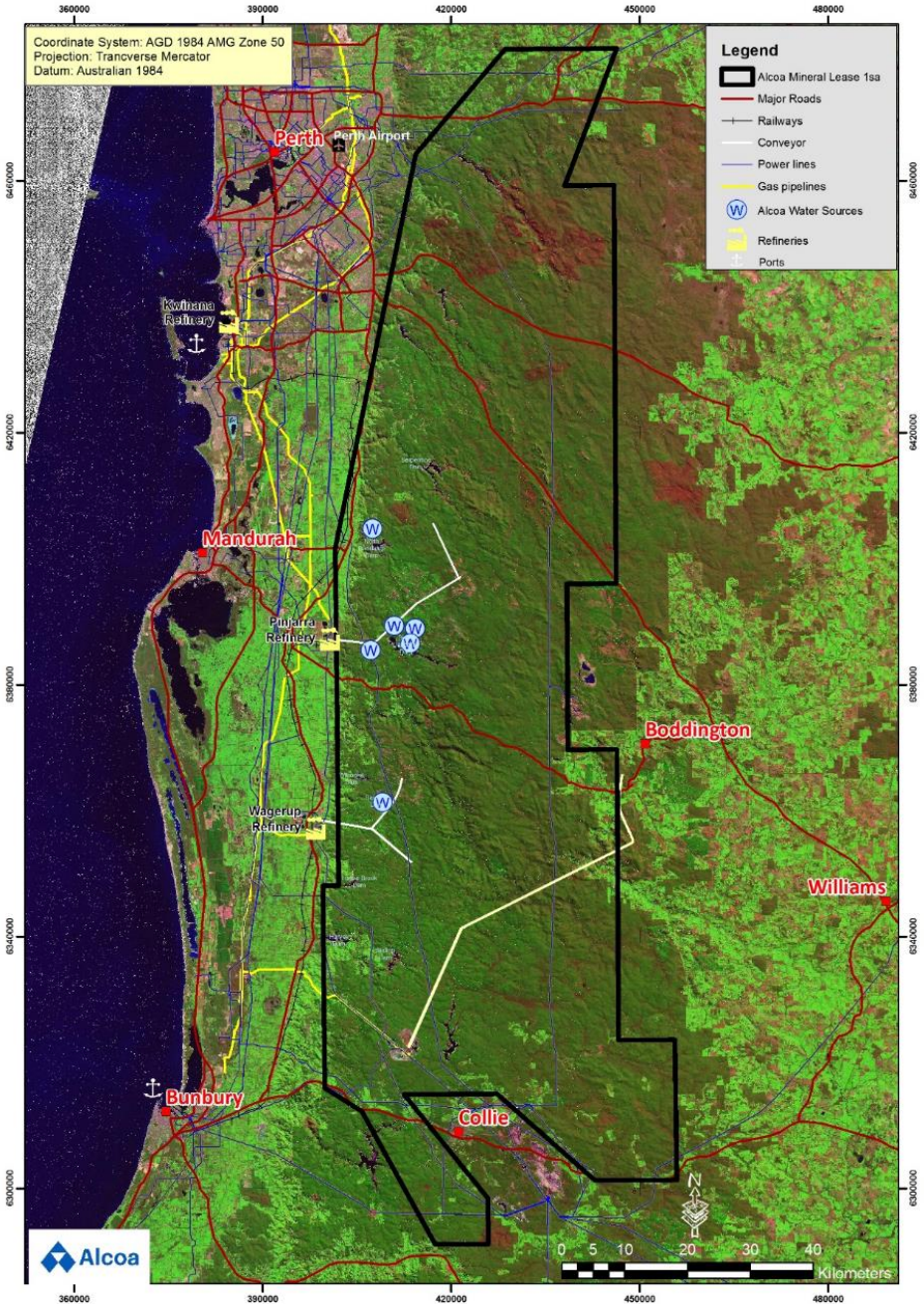


Figure 15-1: Infrastructure Layout (Alcoa, 2022)

15.1 Access Roads

The Darling Range is readily accessible via road from Perth and surrounding areas. The mines are near the towns of Pinjarra and Waroona. Both towns are easily accessible via the national South Western Highway, a sealed single carriageway road, which starts on the southern side of Perth and continues for almost 400 km to the southwest corner of Western Australia.

The Huntly mining area is accessible from the South Western Highway via Del Park Road, a sealed single carriageway road which connects the town of North Dandalup in the north with Dwellingup in the south. From Del Park Road, a further sealed road which follows the route of the bauxite conveyor to the Pinjarra refinery provides access to the Huntly site.

The Willowdale mining area is similarly accessible from the South Western Highway via Willowdale Road, a sealed single carriageway road to the south of Waroona.

Major haul roads have been established to each mining area. Roads are unsealed and require continuous ongoing maintenance which was observed during the site visit. Secondary haul roads, also unsealed, cross-cut each individual mining plateau.

15.2 Power

The Darling Range's Pinjarra refinery receives power from the South West Interconnected System (SWIS). The refinery also has internal generation capacity of 100 MW from 4 steam driven turbine alternators, with steam produced by gas fired boilers and a gas turbine Heat Recovery Steam Generator (HRSG). The refinery supplies power to the Huntly Mine by three different power supply lines (a single 33 kV and two 13.8 kV).

Willowdale Mine has a single 22 kV power supply fed from the Wagerup refinery. The Wagerup refinery is a net exporter of power to the SWIS, with internal generation capacity of 108 MW from three steam driven turbine alternators and one gas turbine. The steam is produced by gas fired boilers.

The power consumption of the Huntly operation is approximately 8,000 MWh to 9,000 MWh per month. The Willowdale power consumption is approximately 2,000 MWh per month.

15.3 Water

Water is used on the mines for dust suppression, dieback washdown, vehicle washdown, workshops, conveyor belt wash, construction, and domestic purposes. The water supplies for mining consist of licensed surface water sources supplemented with treated wastewater from vehicle washdowns, stormwater runoff and maintenance workshops.

The WA mines are licensed by the Department of Water and Environmental Regulation (DWER) to draw surface water from five locations to meet their water supply requirements. The Huntly mine draws water from Banksiadale Dam and Boronia Waterhole. Huntly mine also holds a license to draw water from Pig Swamp and Marrinup, however these resources are retained as a backup water supply and have not been utilized in recent years. Huntly mine is also permitted to draw water from South Dandalup Dam under an agreement with the Water Corporation. A pumpback facility from South Dandalup Dam to Banksiadale Dam is used to raise levels in Banksiadale Dam during periods of low rainfall runoff. Willowdale Mine draws water from Samson Dam.

Table 14-2 summarizes the license allocation for water usage. In 2021, water abstraction comprised approximately 74% of the total DWER license allocation (for those sites where abstraction occurred). An

additional 336,105 kL was also abstracted from South Dandalup Dam under the agreement with Water Corporation.

Table 15-1: Water Abstraction License Volumes

Site	Water source	Surface Water license	Annual Water Entitlement
Huntly	South Dandalup Dam	N/A	N/A
Huntly	Banksiadale Dam	SWL63409	500,000
Huntly	Pig Swamp Waterhole	SWL153635	30,000
Huntly	Boronia Waterholeon Marrinup Brook	SWL83356	70,000
Marrinup Nursery	Lot 908 on Marrinup Brook	SWL68893	45,000
Willowdale	Samson Dam	SWL61024	450,000

15.4 Accommodation Camp

There are no Alcoa accommodation facilities within the Darling Range. As described above, the Huntly and Willowdale mining areas are within proximity to established population centers including Pinjarra approximately 25 km to the West of Huntly and Waroona approximately 20 km West of Willowdale.

On site facilities includes offices, ablutions, crib-rooms, and workshops, all of which were observed to be in excellent condition.

15.5 Mine Waste Management

15.5.1 Tailings Disposal

No tailings are generated within the boundaries of the mining operations. The management of tailings generated downstream at the refineries is beyond the boundaries of the Darling Range mining operations and are therefore not considered in this TRS.

15.5.2 Waste Rock Disposal

Alcoa's Darling Range mining operations do not produce mine waste or "mullock" in the same manner as conventional mining operations and waste dumps are not constructed.

Overburden from Darling Range ore blocks is carefully segregated for later rehabilitation of adjacent, completed mining operations. Non-viable rock is used to backfill these shallow, completed pits and the viable topsoil spread on top and contoured. Jarrah forest is then re-established through seeding and the planting of nursery-raised seedlings. Water runoff from active and backfilled mining areas is contained and directed toward settlement ponds, which are later rehabilitated and seeded.

To date, some 20,000 ha of mined areas have been backfilled and reforested, which represents around 75% of the area mined since 1966, including areas reserved for long-term infrastructure. Rehabilitation standards are described in Alcoa's 2016 statutory Bauxite Mine Rehabilitation Completion Criteria. These completion criteria have been progressively revised since inception in the 1990s.

16.0 MARKET STUDIES

16.1 Overview

Alcoa Corporation is a vertically integrated aluminum company comprising bauxite mining, alumina refining, aluminum production (smelting and casting), and energy generation.

Through direct and indirect ownership, Alcoa Corporation has 27 locations in nine countries around the world, situated primarily in Australia, Brazil, Canada, Iceland, Norway, Spain, and the United States. Governmental policies, laws and regulations, and other economic factors, including inflation and fluctuations in foreign currency exchange rates and interest rates, affect the results of operations in these countries.

There are three commodities in the vertically integrated system: bauxite, alumina, and aluminum, with each having their own market and related price and impacted by their own market fundamentals. Bauxite, which contains various aluminum hydroxide minerals, is the principal raw material used to produce alumina. Bauxite is refined using the Bayer process to produce alumina, a compound of aluminum and oxygen, which in turn is the raw material used by smelters to produce aluminum metal.

Alcoa obtains bauxite from its own resources and processes over 85% of its combined bauxite production into alumina. The remainder is sold to the third-party market. In 2022, total Alcoa production was 42.1 million dmt (dry metric tonne) of bauxite.

Aluminum is a commodity that is traded freely on the London Metal Exchange (LME) and priced daily. Pricing for primary aluminum products is typically composed of three components:

(i) The published LME aluminum price for commodity grade P1020 aluminum;

(ii) The published regional premium applicable to the delivery locale; and

(iii) A negotiated product premium that accounts for factors such as shape and alloy.

Further, alumina is subject to market pricing through the Alumina Price Index (API), which is calculated by the Company based on the weighted average of a prior month's daily spot prices published by the following three indices: CRU Metallurgical Grade Alumina Price; Platts Metals Daily Alumina PAX Price; and Metal Bulletin Non-Ferrous Metals Alumina Index. As a result, the price of both aluminum and alumina is subject to significant volatility and, therefore, influences the operating results of Alcoa Corporation.

Unlike alumina and aluminum, bauxite is not a standard commodity traded on an index. Bauxite's grades and characteristics vary significantly by deposit location and the value of bauxite deposits for each downstream refinery could be different, based upon:

- refinery technology;
- the location of each refinery in relation to the ore deposit; and
- the cost of related raw materials to each refinery.

As such, there is no widely accepted index for bauxite. Most bauxite traded on the third-party market is priced using a value-in-use methodology. The key assumption for the value-in-use methodology is that both the (1) offered bauxite and the (2) comparative bauxite being used in the target refinery will generate the same refining cost. As such, using the known price for the comparative bauxite used in the

target refinery, the offered bauxite price will then be derived by considering the bauxite characteristics and quality differences between the offered and comparative bauxite.

16.1.1 Market Fundamentals

Bauxite is the principal ore of alumina (Al2O3), which is used to produce aluminum. Bauxite mining and alumina refining are the upstream operations of primary aluminum production. China is the largest third-party seaborne bauxite market and accounts for more than 90% of all bauxite traded. Bauxite is sourced primarily from Australia, Guinea, and Indonesia on the third-party market. In the long run, China is expected to continue to be the largest consumer of third-party bauxite with Guinea expected to be the majority supplier. Further, third-party traded bauxite is expected to be in surplus over the next decade, with most new mining projects announced recently being located in Guinea.

Bauxite characteristics and variations in quality heavily impact the selection of refining technology and refinery operating cost. A market bauxite with high impurities could limit the customer volume an existing refinery could use, resulting in a discount applied to the value-in-use price basis.

Besides quality and geography, market fundamentals, including macroeconomic trends – the prices of raw materials, like caustic soda and energy, the prices of Alumina and Aluminum, and the cost of freight – will also play a role in bauxite prices.

16.2 Market: Darling Range

16.2.1 Operation

The Darling Range mines are part of an integrated operation of two mines, three refineries and two ports. Prior to 2016, production from the Darling Range mines (Huntly and Willowdale) was used exclusively for consumption by the integrated refineries.

Bauxite is transferred from each mine to the refineries primarily via long distance conveyor belt, apart from the Kwinana refinery, which receives bauxite via railway. The Alumina produced by the three refineries is then shipped to external and internal smelter customers through two ports, based in Kwinana and Bunbury.

16.2.2 Pricing

In 2016, Darling Range entered into a 5-year third-party sales contract with a major alumina producer in China. Following the expiration of the third-party sales contract at the end of 2021, all bauxite production from Huntly and Willowdale was consumed internally by the Darling Range.

The pricing mechanism of the third-party sales contract was based on a value-in-use methodology (as described in Section 16-1) that was anchored to the customer's other bauxite sources at the time of execution, with a market adjustment factor linked to the Alumina price.

A price of $19/t has been utilized for 2022 with an estimate for economic market-based factors applied throughout the LOM.

16.3 Contracts

All Darling Range production is shipped via conveyor or train to one of the Alcoa's three Western Australia refineries.

Major operational contracts that are in place include, but are not limited to the following:

- Railway contract: Alcoa has a long-term contractual agreement with a third-party to deliver bauxite to one of its refineries. Pricing is based on a fixed rate schedule, payable on volume of bauxite delivered.
- Mining contractor contract: Alcoa has a long-term contractual agreement with a third-party to operate a designated mine region. The contractor is responsible for development, mining, hauling and rehabilitation of the designated mine pits; the contract runs a day-only operation. Pricing is based on a fixed rate schedule, payable on production tonnes.
- Rehabilitation contract: Alcoa has a long-term contractual agreement with a third-party to rehabilitate certain mined areas, ready for closure. Pricing is based on a fixed rate schedule, payable on equipment and labor hire rates.
- Fuel contract: Alcoa has a mid-term contractual agreement with a third-party to supply diesel fuel for mining operations. Pricing is based on market pricing for diesel, payable on volume consumed.

These types of contracts are typical of other similar mining operations.

17.0 ENVIRONMENTAL STUDIES, PERMITTING, AND PLANS, NEGOTIATIONS, OR AGREEMENTS WITH LOCAL INDIVIDUALS OR GROUPS

17.1 Environmental Studies

17.1.1 Existing Operations

Alcoa has established practices and processes for ensuring conformance to environmental requirements. Sensitive areas are identified and managed ahead of disturbance. Environmental factors are taken into account prior to infill drilling; hence, mining blocks carrying environmental risks do not feature in the Mineral Reserves (for example, areas around granite outcrops and water courses have a buffer applied and essentially no-go areas from a mining perspective).

The environmental reviews and approvals form part of the MMPLG approvals process outlined in Section 3.6.

Regarding existing operations, the threat of bushfires is the only significant naturally occurring risk identified. Bushfires have occurred in the past, but to date have not had a material impact on production.

The current plans are considered adequate and there are no other environmental, social, or permitting risks that affect the current mine operability or Reserve estimation.

Approvals for the mining of future resources are being evaluated under Part IV of the Western Australian Environmental Protection Act 1986 to ensure appropriate consideration of environmental constraints. Environmental constraints on the resource are being applied before deposit definition drilling (i.e. only includes material above the water table, that does not require redirection of surface water courses, impact heritage listed sites, etc.).

17.1.2 Future Mining Operations

Alcoa is modernizing its environmental approvals framework for its Huntly Bauxite Mine and Pinjarra Alumina Refinery, by referring future mining plans for assessment under Part IV of the Western Australian *Environmental Protection Act 1986* and the Australian *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The future mining plans that have currently been referred to both state and federal departments includes:

- The transition of Huntly Mine into the proposed Myara North and Holyoake mine regions within Alcoa's Mining Lease ML1SA (inclusive of bauxite for the Pinjarra Alumina Refinery and the Kwinana Alumina Refinery).

The Western Australian Environmental Protection Authority (State) has determined that the Pinjarra Alumina Refinery Revised Proposal (Assessment No. 2253), which includes the Huntly Bauxite Mine, will be assessed via a Public Environmental Review (PER).

Alcoa referred two separate Proposed Actions under the EPBC Act (Federal) for the following components:

- Huntly Bauxite Mine Transition – Myara North and Holyoake; and

- Pinjarra Alumina Refinery – development of water storage ponds and associated borrow pits.

The referred actions have been determined as Controlled Actions under the EPBC Act, and as such, require formal assessment.

The resulting Environmental Impact Assessments (EIAs) under State and Federal legislation will inform stakeholders on long-term mine plans and environmental management requirements and facilitate the setting of approval conditions.

Construction for Myara North will be commenced pursuant to the requirements of the Ministerial Decision, which will be issued upon completion of the EPA assessment process indicatively forecast for completion circa Q3 2024. Alcoa plans to commence construction, to facilitate the transition to Holyoake Central, from approximately 2028 and commence operation from approximately 2030.

Numerous baseline studies have now been completed to support approvals for future extensions to the mining footprint to the Myara North and Holyoake regions. Baseline studies are guided by the requirements of the Western Australian Environmental Protection Authority (EPA) and guidelines under the EPBC Act and are well understood. Several baseline environmental studies were undertaken in 2021 and 2022 within the Myara North and Holyoake mine development envelopes, to define the environmental values and constraints associated with:

- Flora and vegetation
- Short-range endemic vertebrates
- Aquatic and subterranean fauna
- Phytophthora dieback
- Terrestrial fauna and black cockatoo habitat
- Surface water
- Groundwater quality and dewatering drawdown
- Air quality
- Noise
- Landscape and visual impacts
- Historical and aboriginal heritage

Additional environmental studies were separately undertaken to identify regional environmental risks associated with PFAS in surface water catchments around the current and future Huntly and Willowdale operations.

17.2 Waste and Tailings Disposal, Site Monitoring, and Water Management

17.2.1 Waste and Tailings Disposal

No tailings are generated within the boundaries of the mining operations as bauxite processing residue is only generated at the refineries. Similarly, Alcoa's Darling Range mining operations do not produce mine waste or "mullock" in the same manner as conventional mining operations and as such waste dumps are not constructed.

Overburden from Darling Range ore blocks is carefully segregated for later contouring and rehabilitation of adjacent, completed mining operations. Caprock and other non-viable rock is used to backfill these shallow, completed pits and the viable topsoil spread on top, contoured, and revegetated.

As such, there is no requirement for the monitoring of any tailings or mine waste dumps associated within the mining operations as all tailings are processed outside the mine lease boundary.

17.2.2 Site Monitoring

Alcoa's mine sites are monitored in accordance with conditions of Government authorizations and its operational licenses at Huntly (L6210/1991/10) and Willowdale (L6465/1989/10). Environmental management and monitoring commitments exist for the following environmental aspects which have been assessed as being significant and therefore require operational controls as a minimum. The significant environmental aspects for which monitoring and/or management undertaken are:

- Chemical releases including loss of containment prevention and response and dangerous goods storage. All underground storage tanks have been removed from Alcoa's operations and are prohibited.
- Waste management and minimization.
- The management of mining within the lower rainfall zone to minimize risks of salinization of land and water resources.
- Surface water catchment protection for the nearby Public Drinking Water Source Areas (PDWSAs).
- Air emissions including:
    - Smoke pollution associated with wood waste
    - An ambient dust monitoring program to identify and quantify fugitive dust emissions from operating areas
    - Ozone depleting substances
- Hazardous materials management including asbestos, synthetic mineral fiber, polychlorinated biphenyls.
- Land including:
    - Recordkeeping and Geographical Information System (GIS) mapping of the location and timing of all soil removal, landscaping, soil return, ripping and seeding
    - Rehabilitation area monitoring to ensure the number of established plants meet the completion criteria targets associated with species enrichment, weed outbreaks and erosion
    - Dieback management, mapping and field identification
    - Forest and land clearing
- Flora and fauna.
- Aboriginal and European heritage.
- Environmental value of national parks, nature reserves and native forests.

- Visual amenity.
- Noise.

Outcomes of and compliance with the management and monitoring programs are tracked within Alcoa's Environmental Management System and reported within the Annual Environmental Review report. Review of the most recent report, JTSI Annual Environmental Review 2021 (dated August 2022), largely reported compliance with environmental commitments and success of operational controls to managed environmental objectives, with only the following reportable incidents noted:

- Four dieback breaches at Huntly and two dieback breaches at Willowdale were reported resulting in a downgrade to dieback status of vegetation. Two dieback events were the result of incorrect identification of dieback lines by operators in the field, and the other events were due to surface water flow from a dieback area to a dieback-free area. All incidences were investigated with corrective actions addressing the root causes actioned.
- Several surface water recordings of elevated turbidity were recorded for a period exceeding 1 hour above the reporting criteria (25 NTU). There were 30 turbidity events recorded at Huntly in 2021, 20 of which were confirmed to have been affected by mine site contributions. The remaining ten events did not have any mine site contributions identified. There were 14 turbidity events at Willowdale recorded in 2021, two of which had identified mining contributions. Four events had non-mining related contributions identified. The remaining eight events did not have an identified cause. All incidences were investigated with corrective actions addressing the root causes actioned where mining contributions were identified.
- Alcoa reported 105 loss of containment (LOC) events at Huntly and 49 LOC events at Willowdale in 2021. Reportable events (over 20L) were associated with LOC of diesel fuel and hydraulic oils, PFAS-free AFFF fire suppressants, and coolants largely associated with the mobile maintenance and operations fleet. In response to release events, a range of LOC reduction initiatives were developed to address common failure mechanisms within equipment fleets, to reduce the frequency of recurrence.
- Alcoa voluntarily reported nine incidents under *s.72* in 2021. Huntly Mine reported four PFAS-free AFFF releases and Willowdale Mine reported five PFAS-free AFFF releases. Alcoa completed a program to remove all AFFF fire suppressant foams which contained PFAS from all heavy vehicles (including contractor fleets) from both mine sites in 2021.

Alcoa is proactively working with key regulatory agencies to address operational incidents and implement operational improvements to reduce releases to the environment.

17.2.3 Water Management

Alcoa implements a comprehensive water management and monitoring program in accordance with the requirements of its surface water and operational licenses. Key components of Alcoa's water management and monitoring program include:

- Treatment of stormwater that may contain traces of hydrocarbons via a wastewater treatment system to concentrations that meet DWER license requirements prior to release
- Turbidity monitoring along tributaries to key catchments to prevent contaminated or turbid runoff into the drinking water supply

- Wastewater treatment and monitoring to meet DWER license requirements prior to release including treated water quality monitoring prior to release and continuous discharge volumes
- Surface water drainage management to prevent uncontrolled surface water runoff from operations to the surrounding forest and/or surface water bodies
- Implementation of the *Interim PFAS Water Management Strategy*
- Drainage protection management through the implementation of a Drainage Control Management Plan.
- Sewage management though a biological aeration treatment unit (BioMAX)
- Monitoring of cumulative water abstraction volumes at licensed and unlicensed surface water abstraction points in accordance with the *Surface Water License Operating Strategies* for Huntly and Samson Dam
- Potable water monitoring for identification of possible biological or chemical contamination
- Ecological water requirements (EWRs) have not been defined for the site however, Alcoa undertakes monitoring of the downstream environments to ensure no unacceptable impact. This is completed via photographic monitoring for Banksiadale Dam, Pig Swamp Waterhole, Boronia Dam and Marrinup Nursery
- Water use efficiency programs are implemented pertaining to wastewater recycling, efficient watering of haul roads, pumping and reusing water from roadside sumps, and effective mining planning to reduce dust suppression requirements
- A groundwater monitoring program commenced in H2 2022 across the Darling Range operations to support approvals and operational monitoring.
    - Alcoa will continue to expand its monitoring program, as necessary, if groundwater quality or quantity has been identified as potentially at risk due to operational or mining activities, or potential exists for mining to impact offsite/private groundwater supply quantity or quality.
    - Alcoa has a long-term groundwater research project within the Intermediate Rainfall Zone to evaluate potential impacts of clearing on groundwater salinization.

Baseline water quality monitoring has been undertaken at Myara North and Holyoake as part of the Part IV approvals process for these mining areas. It is anticipated that groundwater monitoring will be required as part of the operational license for these deposits.

17.3 Project Permitting

The environmental reviews and approvals form part of the MMPLG approvals process outlined in Section 3.6. Compliance with the MMPLG is demonstrated through an annual report submitted to the Department of Jobs, Tourism, Science and Innovation.

Operational matters at the Willowdale and Huntly mines are licensed by the Department of Water and Environmental Regulation via instruments L6465/1989/10 and L6210/1991/10, respectively. These licenses condition the processing of ore and reporting is required annually to DWER describing the total volume of bauxite crushed and any non-compliance. The latest available reporting at the time of writing is for calendar year 2021.

Compliance with the Alcoa ISO14001 accredited EMS was audited in December 2021, with recertification issued in May 2022. This recertification is valid until May 2025.

There are no known requirements to post performance or reclamation bonds.

17.4 Social or Community Requirements

Alcoa has established systems and processes for maintaining its social license to operate and was admitted to ICMM in 2019, aligning to its social performance requirements. Related to the requirements of the MMPLG, Alcoa's actions include an annual 5-year consultation process aligned with the 5 Year Mine Plan. The consultation process involves engaging with affected landowners. Alcoa's consultation extends to shires, as well as state and local government.

Where appropriate, the mine plan accommodates community requirements, in particular, concerns related to noise, dust, etc., and allows for buffer zones and modified working hours.

17.4.1 Community Consultation

Community consultation results (both in-bound [e.g. noise complaints] and out-bound [e.g. Alcoa-initiated engagement with stakeholder groups]) are recorded in the Community Consultation System (CCS). Annual targets for consultation are set based on current and proposed mine plans. CCS allocates and tracks follow-up actions.

In 2019, Alcoa engaged Ipsos to undertake stakeholder perception research among key stakeholders and communities to better understand perceptions and expectations of Alcoa and its operations in Western Australia. Three audiences were included in the benchmark wave of research: Perth Community, Host Community and Stakeholders. Two years later in 2021, a second wave of research was conducted with a focus on two of the three audiences from the benchmark wave: Perth Community and Host Community. A deep dive was added for two host communities, Jarrahdale and Dwellingup to understand community perception in greater detail in these communities. Results of the perception survey were detailed in the *Reputation Measurement and Management Wave 2 Report* (Ipsos, 2022). The benchmark research in 2019 revealed that while Alcoa had been successful in building and maintaining a strong reputation and associated social license in Western Australia, there was a growing need for its approach to stakeholder management to be modified in the face of evolving and increasing stakeholder expectations. The second wave of research in 2021 has revealed the community issues identified in 2019 intensified. These changing expectations mirror what is being experienced by the extractives sector locally and globally. A realization that mining is finite and a growing concern for the environment is driving host communities to demand a newly-defined social contract with resources companies. These issues are intensified for Alcoa given its proximity to the Perth metropolitan area, other towns and competing land users and uses, as well the fact that it operates within the jarrah forest and Perth's water catchment area.

Alcoa's move towards formal, publicly scrutinized environmental impact assessment and approval under the State and Federal acts (Section 3.6) for the extraction of future resources will provide greater transparency around Alcoa's future operations that should go some way to addressing the challenges it faces.

As described in 17.1, the threat of bushfires is a risk to operation and the local communities. Bushfire mitigation and firefighting activities within state forest are managed by the Department of Biodiversity Conservation and Attractions (DBCA). Alcoa maintains fire access tracks as required by the working arrangement with DBCA and complies with requirements of the Bushfires Act including seeking

exemptions for certain activities during Total Fire Bans. Asset protection zones are not mandated although Alcoa do maintain them around infrastructure as per internal standards to mitigate risk.

Alcoa owned private property is maintained to local government requirements as per the requirements of the Bushfire Act.

Alcoa operations look to add value to the communities where it operates and beyond. Through a drive for sustainable development and desire to support reputable non-profit and community based organizations, community investment supports partnerships and initiatives that look to long-term community benefits.

Each year the community partnership program invests in a wide variety of community programs at the local, state and national level. Some of these partnerships, including the acclaimed Three Rivers, One Estuary initiative are supported by Alcoa's global Alcoa Foundation.

In addition to community partnerships, employees are encouraged to participate each year in Alcoa Volunteers (volunteering as teams during work time) and employee giving programs.

17.4.2 Social Performance Management System

Alcoa is implementing a Social Performance Management System (SPMS) across its global operations. Alcoa has conducted a gap analysis of existing practices against best-in-class social management systems and defined a program to close these gaps, which are mostly related to developing a more structured approach to social risk management and formalizing Alcoa's social performance actions. Since 2022, Alcoa will focus on:

- Better understanding and engaging with our communities and stakeholder through:
    - Perception surveys
    - Community and stakeholder engagement plans
    - Socio-economic baselines
- Understanding and managing our risks, impacts, and opportunities through:
    - Social risk assessments
    - Social investment reviews
    - Social impact assessments
- Reviewing and improving existing processes including:
    - Social records and obligations
    - Grievances and complaints.

17.5 Mine Closure Requirements

Alcoa's Closure Planning group for Darling Range (located within the Global Planning Team) is responsible for developing the closure planning process as well as the subsequent Long-Term Mine Closure Plans (LTMCPs) of Alcoa's WA Mining Operations (Huntly and Willowdale). Closure Strategies, Schedules and Cost Estimates are being developed across organizational divisions and includes multidisciplinary inputs from Operations, Mid- and Short-term Planning, Finance, Centre for Excellence, Environment and Asset Management (both Fixed and Mobile Plant).

The agreed closure requirements for Darling Range centers around the return of Jarrah Forest across the site. End land uses are required to comply with the State's Forest Management Plan and include water catchment protection, timber production and biodiversity conservation. Closure criteria were revised in 2015 by the MMPLG for rehabilitation works commencing in and after 2016. These criteria do not apply to areas which commenced rehabilitation prior to 2015 and represent a 'step forward' in rehabilitation practices at Darling Rage. The criteria are structured into the following broad steps, with documented guidelines for acceptance, standards, and corrective active actions:

- Planning
- Rehabilitation Earth Works
- Early Establishment – first 5 years
- Vegetation - 12 years and over.

As described in Section 15.5.2, overburden is used to backfill adjacent, completed mining operations and the topsoil spread on top and contoured. Maximum slopes (angle and length) are defined in the 2015 Criteria. If topsoil has been harvested and stored for up to three months prior to use as a rehabilitation input it is considered 'direct-return' and seeding may not be undertaken. If it is older than 3 months, it is considered 'fallow' and requires seeding. Nursery-raised seedlings are also used in rehabilitated areas.

Current rehabilitation practices and closure planning have evolved positively since the 1990s.

Mine closure costs are described in Section 18.0.

17.6 Local Procurement and Hiring

The Alcoa procurement system defines "local" as the localities of Dwellingup, Harvey, Pinjarra, Waroona, Coolup, North Dandalup, Jarrahdale and Yarloop. Within Alcoa's guidelines of safe, ethical, and competitive business practices, they state they will:

- Invite capable local business to bid on locally supplied or manufactured goods or services.
- Give preference to local business in a competitive situation.
- Work with local business interest groups to identify and utilize local suppliers.
- Where possible, structure bids to enable local supplier participation.

Alcoa also endeavors to add value to Traditional Owners and the local economy through the use of businesses owned by Traditional Owners, businesses that employ and work with Traditional Owners and locally owned businesses. Alcoa will help Traditional Owner businesses and local businesses to do business with Alcoa and encourage the employment of Traditional Owner and local labor and have made a policy commitment to:

- Invite capable local Traditional Owner, Aboriginal and Torres Strait Islander and Local businesses to bid on every locally supplied or manufactured good or service.
- Give preference to Traditional Owner, Aboriginal and Torres Strait Islander and Local businesses in a competitive situation.
- Tender evaluations shall apply a minimum weighting of 10 per cent for Traditional Owner, Aboriginal and Torres Strait Islander and Local businesses.

- Work with Traditional Owner, Aboriginal and Torres Strait Islander and Local business interest groups to identify, utilize and build local supplier capability.
- Offer reduced Payment Terms to support the growth and sustainability of Traditional Owner, Aboriginal and Torres Strait Islander and Local business.

18.0 CAPITAL AND OPERATING COSTS

Alcoa forecasts its capital and operating costs estimates based on annual budgets and historical actuals over the long life of the current operation. All values are presented in United States Dollars ($) unless otherwise stated.

18.1 Capital Costs

The operation is well-established, and the LOM plan does not envisage any significant change of the production rate over the LOM. Anticipated future major capital expenditure is related to major mine moves and sustaining the on-going operations.

Projected capital expenditure over the next nine years of mine life is estimated to total $603 million. Of this total, $158 million is associated with the completion of the mine move to the Myara North site and $241 million is estimated for the Holyoake move.

A breakdown of the major expenditure areas and other sustaining capital expenditure over the next nine years of mine life (2023 – 2031) is shown below.

Table 18-1: LOM Sustaining Capital Costs by Area

Project	Cost $ Million	Percentage of Total
Mine Moves	399	66.2%
Conveyor Belt Replacements	69	11.4%
Haul Road Improvements	55	9.1%
Other Sustaining capital	80	13.3%
Total	**603**	**100%**

Other capital costs are for replacement of conveyors, haul road improvements and other sustaining capital needed to continue the operations.

Alcoa's sustaining capital estimates for Darling Range are derived from annual budgets and historical actuals over the long life of the current operation. According to the American Association of Cost Engineers (AACE) International, these estimates would generally be classified as Class 1 or Class 2 with an expected accuracy range of -3% to -10% to +3% to +15%.

18.2 Operating Costs

The main production mining operations are primarily Owner-operated using Alcoa equipment and employees. Contractors are also used for certain activities on site.

The operating costs are based on historical actual site cost data and, in the opinion of the QP, represent an accuracy range of -10% to +15%.

No items have been identified that would significantly impact operating costs either positively or negatively over the life of mine. Minor year-to-year variations should be expected based upon

maintenance outages and production schedules. Forecast costs for 2023 and average mine operating costs the nine-year LOM are shown below in Table 18-2.

Table 18-2: LOM Mine Operating Costs by Category*

Cost Centre	2023 ($/wmt)	Average LOM ($/wmt)	Percentage of Operating Cost (%)
Direct Labor	$3.43	$4.87	38%
Services	$2.07	$1.88	15%
Other	$1.45	$2.21	17%
Corporate Chargebacks for support services	$0.53	$0.59	5%
Energy	$0.34	$0.37	3%
Fuel	$0.37	$0.67	5%
Operating Supplies and Spare Parts	$0.44	$0.69	5%
Maintenance (fixed plant and mobile fleet	$1.06	$1.67	13%
Mine Operating Cash Cost ($/wmt)	**$9.70**	**$12.95**	**100%**
Off-site Costs			
G & A, selling and other expenses	$0.28	$0.24	
R & D Corporate Chargebacks	$0.03	$0.03	
Total Cash Operating Costs	**$10.01**	**$13.21**	

*Due to rounding, numbers presented may not add up precisely to the totals provided.

Services costs includes contractor costs for certain mining activities such as in noise sensitive areas and for haul road construction services, in select areas of pit development, and during landscaping activities for rehabilitation after mining.

As of December 2022, the Huntly and Willowdale operations together employ a total of 887 employees consisting of 48 technical, 77 management and 762 operations employees. Additionally, 67 employees are centrally employed on the combined operations.

Table 18-3 summarizes the current workforce for the operations.

Table 18-3: Workforce Summary

Category	Technical	Management	Operations	Total
Huntly	37	50	524	611
Willowdale	11	27	238	276
Central	18	8	41	67
Total	**66**	**85**	**803**	**954**

As regards mine closure, compensation for vegetation clearing is paid in advance and rehabilitation is an ongoing process that is incorporated into the mining cost (as part of Asset Retirement Obligations (ARO)).

19.0 ECONOMIC ANALYSIS

19.1 Economic Criteria

Alcoa prepares a rolling operational Ten-Year Mine plan for the purposes of long-term mine and business planning.

In accordance with the requirements of SK-1300, the economic analysis presented in this section of the TRS is based on mining the estimated Proven and Probable Mineral Reserves, which generate a current mine life of nine years (2023 to 2031 inclusive) at an average production rate of 34.5 Mtpa (dry tonnes).

It is noted that production is driven by refinery requirements rather than mine plan output, so annual fluctuations in mined tonnage are constrained by refinery demand and operation rather than a mining schedule. Therefore, tonnages used in the model are based on forecasted refinery consumption rather than mine plan outputs. The QP is satisfied that this approach is standard operating practice for Alcoa and there is sufficient Proven and Probable Reserve tonnage available to cover the extent of the 9-year model life.

In addition, the QP recognizes that Alcoa undertakes on-going infill drilling to annually convert Mineral Resources to Reserves and based on Alcoa's long operating history at the mine, the scale of the deposits available, and the historical success of Resource to Reserve conversion, the QP sees no reason why the life of the operation will not be extended well beyond 2031.

The assumptions used in the analysis are current at the end of December 2022.

An un-escalated technical-economic model was prepared on an after-tax DCF basis, the results of which are presented in this section.

The cashflow is presented on a 100% attributable basis. Alcoa uses a 12.25% discount rate for DCF analysis. The QP is of the opinion that a 12.25% discount/hurdle rate for after-tax cash flow discounting of such large-scale bauxite operations in Western Australia is reasonable and appropriate.

Key criteria used in the analysis are discussed elsewhere throughout this TRS. General assumptions used are summarized in Table 19-1.

Table 19-1: Technical-Economic Assumptions

Description	Value
Start Date	January 1, 2023
Mine Life based on Mineral Reserves	9 years
Average LOM Price Assumption	$21.00
Total Operating Costs	$4,330.6 million
Capital over nine years	$603.2 million
Income tax	$472.5 million
Discount Rate	12.25%
Discounting Basis	End of Period
Inflation	0%

Description	Value
Corporate Income Tax Rate	30%

Table 19-2 provides a summary of the estimated mine production over the nine-year mine life.

Table 19-2: LOM Production Summary

Description	Units	Value
Total ROM Ore	Mt	327.8
Waste Mined	Mt	65.6
Total Material Moved	Mt	393.4
Annual Average Ore Mining Rate	Mtpa	36.4

19.2 Cash Flow Analysis

The indicative economic analysis results, presented in Table 19-3, indicate an after-tax NPV of $463.9 million at a 12.25% discount rate and an average bauxite price of $21.00/t, over the 9-year period.

The cashflow is presented on a 100% attributable basis.

Capital identified in the economics is for sustaining operations and plant rebuilds as necessary.

Project economic results and estimated cash costs are summarized in Table 19-3. Annual estimates of mine production with associated cash flows are provided for years 2023 to 2031.

The economic analysis was performed using the estimates presented in this TRS and confirms that the outcome is a positive cash flow that supports the statement of Mineral Reserves.

Table 19-3: LOM Indicative Economic Results

Asset	Huntly									
Operating Case (Base Data)	Base Case									
Price Scenario	WA - Custom									
		1	2	3	4	5	6	7	8	9
		30/06/2022	30/06/2023	30/06/2024	30/06/2025	30/06/2026	30/06/2027	30/06/2028	30/06/2029	30/06/2030
	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
Key Assumptions										
InterCo Bauxite ($/t)	$19.00	$19.38	$19.77	$20.16	$20.57	$20.98	$21.40	$21.83	$22.26	$22.71
Third Party Bauxite ($/t)	$23.00	$23.50	$24.00	$24.50	$24.50	$25.00	$25.50	$26.50	$27.00	$27.00
Australia (AUD/USD)	$1.28	$1.28	$1.28	$1.28	$1.28	$1.29	$1.29	$1.30	$1.30	$1.31
Brazil (BRL)	$5.48	$5.25	$5.29	$5.33	$5.39	$5.46	$5.53	$5.61	$5.68	$5.75
Tax Rate (%)	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Minority Interest (% not owned by Alcoa)	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Production										
InterCo Production (Mt)	34,190,501	32,045,204	35,718,266	36,118,370	37,275,149	37,526,957	37,778,450	37,441,247	36,923,130	36,934,145
Third Party Production (Mt)	0	0	0	0	0	0	0	0	0	0
Total Production (Mt)	34,190,501	32,045,204	35,718,266	36,118,370	37,275,149	37,526,957	37,778,450	37,441,247	36,923,130	36,934,145
Income Statement										
Sales	$649,619,527	$621,036,057	$706,064,387	$728,252,961	$766,608,574	$787,223,069	$808,348,738	$817,156,263	$821,965,294	$838,654,732
Cost of goods sold	$350,519,573	$310,683,297	$395,201,830	$495,339,878	$512,232,965	$575,447,040	$573,150,425	$500,002,443	$430,497,874	$450,382,228
Selling, general administrative, and other expenses	$8,272,242	$8,838,834	$8,865,431	$8,865,431	$8,847,735	$8,812,485	$8,777,376	$8,742,406	$8,707,575	$8,672,884
Research and development expenses	$893,590	$954,795	$957,668	$957,668	$955,757	$951,948	$948,156	$944,378	$940,616	$936,869
Provision for depreciation, depletion, and amortizati	$84,540,884	$70,875,065	$85,425,122	$129,360,130	$126,718,540	$121,665,349	$119,733,309	$115,636,417	$111,450,910	$108,878,679
Total costs and expenses	$444,226,290	$391,351,991	$490,450,051	$634,523,107	$648,754,997	$706,876,822	$702,609,266	$625,325,643	$551,596,975	$568,870,659
Income (loss) before income taxes	$205,393,237	$229,684,065	$215,614,336	$93,729,854	$117,853,576	$80,346,247	$105,739,472	$191,830,620	$270,368,319	$269,784,073
Provision for income taxes	$61,617,971	$68,905,220	$64,684,301	$28,118,956	$35,356,073	$24,103,874	$31,721,842	$57,549,186	$81,110,496	$80,935,222
Net income (loss)	$143,775,266	$160,778,846	$150,930,035	$65,610,898	$82,497,503	$56,242,373	$74,017,630	$134,281,434	$189,257,823	$188,848,851
Less: Net income attributable to noncontrolling inter	$57,510,106	$64,311,538	$60,372,014	$26,244,359	$32,999,001	$22,496,949	$29,607,052	$53,712,573	$75,703,129	$75,539,540
Net Income (Loss) Attributable to Alcoa Corpo	$86,265,160	$96,467,307	$90,558,021	$39,366,539	$49,498,502	$33,745,424	$44,410,578	$80,568,860	$113,554,694	$113,309,311
EBITDA	$289,934,121	**$300,559,130**	**$301,039,458**	**$223,089,983**	**$244,572,117**	**$202,011,595**	**$225,472,781**	**$307,467,036**	**$381,819,229**	**$378,662,752**
EBIT	$205,393,237	**$229,684,065**	**$215,614,336**	**$93,729,854**	**$117,853,576**	**$80,346,247**	**$105,739,472**	**$191,830,620**	**$270,368,319**	**$269,784,073**
Statement of Cash Flows										
Income before NCI	$143,775,266	$160,778,846	$150,930,035	$65,610,898	$82,497,503	$56,242,373	$74,017,630	$134,281,434	$189,257,823	$188,848,851
Depreciation, depletion, and amortization	$84,540,884	$70,875,065	$85,425,122	$129,360,130	$126,718,540	$121,665,349	$119,733,309	$115,636,417	$111,450,910	$108,878,679
Working capital change	$484,231	$18,809,748	$3,894,519	$10,729,955	$2,679,216	$20,946,251	-$7,131,191	-$22,861,677	-$13,946,909	$1,669,754
Other (Cash from Operations)	-$50442390	-63,638,365	-$66725068	-$69172310	-$68240990	-$71072005	-$70503752	-$69769309	-$70777867	-$71269875
Cash from Operations	$178,357,991	**$186,825,294**	**$173,524,611**	**$136,528,672**	**$143,654,269**	**$127,781,967**	**$116,115,996**	**$157,286,864**	**$215,983,957**	**$228,127,409**
Distributions to NCIs	-$ 71,343,196	-$ 74,730,117	-$ 69,409,844	-$ 54,611,469	-$ 57,461,708	-$ 51,112,787	-$ 46,446,399	-$ 62,914,746	-$ 86,393,583	-$ 91,250,964
Contributions from NCIs	$19,232,995	$37,701,778	$32,501,176	$33,501,665	$36,040,625	$54,353,485	$21,634,889	$9,154,184	$8,865,583	$7,516,461
Cash from Financing	-$ 52,110,202	**-$ 37,028,339**	**-$ 36,908,668**	**-$ 21,109,804**	**-$ 21,421,083**	**$3,240,699**	**-$ 24,811,509**	**-$ 53,760,562**	**-$ 77,528,000**	**-$ 83,734,502**
Capital expenditures	-$ 48,082,486	-$ 94,254,445	-$ 81,252,940	-$ 83,754,163	-$ 90,101,561	-$ 135,883,714	-$ 54,087,224	-$ 22,885,459	-$ 22,163,956	-$ 18,791,153
Other (Cash from Investing)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash from Investing	-$ 48,082,486	**-$ 94,254,445**	**-$ 81,252,940**	**-$ 83,754,163**	**-$ 90,101,561**	**-$ 135,883,714**	**-$ 54,087,224**	**-$ 22,885,459**	**-$ 22,163,956**	**-$ 18,791,153**
Consolidated Free Cash Flow	$130,275,505	**$92,570,849**	**$92,271,670**	**$52,774,510**	**$53,552,708**	**-$ 8,101,747**	**$62,028,773**	**$134,401,405**	**$193,820,001**	**$209,336,256**
NPV	**$463,947,047**	$82,468,462	$73,231,121	$37,313,429	$33,731,530	-$ 4,546,183	$31,008,095	$59,854,852	$76,896,716	$73,989,025

19.3 Sensitivity Analysis

Project risks can be identified in both economic and non-economic terms. Key economic risks were examined by running cash flow sensitivities. The operation is nominally most sensitive to market prices (revenues) followed by operating costs (Figure 19-1).

NPV $M OPEX	80%	90%	100%	110%	120%
9.00%	$936.97	$738.57	$540.18	$341.78	$143.39
11.00%	$856.01	$673.60	$491.18	$308.77	$126.35
12.25%	$810.71	$637.33	**$463.95**	$290.56	$117.18
13.00%	$785.28	$617.00	$448.72	$280.44	$112.16
14.00%	$753.26	$591.44	$429.61	$267.79	$105.97

NPV $M CAPEX	80%	90%	100%	110%	120%
9.00%	$627.42	$583.80	$540.18	$496.56	$452.93
11.00%	$572.98	$532.08	$491.18	$450.28	$409.38
12.25%	$542.61	$503.28	**$463.95**	$424.61	$385.28
13.00%	$525.60	$487.16	$448.72	$410.28	$371.84
14.00%	$504.21	$466.91	$429.61	$392.31	$355.01

NPV $M Bx Price	80%	90%	100%	110%	120%
9.00%	($91.05)	$224.56	$540.18	$855.79	$1,171.41
11.00%	($89.47)	$200.86	$491.18	$781.51	$1,071.83
12.25%	($88.17)	$187.89	**$463.95**	$740.00	$1,016.06
13.00%	($87.29)	$180.71	$448.72	$716.73	$984.74
14.00%	($86.04)	$171.79	$429.61	$687.44	$945.27

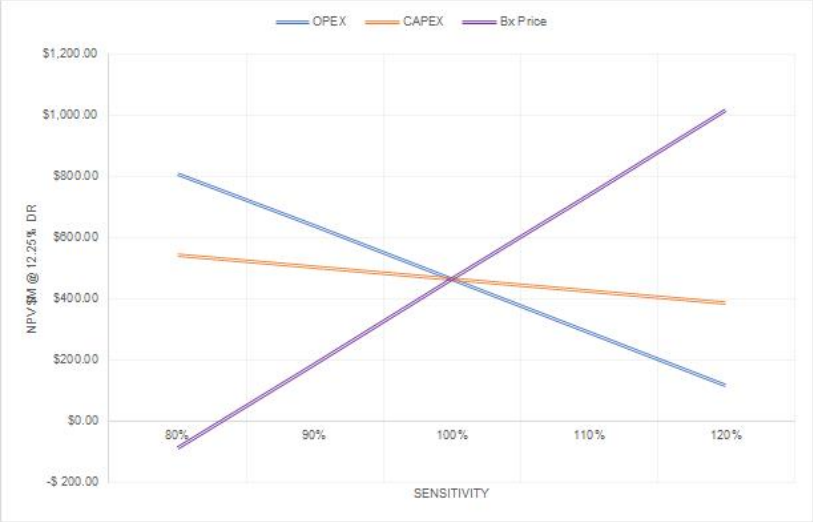


Figure 19-1: Sensitivity Analysis (NPV)

20.0 ADJACENT PROPERTIES

The Darling Range has no material adjacent properties.

21.0 OTHER RELEVANT DATA AND INFORMATION

No additional information or explanation is necessary to make this Technical Report Summary understandable and not misleading.

22.0 INTERPRETATION AND CONCLUSIONS

22.1 Geology and Mineral Resources

- SLR is independently declaring the 31 December 2022 Mineral Resources for the defined bauxites located within Alcoa's Darling Range deposits. The Mineral Resource models were prepared by Alcoa using their in-house estimation procedures and reviewed extensively by SLR.
- As of December 31, 2022, exclusive of Mineral Reserves, as summarized in Table 11-5 at an appropriate level of precision reflecting confidence, the Measured Mineral Resources are estimated to be 44.9 Mt at a grade of 31.2% available alumina (A.Al2O3) and 1.15% reactive silica (R.SiO2). Similarly the Indicated Mineral Resources are estimated to be 51.8 Mt at 31.4% A.Al2O3 and 1.17% R.SiO2, and the Inferred Mineral Resources are estimated to be 140.3 Mt at 32.9% A.Al2O3 and 1.26% R.SiO2.
- Drill sampling and sample control procedures at Alcoa's Darling Range Bauxite Operations are adequate and appropriate for use in the estimation of Mineral Resources. The defined volumes and grades of mineralization are not expected to be systematically impacted (biased) by errors in either the collar location or the 3D sample location.
- The QA/QC of sample preparation and assaying is adequate, and the assay results are suitable for use in Mineral Resource estimation.
- Analytical procedures used for the Alcoa Mineral Resource comprises part of conventional industry practice. FTIR is not widely used yet in the bauxite industry but is becoming more widely accepted and applied to more operations. At Alcoa the method has been consistently applied successfully for a decade and is routinely validated by industry standard XRF and wet chemical procedures as discussed in Section 8.3 and 8.4. It is the opinion of the QP from the studies on FTIR repeatability discussed above that the overall precision and accuracy of the FTIR assaying is acceptable.
- The database is adequate, and the data is appropriate for the purpose of Mineral Resource estimation.
- The continuous improvements in the geological modelling, estimation techniques, and block model migration to the 3D approach are appropriate and constantly improve the confidence level and precision of the Mineral Resources.
- The dry bulk density data is less well controlled than other analytes, although different attempts were taken since 1980. However, based on the different reconciliation approaches and on the fact that the polygonal and GSM model have lower confidence level, the density values are acceptable for the Resource estimation.
- The condition of Reasonable Prospects for Economic Extraction is met by constraining the Mineral Resource model using the ArcGIS system, by ensuring that the model defines key parameters for the refinery, and by sound reconciliation practices providing feedback that the modelling is appropriate for the purpose.

22.2 Mining and Mineral Reserves

- As of December 31, 2022, Proven Mineral Reserves are estimated to total 145.8 Mt at 31.4% A.Al2O3 and 1.17% R.SiO2 and Probable Mineral Reserves are estimated to total 255.8 Mt at 32.4% A.Al2O3 and 1.15% R.SiO2.
- The QP has used the December 31, Mineral Resource estimate as the basis for its Mineral Reserve estimate. The bauxite operations are operating mining projects with a long history of production for which establishment capital has been repaid and for which sustaining capital and supported operating costs have been observed to be applied in economic analysis. Consequently, the QP considers that support by a Feasibility Study is demonstrated by the demonstrable history of profitable operation and the level of technical support for the Modifying Factors. The QP has reviewed the operating and planning procedures and parameters for the operations.
- The QP considers that the accuracy and confidence in the Mineral Reserve estimate to be appropriate for the classification applied, which is supported by both the conservative operational processes and the long operational history.
- The QP is not aware of any risk factors associated with, or changes to, any aspects of the Modifying Factors such as mining, metallurgical, infrastructure, permitting, or other relevant factors that could materially affect the Mineral Reserve estimate.

22.3 Mineral Processing

- The operating data between 2010 to 2022 indicates that the product from the Darling Range operations consisted of an average A.Al2O3 grade of 33%, with R.SiO2 below the target for refinery feed.
- The QP is of the opinion that the Darling Range operation demonstrated that ore can be effectively crushed and supplied to a refinery for further upgrading to produce alumina. The historical operational data confirmed that the ore consistently met refinery specifications without any deleterious elements.
    - Based on this, and additional information provided by Alcoa regarding the mine plan, it is reasonable to assume that the ore from Darling range can be economically processed for the next 10 years.

22.4 Infrastructure

- The Darling Range mining operations have established and operational infrastructure, with mining hubs that host administrative offices, as well as crushing facilities and maintenance facilities.
    - Hubs are relocated periodically as production moves away from the hub and transportation costs increase. These relocations are well-understood with planning and associated budgeting occurring well in advance of relocations; production restarted seven days after the shutdown.
- An extensive haul road network, rail, and overland conveyors transport crushed bauxite from the Hub to the refineries.

- Bauxite is transferred from each mine to the refineries primarily via long distance conveyor belt, apart from the Kwinana refinery which receives bauxite via railway.
- Alumina produced by the three refineries is then shipped to external and internal smelter customers through the Kwinana and Bunbury ports.

- The Huntly and Willowdale mines are located near the towns of Pinjarra and Waroona respectively. These are easily accessible via the national South Western Highway, a sealed single carriageway road, spanning almost 400 km from the southern side of Perth to the southwest corner of Western Australia.
- Major haul roads have been established to each mining area, while secondary haul roads, cross-cut each individual mining plateau. Roads are unsealed and require continuous maintenance.
- The Darling Range's Pinjarra refinery receives power from the South West Interconnected System (SWIS), but also has internal generation capacity of 100 MW from four steam driven turbine alternators, with steam produced by gas fired boilers and a gas turbine Heat Recovery Steam Generator (HRSG).
  - The refinery supplies power to the Huntly Mine by a 33,000 volt power supply line and two 13,800 volt lines.
- The Wagerup refinery is a net exporter of power to the SWIS, with internal generation capacity of 108 MW from three steam driven turbine alternators and one gas turbine; steam being generated by gas fired boilers.
  - The refinery supplies power to the Willowdale Mine by a single 22,000 volt power supply.
- Water is used on the mines for dust suppression, dieback washdown, vehicle washdown, workshops, conveyor belt wash, construction, and domestic purposes.
  - The water supplies for mining consist of licensed surface water sources supplemented with treated wastewater from vehicle washdowns, stormwater runoff and maintenance workshops.
  - In 2020, water abstraction comprised approximately 74% of the total Department of Water and Environmental Regulation license allocation (for those sites where abstraction occurred). An additional 336,105kL was also abstracted from South Dandalup Dam under the agreement with Water Corporation.
- On site facilities include offices, ablutions, crib-rooms, and workshops, however there are no Alcoa accommodation facilities, as the Huntly and Willowdale mining areas are close to established population centers.
- No tailings are generated within the boundaries of the mining operations. The management of tailings generated downstream at the refineries is beyond the boundaries of the Darling Range mining operations and are therefore not considered in this TRS. Waste rock is used to backfill shallow completed before covering with topsoil and reforesting.

22.5 Environment

- Alcoa has established processes to facilitate conformance with environmental requirements, while identifying sensitive areas ahead of time enables them to be managed ahead of disturbance.
- Overburden is carefully segregated for later contouring and rehabilitation of adjacent, completed mining operations. Caprock and other non-viable rock is used to backfill these shallow, completed pits and the viable topsoil spread on top, contoured, and revegetated.
- Bauxite processing residue is only generated at the Refineries, with no tailings generated within the boundaries of the mining operations. Absence of mine waste prevents the need for waste dump construction and monitoring.
- Site monitoring is completed in accordance with conditions of government authorizations and operational licenses at Huntly and Willowdale.
- A groundwater monitoring program commenced in H2 2022 across the Darling Range operations to support approvals and operational monitoring.
    - Alcoa will continue to expand its monitoring program, as necessary, if groundwater quality or quantity has been identified as potentially at risk due to operational or mining activities, or potential exists for mining to impact offsite/private groundwater supply quantity or quality.
    - Alcoa has a long-term groundwater research project within the Intermediate Rainfall Zone to evaluate potential impacts of clearing on groundwater salinization.
- Outcomes of and compliance with the management and monitoring programs have most recently been reported within the 2021 Annual Environmental Review report. Consistent with the outcomes reported between 2018 and 2020:
    - Review of the most recent report, published for 2021 largely reported compliance with environmental commitments and success of operational controls to managed environmental objectives.
- Baseline water quality monitoring has been undertaken at Myara North and Holyoake as part of the Part IV approvals process for these mining areas. It is anticipated that groundwater monitoring will be required as part of the operational license for these deposits.
- Outcomes of and compliance with the management and monitoring programs have most recently been reported within the 2021 Annual Environmental Review report. Consistent with the outcomes reported between 2018 and 2020:
    - Review of the most recent report, published for 2021 largely reported compliance with environmental commitments and success of operational controls to managed environmental objectives.
    - Only a small number of reportable environmental incidents were noted for which corrective actions have been proactively undertaken by Alcoa.

23.0 RECOMMENDATIONS

23.1 Geology and Mineral Resources

It is apparent to the QP that the long history of exploration, development and mining of Alcoa's Darling Range bauxite tenements have established sound knowledge and understanding of the geology and mineral endowment. The QP has not identified any fatal flaws in the current practices of mapping (based on the ArcGIS system), drill sampling (based on progressive continuous improvement), assaying (based on calibrated and validated FTIR, with reasonable quality control), estimation (3DBM), database management (using acQuire), the application of mining criteria that assure Reasonable Prospects for Economic Extraction (RPEEE), and the application of constraints establishing forestry, heritage and noise limits to the Mineral Resource definition. The following recommendations are offered as suggestions for further improvement, aligned with Alcoa's comprehensive approach to research and development (seen for example in the evolution of their drilling, sampling and assaying technologies). These recommendations are prioritized in terms of their perceived value to the overall operation:

- Continuing to replace the GSM and polygonal areas to the 3D block modelling methodology, using a script-based semi-automated approach, which enables more robust rapid model building. The validation of interpolation parameters using risk-based (conditional simulation) techniques to quantify confidence should be considered.
- To improve the reporting of recoverable resources, a re-blocked block model to a minimum practical mining scale or single mining unit (SMU) should be considered. Economical parameters considering more flexible costs and bauxite prices related to the Mineral Reserves can also be implemented in the Mineral Resources workflow, aiming to optimize the bauxite mineable portion including potential marginal grades.
- Investigate whether the 5% bias in the tonnage between the As Mined and sampling tower weightometers is persistent in the 3D block models.
- Further redrilling or where viable re-assaying of pulps
- Implementation of a mine wide reconciliation system should be considered as a way to overcome the issue of density estimation. This could be integrated with the extensive production tracking data already available from the current fleet management system and operational control system (covering the mining equipment, crushers, conveyors, sampling towers, stockpile stackers and reclaimers).
- To include volume surveys using drones and truck gantry scanning, wet mass measurement using weightometers on conveyors and LoadRite sensors on mining equipment, and infra-red moisture determination, mean that better in situ dry density estimation may become possible if the operation requires it for better refinery feedstock control.
- The QP considers that twinned hole studies are of limited value and should only be implemented once the sample splitting and preparation demonstrates good repeatability, using field duplicates (or the equivalent STE samples). They may be of value to investigate specific issues under closely supervised conditions.

- While the STE procedure could be retained for specific studies, in the QP's opinion, the reintroduction of field duplicates using appropriate riffle splitters under supervision should be considered.
- The QP is of the opinion that the grade characteristics of the bauxite profile could be reproduced in the model, which enables optimization techniques to be used for the definition of mining floors and boundaries, better support for ore loss and dilution studies, and more accurate reconciliation studies.

23.2 Mining and Mineral Reserves

- Currently a dilution and mining recovery factor is applied to the final Reserves to reconcile the tonnes and grade. The QP recommends applying dilution and ore loss at the re-blocked model level before performing the optimization and reporting these values independently.
- The life-of-mine scheduling requires further refinement with regards to sequencing of the different mining areas and assigning the scheduled years back to the OreBest model (the mining output that defines Reserves).
- The QP recommends detailed haulage analysis focusing on haulage profiles and cycle times to provide more accurate operating costs.
- The QP noted the mining models were in both a 2D grid and 3D model system. Aligning all the mining models within the same 3D mining model system will provide clarity and consistency across Darling Range project with regards to evaluation and reporting processes.

23.3 Mineral Processing

As mentioned in Section 22.3, the historical operational data for the Darling Range demonstrate that ore consistently met refinery specifications.

Ideally, independent verification of sample analysis is conducted, by a certified laboratory, on a structured program, in order to ensure the QA/QC aspects of the internal analysis. Within this process a proportion of samples from each batch could be sent to the independent laboratory for analysis and the results can be compared with the internal analysis.

The QP is appreciative that the mine is operational meaning a trade-off versus logistics / practicality would need to be carried out.

23.4 Infrastructure

The Darling Range mining operations have well established infrastructure, with mining hubs that are periodically moved to reduce transportation distances between mining operations and the hubs. The QP makes no recommendations regarding infrastructure.

23.5 Environment

Alcoa has established systems to facilitate adherence to environmental commitments. The QP recommends that the following actions are taken to monitor previously enacted corrective actions, made in response to minor environmental incidents:

- Additional monitoring should be undertaken post-implementation of corrective actions to demonstrate their effectiveness, in particular:

    a. following drainage failures related to significant rainfall events, which resulted in surface water flow from dieback areas into dieback free areas.

    b. following recordings of elevated turbidity for a period exceeding the compliance criteria (25 NTU).

    c. in response to incidents involving PFAS and AFFF contamination

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25.0 RELIANCE ON INFORMATION PROVIDED BY THE REGISTRANT

This report has been prepared by SLR for Alcoa. The information, conclusions, opinions, and estimates contained herein are based on:

- Information available to SLR at the time of preparation of this report,
- Assumptions, conditions, and qualifications as set forth in this report, and
- Data, reports, and other information supplied by Alcoa and other third party sources.

For the purpose of this report, SLR has relied on ownership information provided by Alcoa in a legal opinion by Paul Volich, Managing Counsel – Australia, dated February 10, 2022, entitled Alcoa of Australia to SLR Corporation - ML1SA in good standing. SLR has not researched property title or mineral rights for the Darling Range as we consider it reasonable to rely on Alcoa's legal counsel who is responsible for maintaining this information.

SLR has relied on Alcoa for guidance on applicable taxes, royalties, and other government levies or interests, applicable to revenue or income from Darling Range in the Executive Summary and Section 19. As Darling Range has been in operation for over ten years, Alcoa has considerable experience in this area.

The Qualified Persons have taken all appropriate steps, in their professional opinion, to ensure that the above information from Alcoa is sound.

Except for the purposes legislated under applicable securities laws, any use of this report by any third party is at that party's sole risk.

26.0 DATE AND SIGNATURE PAGE

This report titled “Technical Report Summary on the Darling Range, Western Australia, S-K 1300 Report” with an effective date of December 31, 2022 was prepared and signed by:

SLR Consulting Ltd

Per:

/s/ John R. Walker

John R. Walker, FGS, MIMMM, FIQ
Technical Director, Mining Advisory Europe

Dated in UK
February 23, 2023