

# Think beyond.

# Shape the future.



## Our purpose

**Vesuvius is a global leader in molten metal flow engineering and technology, serving process industries operating in challenging high temperature conditions.**

We think beyond today to create the innovative solutions that will shape the future for everyone, delivering products and services that help our customers make their industrial processes safer, more efficient and more sustainable.

In turn, we provide our employees with a safe workplace where they are recognised, developed and properly rewarded, and aim to deliver sustainable, profitable growth to provide our shareholders with a superior return on their investment.





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Risk, viability and going concern

We think beyond today's products

and shape the future through innovation





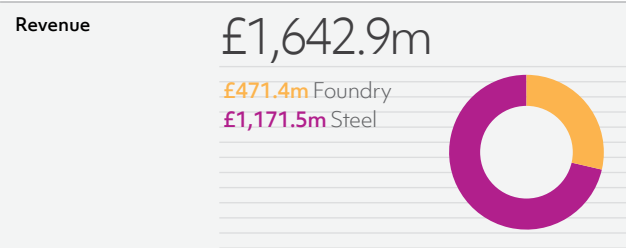
At a glance

Our business

We are a global group with a business model based on offering customised products, solutions and services from production facilities in close proximity to our customers.

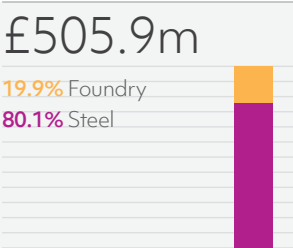
Our two divisions – Steel and Foundry – mainly serve the global steel and foundry industries.

Our global presence



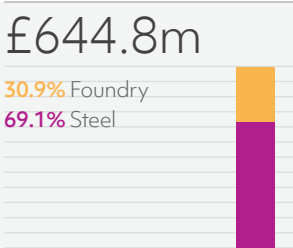
Continents	6
Countries	40
Employees	11,204
Sales offices	75
R&D centres	6
Production sites	54

Americas



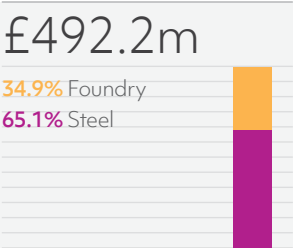
Employees	3,367
Sales offices	21
R&D centres	1
Production sites	18

EMEA



Employees	4,352
Sales offices	28
R&D centres	3
Production sites	19

Asia-Pacific



Employees	3,485
Sales offices	26
R&D centres	2
Production sites	17



This map shows our production, R&D and commercial sites worldwide

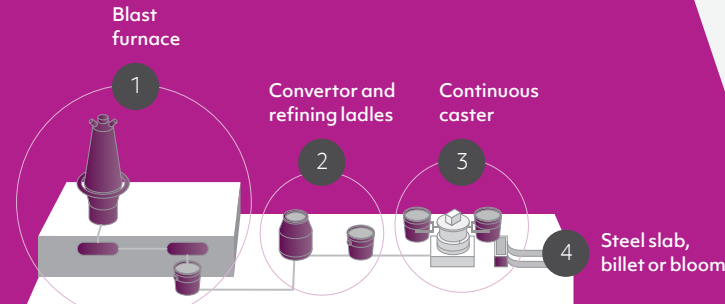
Divisional overviews

Steel Division

Operating review	44
Revenue	£1,171.5m
	2020: £1,045.4m
Return on sales	8.7%
	2020: 7.3%
Trading profit	£102.0m
	2020: £76.4m

**Overview**

Our customers are steel producers and other high-temperature industries. Vesuvius is a world leader in the supply of refractory products, systems and solutions. These help our customers increase their efficiency and productivity, enhance quality, improve safety and reduce their costs and their environmental impact.



Business unit

Steel Flow Control

Operating review 45

What we do

The Vesuvius Flow Control business unit supplies the global steel industry with consumable ceramic products, systems, robotics, digital services and technical services. These products are used to contain, control and monitor the flow of molten steel in the continuous casting process.

How the process works

The continuous casting process enables steel manufactured from a blast furnace or an electric arc furnace to be cast without interruption, whilst protecting it from the atmosphere. Avoiding atmospheric contact is crucial as it significantly reduces contamination and oxidation of the steel being produced.

Our products

The consumable ceramic products that Vesuvius supplies have a short service life (often a matter of a few hours) due to the significant wear caused by the extremely demanding environment in which they are used. These products must withstand extreme temperature changes, whilst resisting liquid steel and slag corrosion. In addition, the ceramic parts in contact with the liquid steel must not in any way contaminate it. The quality, reliability and consistency of these products and the associated robotic solutions and digital services we provide are therefore critical to the quality of the finished metal being produced and the productivity, profitability and safety of our customers' processes.

Steel Sensors & Probes

Operating review 47

The Sensors & Probes business unit offers digital measurement solutions to our customers to enable them to make their underlying processes more efficient and reliable. The business unit focuses on providing a range of products that enhance the control and monitoring of our customers' production processes, complementing Vesuvius' strong presence and expertise in molten metal engineering. These products include temperature sensors, oxygen, hydrogen and substance probes, and iron oxide and metal sampling for the steel, aluminium and foundry industries. By using these technologies, customers can focus on critical parameters within their processes, enabling them to refine their production methods to improve quality, lower production costs and maximise efficiency.

Steel Advanced Refractories

Operating review 46

What we do

Vesuvius' Advanced Refractories business unit supplies complete value-added solutions to its customers, including specialist refractory materials and advanced installation technologies, which harness mechatronic solutions, computational fluid dynamics capabilities and lasers.

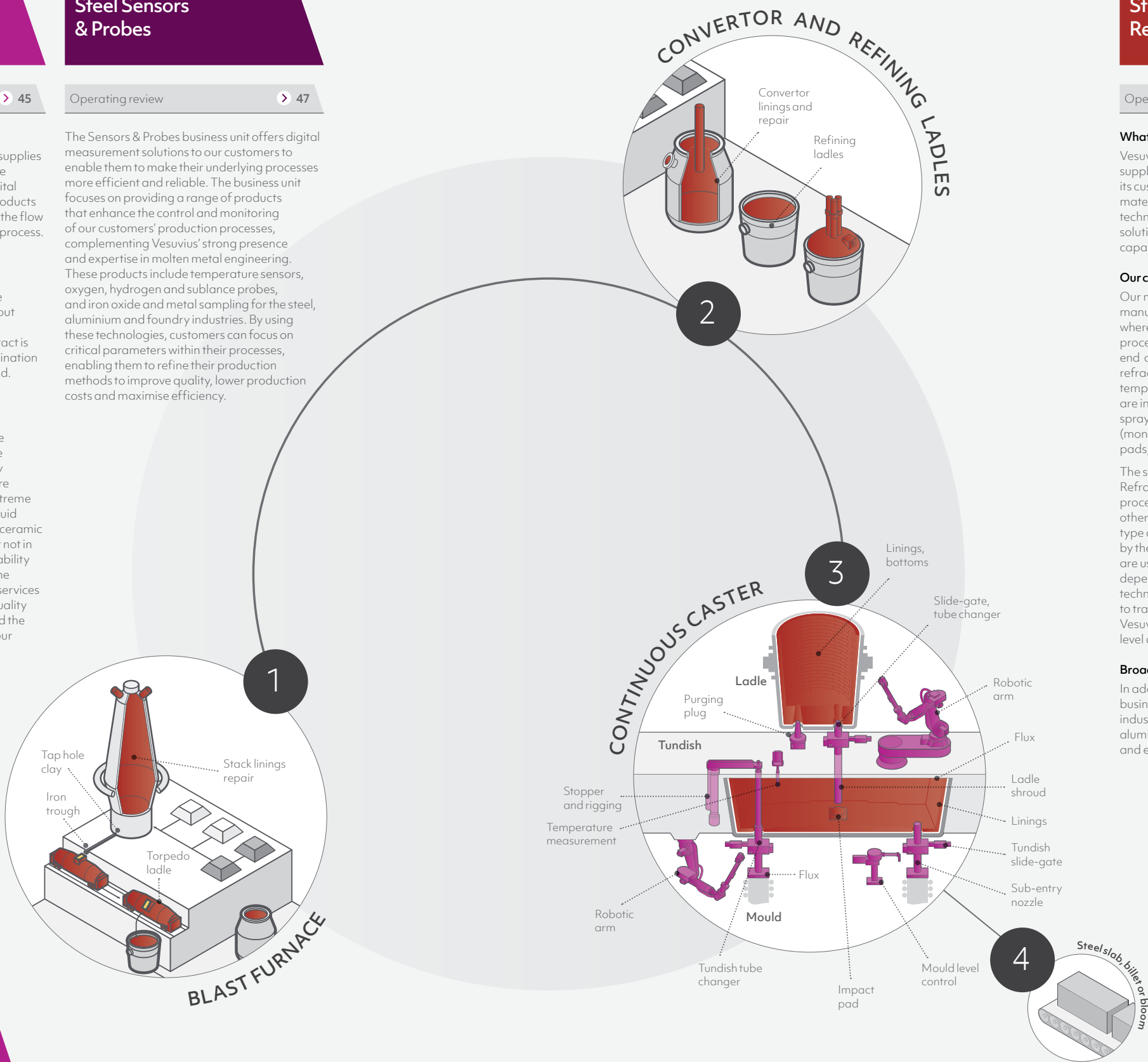
Our customers and the process

Our main customers are steel producers and manufacturers of steel production equipment, where our products accompany the steel-making process from its early steps all the way to the end of production in the rolling mill. The specialist refractory materials are subject to extreme temperatures, corrosion and abrasion, and are in the form of powder mixes, which are spray-applied or cast onto the vessel to be lined (monolithics) and refractory shapes (e.g. bricks, pads, dams and other larger precast shapes).

The service life of the products that Advanced Refractories supplies into the steel-making process can vary (some a matter of hours and others for a period of years) based on the type of refractory and the level of wear caused by the demanding environment in which they are used. An integral part of our success depends on our best-in-class installation technologies which use robots and lasers to track the performance of installed Vesuvius refractories, as well as the high level of collaboration with our customers.

Broader offer

In addition, Vesuvius' Advanced Refractories business unit supplies other high-temperature industries such as primary and secondary aluminium, copper, cement, petrochemicals and energy from waste.





Divisional overviews

Foundry Division

Operating review	48
Revenue	£471.4m
	2020: £412.9m
Return on sales	8.6%
	2020: 6.1%
Trading profit	£40.4m
	2020: £25.0m

**Overview**

We are a world leader in the supply of consumable products, technical advice and application support to the global foundry industry, improving casting quality and foundry efficiency. Our primary customers are ferrous and non-ferrous foundries serving various end-markets, from large bespoke castings to high-volume automotive pieces. We operate in the foundry sector under the Foseco brand.

Business unit

Foundry

**What we do**

The casting process is highly sequential and is critically dependent on consistency of product quality and productivity optimisation. Working alongside customers at their sites, our engineers provide on-site technical expertise in addition to advanced computational fluid dynamics capabilities to develop the best customised production solutions.

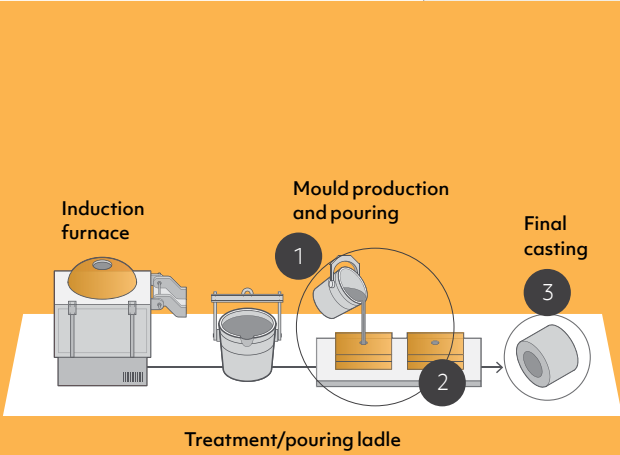
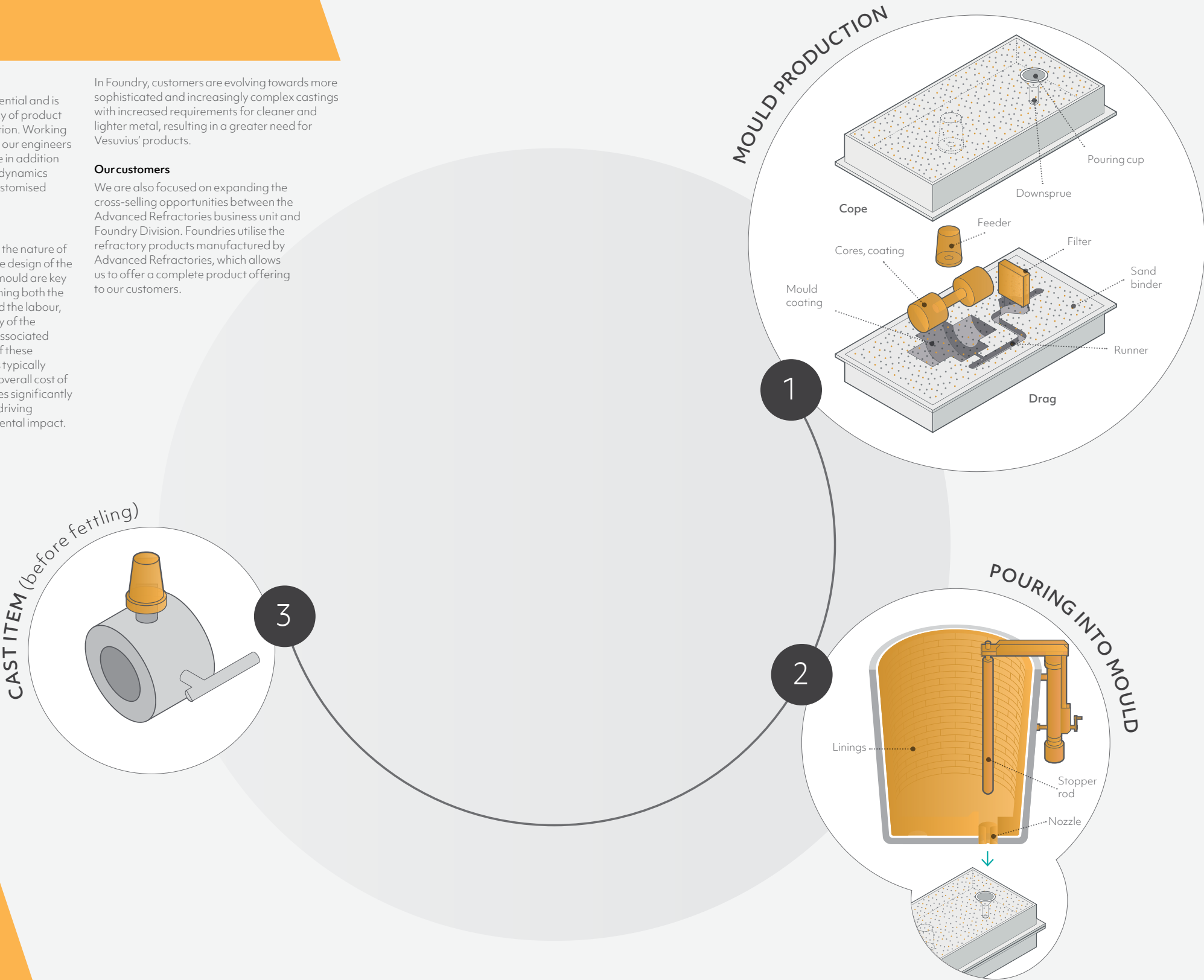
**Our products**

The conditioning of molten metal, the nature of the mould used and, especially, the design of the way in which metal flows into the mould are key parameters in a foundry, determining both the quality of the finished castings and the labour, energy and metal usage efficiency of the foundry. Vesuvius' products and associated services to foundries improve all of these parameters. Each of our products typically represents a small element of the overall cost of the foundry process but contributes significantly to product quality and yield, thus driving efficiency and reducing environmental impact.

In Foundry, customers are evolving towards more sophisticated and increasingly complex castings with increased requirements for cleaner and lighter metal, resulting in a greater need for Vesuvius' products.

**Our customers**

We are also focused on expanding the cross-selling opportunities between the Advanced Refractories business unit and Foundry Division. Foundries utilise the refractory products manufactured by Advanced Refractories, which allows us to offer a complete product offering to our customers.



Chairman’s statement

Maintaining strong momentum during disrupted trading conditions

2021 was another challenging year for Vesuvius. Despite a recovery across the majority of our end markets starting at the end of 2020, the COVID-19 pandemic continued to result in operational restrictions and promoted wide-spread global supply chain and freight disruption together with raw material and freight cost increases. Throughout this uncertain trading backdrop, our top priority remained the health and safety of our people and other stakeholders as they interacted with Vesuvius. Despite all of our efforts, we lost 11 people to the pandemic during 2021. We offer our sincerest condolences to all those who have lost family and friends.

Throughout 2021 the Board prioritised actions to respond to the continuing pandemic, particularly where they pertained to the well-being of our employees. I am incredibly proud of the great efforts that have been made across the globe to enable our employees to be vaccinated. In India, for example, we made available private vaccinations for all of our employees and their immediate families.

Our local site managers have continued to work tirelessly to implement measures to protect and support our employees whilst at the same time keeping our plants operational to serve our customers. On my visits to our sites I am consistently struck by the dedication and focus of our people and their commitment to building the business through excellent customer service.

We therefore start 2022 with renewed vigour to face the challenges that lie ahead. Whilst supply chain, freight issues and cost inflation may persist well into 2022, we know that our people have the determination and capability to overcome these challenges.

Strategy

We continued to progress our strategy successfully in 2021. Despite the difficult circumstances, the Board was happy to support further key investments in the Group. In December 2021, we acquired the business of Universal Refractories, which enhanced our presence and expertise in the US and positions us well for growth.

Alongside targeted M&A, we also invested in our existing operations, commencing a programme to increase capacity in VISO\* products and slide-gate capacity in Europe and slide-gate capacity for South East Asia. These investments will strengthen Vesuvius’ manufacturing base, which coupled with our ongoing R&D investment – delivering regular new product launches – reinforces Vesuvius’ position for the future.

Sustainability

Sustainability remains at the core of our strategy and in 2021 we progressed our plans to achieve our objective of reaching a net zero carbon footprint at the latest by 2050. Our Sustainability Council, chaired by the Chief Executive, met on a quarterly basis to oversee the Group’s sustainability activity, monitoring progress against our targets and assisting the Group with identifying and assessing the implications of long-term climate-related risks and opportunities. Our operational targets – driving emissions reduction; increasing manufacturing efficiency; reducing waste; and critically, enhancing the efficiency of our customers’ operations – are clear areas of focus for 2022 and the future. The Board believes that the ongoing formalisation and increased breadth of our sustainability initiative is a fundamental building block in the future of Vesuvius – both as we examine our own operations and as we further understand how to contribute to better sustainability outcomes for our customers.

Revenue  
£m

£1,642.9m



All of our activities are underpinned by our CORE values – Courage, Ownership, Respect and Energy. We have considerable pride in how our values and our commitment to pursuing them run through Vesuvius from top to bottom. These CORE values promote our determination to be a company that is at the forefront of active, rather than reactive sustainability. They are recognised annually – as they were again in December – when we hosted the global Vesuvius finals ceremony for our “Living The Values Awards”.

Stakeholders

The Board values every opportunity to engage with our various stakeholders. The Non-executive Directors, both collectively and individually, have always sought to meet as many colleagues as possible; and in doing so, they have broadened and deepened their knowledge and understanding of the global business.

Again in 2021, the pandemic restricted the Board’s ability to travel to as many locations as we would have liked. Where possible, the Non-executive Directors made physical site visits, including to the European shared services centre in Krakow, Poland, as well as visiting our operations in Skawina in Poland, Borken in Germany, Ghlin in Belgium, Suzhou in China, and Charlotte, Cleveland and Pittsburgh in the USA. In each case the questions and feedback we received from our employees gave valuable insights that the Non-executive Directors could take back into the Board’s deliberations and discussions.

Where we have been unable to travel, we have continued with ‘virtual’ site visits conducting meetings with sites in China, India and NAFTA.

The Group again conducted an employee engagement survey in 2021 through our I-Engage programme, and it is a pleasure to see the participation rate remaining reassuringly high, above 90% in both of the past two years.



John McDonough CBE  
Chairman

“ On my visits to our sites I am consistently struck by the dedication and focus of our people and their commitment to building the business through excellent customer service ”

Corporate Governance

We were delighted to welcome Dinggui Gao as an independent Non-executive Director in April. He brings with him nearly 40 years of global operational experience and has already made a strong contribution to the Board.

Unfortunately, due to pandemic-related restrictions, Board meetings started the year being held virtually. However, it was a pleasure to welcome the majority of Board members back to in-person meetings in June. Despite the challenges of remote meetings the Board has learnt from this experience and incorporated some elements of it into regular Board meetings.

Dividend

Our dividend policy aims to deliver long-term dividend growth, provided this is supported by cash flow and underlying earnings, and is justified in the context of our capital expenditure requirements and the prevailing market outlook. The Board has recommended a final dividend of 15.0 pence per share (2020: 14.3 pence per share). If approved at the Annual General Meeting, this final dividend will be paid on 27 May 2022.

Annual General Meeting

The Annual General Meeting will be held on 18 May 2022. The Notice of Meeting and explanatory notes containing details of the resolutions to be put to the meeting accompany this Annual Report and are available on our website: [www.vesuvius.com](http://www.vesuvius.com).

Reflections and farewell

Having served for nine years as the Chairman of Vesuvius, this will be my last Annual Report to shareholders. During the year we commenced a process to select my successor, more details of which are set out in the Corporate Governance Report. I am pleased to report that this process is progressing well.

For my own part, I am delighted by the progress Vesuvius has made during my tenure and the organisation it has become. I am particularly proud of the Board’s detailed focus on global safety, especially during the pandemic. Safety sits at the core of the promise we make to our employees and everyone who visits Vesuvius sites. Much progress has been made, and there is more to come. The Board has also increased its focus on quality processes and operational performance, as well as maintaining strong and robust governance and risk management processes.

Vesuvius’ global management structure has evolved to delegate authority to managers to act locally with resilience and agility. During the pandemic, this enabled us to respond rapidly and effectively to ensure that production was maintained and customers were supplied as required. This decentralised management structure, which draws deeply on the skills of our talented managers, remains the cornerstone of Vesuvius’ flexibility and responsiveness.

Meanwhile, we have invested significantly in R&D, underpinning one of the cornerstones of Vesuvius’ strategy, that of technology leadership. We have rejuvenated our manufacturing footprint to enable profitable and cash-backed growth, and developed our IT and systems capability to deliver improved customer management and systems security. In doing all of these things, we have strengthened Vesuvius for the present and the future.

Vesuvius has a strong, cohesive and diverse Board which embraces our Group values and culture of open debate. We continue to support and constructively challenge management to deliver the Group’s strategy.

I have every confidence that your Directors will continue to lead Vesuvius from strength to strength and I wish them, and all of our colleagues across the globe, the very best in doing so in the years ahead.

John McDonough CBE  
Chairman  
3 March 2022

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Chief Executive’s strategic review

Delivering resilient results, whilst protecting our employees and the security of supply to our customers

During 2021, we delivered resilient results and protected the health and safety of our employees and the security of supply to our customers, despite the persistent COVID-19 crisis and unprecedented supply chain disruptions.

Priority given to the protection of the health and safety of our employees. Best ever safety result

During 2021, our priority remained the protection of the health and safety of our employees. We remained focused on adapting the lay-out of our operations to ensure safe social distancing while enabling the ramp-up of our production to cope with the increased level of activity of our customers. We also continued to promote remote working whenever possible and supported vaccination of our employees and their families each time it was legally possible to do so. I was deeply saddened that despite these efforts, we lost 11 of our colleagues to COVID-19 in 2021. My thoughts remain with their families and friends.

Throughout 2021, we maintained our efforts to improve the safety performance of our operations. Our Lost Time Injury Frequency Rate (LTIFR) progressed further to 1.06 from 1.16 in 2020, our best result ever.

Despite this improvement, we remain unsatisfied and will intensify our efforts in 2022 to make further progress towards our objective of zero accidents.

➔ See more in the **Our people** section on p82–96

Strong operational performance and resilient financial results despite very challenging supply chain disruptions

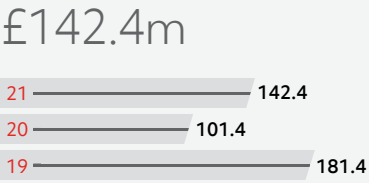
In 2021, our two main end markets of Steel and Foundry recovered significantly from the low point of 2020. In Steel, the recovery was particularly strong in the world excluding China, while in China, after a positive start to the year, steel production declined significantly in the second half. In Foundry, all sectors and all geographies exhibited positive growth, with the notable exception of the automotive sector, which remained at a low level of activity, equivalent to 2020, due to the persistent shortage of semi-conductors.

At the same time as our end markets were recovering, we were confronted with extraordinary supply chain disruption for raw materials and logistics services – both in respect of pricing and in respect of their physical availability, which impacted businesses around the globe.

Thanks to our decentralised, entrepreneurial, non-matrix business model, and the dedication of our management teams and personnel worldwide, we were able to react quickly to these challenges, increasing prices to compensate for raw material and logistics costs increases, while at the same time protecting the security of supply to our customers. We had to declare a temporary force majeure on two product lines during the second half of the year but were able in both cases to subsequently find solutions that avoided interrupting the production of our customers.

In this challenging environment, our Flow Control, Foundry and Sensors & Probes business units registered strong

Trading profit  
£m



commercial performance, outperforming their underlying markets and gaining market share globally, while at the same time adjusting prices upwards to compensate for cost increases. Our Advanced Refractories business unit however, lost market share in 2021 as priority was given very early in the year to pricing over volumes to compensate for raw material and logistics cost increases. As a consequence of this overall strong commercial performance, our underlying revenue increased by 18% in 2021, to £1,642.9m. This increase was made up 75% by volume increments and 25% by price.

This strong growth in our revenue supported a significant increase in our trading profit and return on sales: our trading profit was £142.4m in 2021, compared with £101.4m in 2020 and our return on Sales reached 8.7%, +190bps vs 2020 on an underlying basis. Our trading profit and return on sales were, however, negatively impacted by the timing difference between the pace of our price increases and the pace of the raw material and logistics cost increases we incurred. This generated a headwind of £14m in trading profit for the full year, although this headwind was fully eliminated by year-end as cost inflation was successfully passed through to customers.

We continued to focus on cash generation in 2021 and further reduced our working capital intensity to 20.9% of sales, as compared with 23.2% in 2020 and 24.0% in 2019, despite investing in raw material inventory to mitigate some of the supply chain disruptions we experienced, and the necessary increase in working capital investment associated with a rebound in our end markets.

Thanks to this effort, we maintained our Net Debt to EBITDA ratio at 1.4x, a very limited increase as compared with 2020 (1.2x).

➔ See **Financial review** section on p40–43  
➔ See **Our strategy** section on p14–15



Patrick André  
Chief Executive

“  
Vesuvius ended 2021 in a strong position, our dedicated management teams have laid the foundations for future growth  
”

Launch of an ambitious manufacturing expansion programme to support future organic growth in Flow Control

To support the strong growth and market share gains of our Flow Control business, we launched an important programme to increase our VISO\* and slide-gate plate manufacturing capacity. These expansions will increase the VISO\* and slide-gate capacity at our Skawina plant in Poland by 35% and 100% respectively, as well as increasing the VISO\* capacity of our Kolkata plant in India by 50%.

These strategically important investments will support our ongoing expansion in the fast-growing markets of EEMEA, India and SE Asia.

Sustained R&D effort supporting strong New Product launches

Despite the pandemic, in 2020 we resolved to maintain our R&D investment. Thanks to this decision, we were able to launch 27 new products in 2021, more than double the number of new products launched in 2020. Consequently, our new product sales ratio (the share in our turnover contributed by products which didn’t exist five years ago) reached 15.3% in 2021 (vs 12.4% in 2020).

In 2021, we continued to increase our investment in R&D, in particular expanding our mechatronics centre of excellence in Belgium, which now supports both our Flow Control and Advanced Refractories robotics technology leadership. We also decided to increase our R&D investment to focus further on sustainability, with the development of innovative products and solutions that will lead the market in helping our customers improve their sustainability performance by reducing their CO<sub>2</sub> emissions, and by improving the safety of their people.

Expansion in North America through the acquisition of the Universal Refractories business

We were pleased to announce the acquisition of the business of Universal Refractories, Inc. at the end of 2021. A specialty refractory producer based

in Pennsylvania, Universal Refractories serves the Steel (tundish applications) and Foundry (consumables) industries. The acquisition delivers further expertise to our core business in both the Steel and Foundry markets in North America and in particular provides new opportunities in the growing sector of electric arc furnace steel producers. We are looking forward to the opportunity to integrate the Universal teams and know-how into the Vesuvius business and are expecting to derive significant synergies from this integration.

Significant progress in our sustainability journey

In 2020, we decided to launch a new comprehensive action plan to accelerate our sustainability efforts – bringing together all of our environmental, social and governance initiatives into a global co-ordinated programme with clear priorities, quantified targets, and milestones. In particular, we made a commitment to reach a net zero carbon footprint at the latest by 2050.

2021 was the first full year since the launch of this new Sustainability strategy and, on most parameters, we are running ahead of schedule. In particular, we have continued to make significant progress in the reduction of our carbon footprint with a 16.5% reduction in our carbon intensity as compared with our base year 2019 (versus 3.9% in 2020). We achieved this by improving the energy efficiency of our plants worldwide (9% improvement as compared with 2019) and shifting an increasing number of our operations to carbon-free electricity. We will make further progress in 2022.

We also continued to advance in our journey towards greater gender diversity. Females now represent 21% of our top management, a level that we consider is still too low, but which represents a significant improvement as compared with the level of 12.5% in 2019.

In parallel, we engaged in a comprehensive multi-year programme to assess the sustainability performance of our suppliers worldwide, with a particular focus on greenhouse gas emissions,

anti-bribery and corruption, and child and forced labour. More than 40% of our raw material supplier base has already been assessed.

We are very proud to see these efforts and progress starting to be recognised: our MSCI rating progressed from BBB to A and our EcoVadis rating increased from Silver to Gold during the year.

Given our strategic focus in this area, we expect to make significant further progress in 2022.

Board Chairman

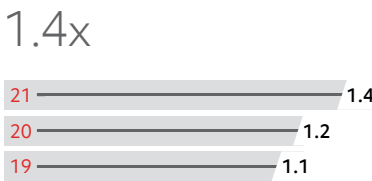
As you will have read in the Chairman’s statement, John McDonough CBE will be stepping down from the Board later this year. John has served as Chairman of the Board since the Company demerged from Cookson Group plc in 2012. Since then he has successfully guided the Company and worked tirelessly in the service of the Group’s stakeholders. He has been a source of invaluable advice and guidance and has been a tremendous support to me and the Board as a whole. On behalf of the Group, I offer him my sincere thanks for all that he has done for Vesuvius over the years.

Outlook

Both our end markets of Steel and Foundry remain positively oriented at the start of 2022. In 2021, Vesuvius demonstrated its ability to successfully pass-through cost inflation through price increases and will continue to do so in 2022, as necessary. Strategic R&D and capacity investments are proceeding as planned and will support market share gains going forward. While we remain concerned about the potential direct and indirect impacts of recent geopolitical events, which have led us to suspend our deliveries to Russian customers for the duration of hostilities, we are nevertheless confident that the Group will deliver a significant improvement in financial performance in 2022.

Patrick André  
Chief Executive  
3 March 2022

Net debt to EBITDA



\* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

Our strategy

Strategic objectives

We are dedicated to accelerating the achievement of our Strategic Objectives to deliver profitable growth. In particular, we will focus our efforts on the high-quality, high-technology segments of the steel and foundry markets, and increase the automation and efficiency of our manufacturing base. We will drive this change with a team of skilful, motivated and talented people.

-  Deliver profitable growth
-  Generate value for our shareholders
-  Maintain an efficient capital structure
-  Always put safety first
-  Think beyond in innovation
-  Run best-in-class sustainable operations
-  Foster talent, skill and motivation in our people

We measure and monitor our performance against these Strategic Objectives through our Key Performance Indicators (KPIs). See our **Key Performance Indicators** on  p38 and 39

Execution priorities

Vesuvius has articulated a number of key execution priorities. These enable us to achieve our core Strategic Objectives of delivering profitable growth, generating value for our shareholders and in line with our sustainability initiative delivering a better tomorrow for our stakeholders.

Reinforce our technology leadership



Vesuvius was built and grew through technology breakthroughs. These enabled the steel continuous casting and foundry industries to improve significantly their efficiency and quality. We focus on delivering market-leading technology which continues to drive our unique value proposition and underpins our ability to deliver ongoing value enhancement to our customers.

Develop our technical service offering and increase penetration of value-creating solutions



Our technology has been widely adopted by the most sophisticated producers in the most advanced markets. However, marked differences remain in the penetration of our solutions within the industry. Consequently, there is a wider audience of customers who we believe can benefit from our solutions. As steel and foundry markets in developing economies become more quality focused, we have the opportunity to significantly increase our penetration of these markets through the value delivered by our solutions.

Capture growth in developing markets




Building on our long-standing presence in all markets, we can leverage the high growth enjoyed by our customers' industries in emerging markets, which are large consumers of steel goods and foundry castings.

Improve cost leadership and margins



We continuously pursue initiatives to adapt our business and our cost base to the changing trading environment. This is central to our efforts to improve profitability. We have embedded the principles of lean manufacturing across all our sites, continuously focusing on quality and productivity.

Drive sustainability

See our **Sustainability** section on  p50 to 101



In line with our updated Sustainability initiative, we are taking steps within the organisation to create a better future for our planet, our customers, our people and our communities. We develop products that seek to help our customers drive efficiency and reduce their environmental footprint, and we are focusing on our own operations to reduce our environmental impact. We focus on giving our employees opportunities for growth and development, and support wider and deeper engagement with our communities.

Progress in 2021

During 2021, we invested 1.8% of our revenue in R&D. We remain committed to spend c.2% of sales on innovation every year. We invest throughout the product cycle from front-end innovation to existing product development, focusing on the projects that deliver the highest impact to our customers.

In 2021, our Advanced Refractories business unit invested significantly in the development of a new mechatronic Centre of Excellence in Ghlin, Belgium. This is now fully operational and will be the global flagship for our Steel Division mechatronic capability.

We continue to work on products that combine developments in robotics, automation and data analytics capabilities with our well-established material science research and modelling ability. In addition, bringing together our diverse research capabilities continues to strengthen our technology leadership. We have also increased our focus on products that help our customers improve their own safety performance and environmental footprint.

In 2021, we dramatically stepped up our new product launch programme with 27 new products launched in 2021, vs 10 in 2020, including the following highlights by business unit:

**Flow Control:** launch of the Air-Shield\* Technology, which creates a better seal between the two plates of our slide-gate mechanism to increase the yield and quality of steel produced.

**Advanced Refractories:** launch of the BASILITE\* QuickStart composition which is an energy-efficient tundish lining developed to be used on a 'QuickStart' heating cycle. It eliminates the typical drying cycle, increasing productivity and reducing energy costs and CO<sub>2</sub> emissions.

**Foundry:** launch of the new FEEDEX\* FEF sleeve range which eliminates fluoride emissions for high pressure greensand iron casting customers. This new range supports foundries in reducing harmful emissions and hazardous waste while delivering high thermal and feeding performance at the same time.

In 2021, Advanced Refractories installed 21 laser and mechatronics solutions at customer locations. More than 30 projects are under discussion for the future.

The sales volume of the Steel Division in 2021 outperformed steel production in the world by 13.7%, with particularly strong performance in India, Japan, China, South America, Vietnam and EEMEA.

Our Foundry Division registered strong sales growth in emerging countries in 2021: with growth of 68% in South America; 36% in India; 35% in Vietnam; and 52% in Turkey. In China, although our customers faced decreasing activity through 2021, we were able to grow by 12%, outperforming the market.

We have continued to deliver on our restructuring savings programme with a further £4.1m of recurring savings delivered in 2021.

Our rigorous working capital management has also paid dividends as we achieved a 20.9% ratio of trade working capital to sales, showing an improvement of 230 bps vs 2020 despite the build up of inventory required to enable us to serve our customers under current market conditions.

Throughout 2021, our teams continued to pursue opportunities to implement lean practices and automate processes in our plants to increase productivity and quality.

We also focused on price management in 2021 to respond to the increase of our input costs and adapt the price of our products accordingly. This remains a strong focus in 2022.

In 2021, despite the challenging environment created by the COVID-19 pandemic, we made good progress on our nine sustainability targets. This exemplifies the commitment of Vesuvius' people to work for a better tomorrow, for the benefit of all stakeholders.

In 2021, we spent time analysing the risks and opportunities created for the Group by climate change, focusing on three long-term scenarios. Work then took place to ensure that these were accurately reflected in the Group's strategic planning. In 2021, we also launched a sustainability assessment programme for our suppliers and developed a methodology to assess the sustainability performance of our products.

Our efforts have been recognised with our MSCI rating improving from BBB to A, and our EcoVadis rating moving from Silver to Gold. Vesuvius was also honoured to be included in the *Financial Times* European Climate Leaders list.

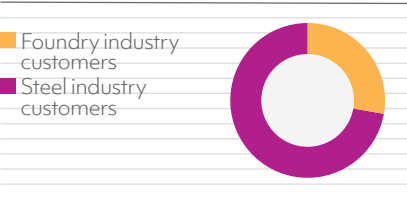
\* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.



Our external environment

Solutions for the changing demands of business

Climate change and the Vesuvius proposition



Almost two thirds of Vesuvius’ revenue comes from providing goods and services to the steel industry. One third of Vesuvius’ revenue is generated from the provision of products and solutions to the foundry industry. The remainder comes from products sold to high temperature industries such as aluminium, cement and energy from waste.

**Steel**

Steel production is a highly energy-intensive process. The World Steel Association has estimated that the steel industry generates between 7% and 9% of global direct emissions from the use of fossil fuel. However, steel continues to play an integral part in the modern world. Steel is a necessary material for the sectors and technologies that will drive a more sustainable economy. It is also infinitely recyclable and the by-products created during steel making, along with the waste energies, are valuable resources.

Vesuvius’ consumables enable our customers to increase manufacturing throughput whilst lowering energy consumption. For several decades, Vesuvius’ products have been assisting the steel industry in reducing greenhouse gas emissions by increasing yields and end-product consistency, therefore improving the energy efficiency of production.

**Foundry**

Foundries consume large amounts of energy in heating metals, generating significant amounts of CO<sub>2</sub>. They are experiencing a drastic change in their end-markets as parts of the world shift towards hybrid and electric vehicles, accelerating a transition away from traditional ferrous casting, as well as a significant movement towards green electricity generation.

Vesuvius’ products help our Foundry customers to maximise their energy efficiency and increase the ratio of metal melted to finished end castings. We systematically monitor the positive CO<sub>2</sub> impact of our products.

**The future**

The pressure on the Steel and Foundry industries to reduce greenhouse gas emissions, particularly CO<sub>2</sub>, is increasing significantly as governments are enforcing stricter regulations, especially in the EU, the US and, recently, China.

Our customers will continue to focus on reducing absolute energy consumption and CO<sub>2</sub> emissions (through the elimination of higher emission processes) and reducing normalised energy consumption and CO<sub>2</sub> emissions via increased efficiency.

Our customers are following several different routes to deliver this reduction and to comply with stricter regulations. The rise of scrap availability and of its recycling is supporting a shift to electric arc furnaces away from blast furnaces, to produce steel – in particular, in the US and the EU. We also expect this trend to gain momentum in China as the country implements its strategy towards net zero. Alongside this, the use of hydrogen in

steel production, particularly in the EU27+UK, to manufacture ‘Green Steel’ is gaining traction and more and more steel producers are exploring hydrogen-based steel-making technologies.

In addition, failure to introduce a Carbon Border Mechanism Adjustment in more regulated regions like the EU is likely to accelerate the delocalisation of steel production from these areas.

In Foundry, as the move to hybrid/electric vehicles and low-carbon forms of transport accelerates, the foundry industry will shift away from manufacturing internal combustion engines. We expect aluminium and steel foundries to grow at a higher rate than iron foundries to support the manufacture of lighter-weight components for vehicles. Governmental funding and regulations are supporting these trends.

In construction, we also see a continued trend of using lighter-weight steel and glass to replace concrete.

**How Vesuvius will respond**

We work closely with our customers to develop new products and technologies to meet these challenges with sustainability being a critical focus in new product development.

Our Steel Division is participating in hydrogen R&D projects to develop solutions for the future of steel making. Additionally, we continue to develop new products with superior sustainability characteristics.

Our Foundry Division teams are developing new filtration, feeding, mould coating and molten metal treatment products to support the availability of higher-performance metal and the manufacture of lighter-weight components for the automotive industry. They are also developing new products for aluminium foundries to support the fast-growing market in electric vehicles.

Technical upgrade of steel and foundry

**What’s happening**

Our view on the long-term growth for the global steel and foundry markets remains positive. The importance of technology to differentiate steel and foundry producers continues to grow, supported by the development of more demanding product applications.

Whilst lower-quality construction steels are currently benefiting from solid growth, this stems from government investment in infrastructure programmes to shield their economies from the ongoing impact of the COVID-19 pandemic. We believe this is only a temporary phenomenon.

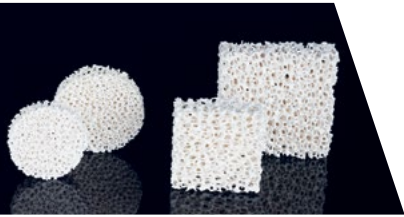
Steel producers are increasingly focused on supplying higher-quality steel grades for automotive and power generation, where the consistency of the finished steel is fundamental. This is driving an above-market growth forecast for high-technology steel in all regions.

**How we are responding**

Vesuvius is strongly positioned to facilitate these upgrades and to benefit from these trends. We have a wide product and service offering designed to support the production of high-technology steel and complex casted components across our broad, global manufacturing base.

We continue to invest heavily in R&D with dedicated centres of excellence to think beyond what exists today.

Vesuvius’ innovative portfolio of products and services, together with its global footprint, enable us to provide high-technology solutions to our worldwide customers.



**Improving quality with our new products**

In Flow Control, we have enhanced our Composite Design Technology (CDT) with a new solution, the Surface Layer CDT, that allows us to design a broader range of shapes and sizes for our slide-gate plates and use a greater proportion of recycled materials, while maintaining a high level of performance. By combining this technology and our innovation on the composition of the plates, we can offer high performing and sustainable products with greater flexibility in design.

Our Foundry Division launched a new filter range this year, the STELEX\* pureflow filter, for small castings in steel and other high temperature alloys. This filter range minimises inclusions to improve the purity of the metal, reduces dependency on zirconia (which is often difficult to source) and optimises filtration capabilities.

Automation – safety and efficiency

**What’s happening**

Companies face ever-increasing regulation and scrutiny to ensure safety and reduce emissions from their operations and products.

Advancements in automation can help transform production, bringing greater consistency whilst lowering cost and delivering significantly improved safety performance in a plant. Thus robotics can support or even substitute operators in hazardous production areas.

Market volatility is increasing and labour shortage is a growing challenge, creating uncertainty and requiring even more flexibility in production. Automation can create more flexible operations to enable a more rapid response to changing market conditions.

**How we are responding**

Vesuvius has the global and in-depth capability to combine know-how in steel mills and foundries with robotic capabilities to deliver superior safety performance in hazardous areas of production.

We provide laser technology to assess refractory wear, allowing targeted repair with our broad range of refractory consumables and application solutions – for efficient and safe operation.

We have invested significant resources in the development of our mechatronics capabilities to shape the future operations of steel and foundry plants with our current robotics offering (e.g. Tundish, Continuous Casting) as well as with new automation capabilities in other areas. We are also exploring new ways to integrate continuous data capture into our solutions to give our customers further insights into the use of consumables in their production processes.



**Leaving the most hazardous work to robots**

In 2021, our Advanced Refractories business unit commissioned several tundish spray robots at customer sites allowing them to automate the re-lining process of their tundishes, thus increasing the safety and reliability of their operations, and reducing the downtime of their equipment.

\* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

Our markets

Steel Division

Business units

Flow Control

Steel production volume is the primary driver of demand for Flow Control's products, whilst the trend for 'high-technology steel' allows us to leverage our advanced solutions and achieve above-market growth rates.

Sensors & Probes

Steel production volume and the need to increase the quality and consistency of cast steel drives demand for our Sensors & Probes business.

Advanced Refractories

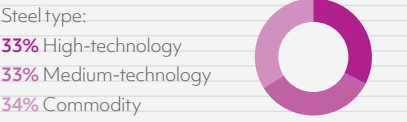
Steel production volume and certain other high-temperature industries, such as aluminium, copper, cement, petrochemical and energy from waste, are the drivers for the Advanced Refractories business unit's product demand.

'High-technology steel'

'High-technology steel' is our internal segmentation that describes steel which is either high performing, e.g. advanced high-strength steel for automotive applications, or for which the production process to produce the steel is complex, e.g. the near net shape production process, which is a continuous casting process that produces steel in very thin slabs near to its final required thickness.

These processes and steel grades, where the consistency of the finished steel is paramount, are gaining momentum worldwide because they provide steel producers with either differentiated products or significant benefits in terms of cost savings and a reduced environmental footprint.

Vesuvius' internal segmentation of global crude steel production



Flow Control business unit end markets



Steel usage	High-technology	Medium-technology	Commodity
	<ul style="list-style-type: none"><li>Near net shape production process</li><li>Stainless steel</li><li>Engineering steel: bearing, shafts, tools, etc.</li><li>Automotive steel</li></ul>	<ul style="list-style-type: none"><li>Construction sheets: roofing, cladding, etc.</li><li>Heavy plates for ship building, pipe</li></ul>	<ul style="list-style-type: none"><li>Basic rebar for concrete reinforcement</li></ul>



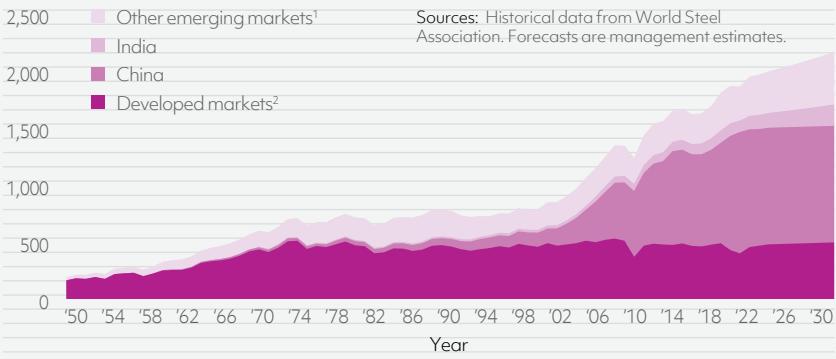
Crude steel production is a structurally growing market

The COVID-19 crisis has disrupted global demand and supply chains around the world. However, from the end of 2020, we have observed a strong rebound in steel demand and thus in production, as our customers were restarting and increasing capacity to meet their own customers' demand. Despite steel producers facing issues ramping up production to meet full demand, crude steel production in the world, excluding China, increased by 12.5% in 2021 compared to the prior year, while China's crude steel production in 2021 decreased by 3%, reversing a growth trend that has been running for several years.

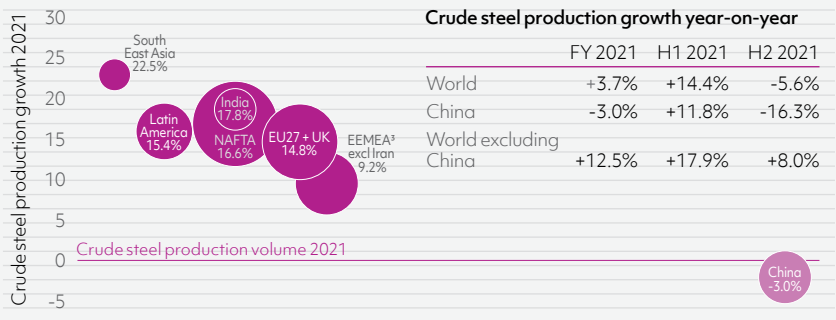
In 2021, we saw the driving forces behind steel production changing, primarily influenced by decarbonisation targets in the US, EU and China. China is now targeting net zero by 2060 and limiting crude steel outputs and exports. We believe this action will benefit other regions. 2021 saw a strong rebound in US and EU27+UK, production at 18.3% vs 2020 and 14.8% vs 2020, respectively. However, we believe the long-term growth will mostly come from emerging regions, in particular from India and South-East Asia, EEMEA and Latin America.

Longer term, we expect global crude steel production to grow at a rate of 1.3% per annum and excluding China, at a rate of 2.5%.

World crude steel production (mt)



Changing driving forces in global crude steel production



Notes to the above charts:

- 1. Eastern Europe, Middle East (incl. Turkey), Africa, Latin America and South East Asia.
- 2. EU27, UK, USA, Canada and North Asia.
- 3. Eastern Europe, Middle East (incl. Turkey) and Africa.

Foundry Division

Higher sophistication, demanding higher-quality metal and increasingly complex castings is the long-term driver for product demand for the Foundry Division.

Foundry industry end-markets

The most important end-markets for the foundry industry are general engineering, light vehicles, including passenger cars and light commercial vehicles, medium and heavy commercial vehicles, construction, agriculture and mining equipment, power-generation equipment, and railroad.

Whilst the COVID-19 pandemic caused a sharp decline in Foundry end-markets in 2020, end-markets rebounded in 2021 with particular improvements in general engineering (12.7%) and mining and construction equipment (19.2%). However, the automotive market continued to suffer from the severe semi-conductor supply shortages in 2021, which significantly impacted light vehicle production, especially during the second half of the year, leading to only a slight increase in production volume of 2.5% in 2021.

Above-average market growth for highly sophisticated and complex castings

The Foundry Division benefits from its capabilities to improve highly sophisticated and complex castings, which are the segments of the foundry market growing the fastest. Foundry customers are evolving towards these types of casting because of increased requirements for cleaner metal to cast complex shapes with thinner sections.

Whilst Foundry Division products typically represent less than 5% of a foundry's production costs, they contribute significantly to the improvement of product quality and manufacturing efficiency, whilst reducing the environmental impact of the casting process and improving the ratio of finished castings to the amount of metal poured. The latter is a key parameter for foundry efficiency.

Technology changes and environmental drivers

New technologies, such as 3D printing, are expected to continue to influence the metal casting industry, allowing for faster prototyping and production of smaller volume parts. Environmental regulations, driven by the desire to reduce volatile organic compound emissions and the use of silica within the industry, are also expected to continue to tighten.

This will drive the trend to find processes and consumable products which support production efficiency and reduce a foundry's impact on the environment.

Iron casting

Iron casting is split between grey and ductile iron, with grey iron representing most of the metal being cast. This is a cost-efficient and robust process producing components that do not need to tolerate extreme mechanical stress. All iron castings require filters and coatings, but grey iron is not as reliant on feeding system utilisation due to its lower shrinkage on solidification. Conversely, ductile iron production requires more sophisticated consumable feeding products to cope with the high shrinkages of metal whilst solidifying.

Steel casting

Steel is used to cast components requiring very high mechanical performance. Steel casting is the most demanding casting process due to higher melting temperatures and greater tendency for shrinkage. This drives greater demand for consumables and technical expertise in this segment.

Aluminium/Non-ferrous casting

Aluminium casting is the segment of the foundry market growing the fastest, capturing a significant share of the light vehicle market. Being molten below 700°C, aluminium can be cast in iron moulds which can then be reused. The casting process growing the fastest is High Pressure Die Casting (HPDC), supported by the growth of electric vehicle production. Vesuvius develops and supplies fluxes, filters and machines that refine the composition and cleanliness of the metal.



Business model

A profitable, flexible, cash-generative model focused on sustainable growth

What we do

We develop and manufacture high-technology products and solutions predominantly for supply to the steel and foundry casting industries, operating a profitable, flexible, cash-generative and growth-building business model. Over many years, we have built the brand equity of our Vesuvius and Foseco products through technology leadership, reliability and service.

The sustainability of our model

The items we have now formalised in our Sustainability initiative have long been at the heart of Vesuvius' value proposition. We act as a responsible corporate citizen, developing products that help our customers to improve their efficiency and reduce their environmental impact.

Our key resources

Financial capital

We use the cash generated by our business to invest in innovation, people, operating assets, technology and sales to generate further growth.

Manufacturing capital

We have a global footprint, with 54 production sites on six continents, giving us proximity to our customers.

Intellectual capital

We have six R&D centres of excellence, together with dedicated R&D staff worldwide, generating innovative products and services that help our customers make their industrial processes safer, more efficient and more sustainable.

Human capital

We invest in developing our skilled and motivated workforce of more than 11,000 people and provide them with a safe environment in which to work.

Social capital

We champion our Values and our ethical conduct. We maintain strong relationships with customers and our wider stakeholder groups.

Natural capital

We utilise high-quality raw materials, secured through reliable and well-developed and sustainable supply chains.

R&D centres of excellence

6

Employees

11,204

Production sites

54

Strategic alignment



Deliver profitable growth



Generate value for our shareholders



Maintain an efficient capital structure



Always put safety first



Think beyond innovation



Run best-in-class sustainable operations



Foster talent, skill and motivation in our people

How we deliver

- Our industry experts are embedded at many customer locations and are therefore ideally placed to collaborate with customers to identify their needs, and potential service and process improvements. This also enables us to grow our solutions and service portfolio.
- We develop high-technology products that deliver quality enhancement, efficiency gains and energy savings to our customers. We focus on environmental sustainability in our own business through the efficient use of energy and natural resources.
- Our model is profitable by allowing value pricing for bespoke products and services. It generates growth as we enlarge our market with additional innovative products and solutions.
- Our model is resilient to end-market volatility due to the flexibility of our diversified manufacturing footprint and adjustable cost base, increasingly supported by automation.
- Our commitment to ethical business delivers strong, long-term, sustainable commercial relationships.

The value we create

Our investors

Strategic alignment



Our cash generative and low capital intensity business provides returns to our shareholders and underpins sustainable growth.

Our customers

Strategic alignment



Our investment in innovation creates cutting-edge products and solutions, delivering enhanced value for our customers and differentiating us from our competitors. Our technology solutions improve customer safety and remove operators from the most dangerous parts of our customers' processes. We embed technical experts within our customers, giving us a fundamental understanding of their needs and delivering them access to our global network of highly skilled individuals.

Our suppliers

Strategic alignment



Maintaining cost-effective access to high-quality raw materials is vital to our success. Our suppliers are critical to our business.

Our people

Strategic alignment



We focus on the health and safety of all our staff. We engage with our people, encouraging and rewarding high performance to create an environment where all can realise their individual potential.

Our communities

Strategic alignment



We are committed to maintaining positive relationships with the communities in which we operate. Our social responsibility activities complement our Values and we encourage our employees to engage with communities and groups local to our operations.

Students and graduates

Strategic alignment



Attracting new talent to Vesuvius is vital for the Group's continuing success. Recruiting new students and graduates feeds the talent pipeline and allows us to tap into new sources of up-to-date business ideas and R&D capability.

Our sustainable competitive advantages



Global presence

Using our global expertise to identify and create market opportunities

Vesuvius is present on six continents, supporting the development of global steel and foundry manufacturing processes with new technologies. We have manufacturing capability in all the main steel and foundry markets and hire and train local engineers. Our local manufacturing, local expertise and global knowledge of customers' processes give us a special relationship with our customers.

See more about Our global presence on p4 and 5

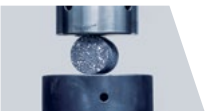


Optimised manufacturing

Low-cost lean manufacturing provides reliable 'just-in-time' products

Our successfully tested products can be produced at high volumes across all of our manufacturing footprint, guaranteeing cost-competitive and time-efficient delivery. We optimise our cost-competitiveness by investing in low-cost production sites and increasing production automation – and have established manufacturing facilities to support our expansion in emerging markets.

See more about Our operations on p44–49



Advanced technology

Our technology centres develop value-adding solutions involving engineered systems and high-value consumables

Our continuing investment in Vesuvius' R&D centres of excellence is reflected in all areas of our offering. We have knowledge of the most advanced ceramic and metallurgical techniques using state-of-the-art equipment and the most advanced technologies of flow simulation and finite element analysis. We are therefore able to provide our customers with sophisticated, innovative, custom-designed solutions.

Read more about our Value-added solutions on p14 and 15



Service and consistency

Serving our customers reliably, competitively and consistently with consumables critical for their manufacturing processes

Alongside our global presence, we ensure a local service to our customers, from inventory management to high-quality technical support at their sites and the ability to swiftly modify production and supply to reflect changes in customer requirements. Our knowledge of end-market processes, specifications and techniques around the world gives our experts an unparalleled ability to support our customers.

Read more about Our operations on p44–49

Section 172(1) Statement

Effective engagement with stakeholders promotes the long-term sustainability of the Group

Under Section 172 of the Companies Act 2006, the Directors have a duty to promote the success of the Company over the long term for the benefit of shareholders as a whole, having regard to a range of other key stakeholders and interests.

The Directors must have regard (among other matters) to the:

Likely consequences of any decision in the long term

Impact of the Company's operations on the community and the environment

Interests of the Company's employees

Desirability of the Company maintaining a reputation for high standards of business conduct

Need to foster the Company's business relationships with suppliers, customers and others

Need to act fairly as between members of the Company



Vesuvius employee photography competition  
Saugata Datta – see inside back cover



The Board is responsible for the overall direction of the Group. It focuses primarily upon strategic and policy issues and is responsible for the Group's long-term success. It sets the Group's strategy, oversees the allocation of resources and monitors the performance of the Group, to ensure that the Group is structured appropriately for the challenges and opportunities of the future.

In performing these duties, the Board is focused on the sustainable success of the Group in the long term, and the existence of a culture that supports this success.

The Board recognises the need for the Group to have effective engagement with, and encourage participation from, all key stakeholders to promote these long-term interests. The Group's key stakeholder groups, reflecting those who have the biggest impact on the business and modes of engagement, are outlined in the table on pages 26 and 27. The Board has regard to the activities undertaken throughout the Group in considering its own Section 172 responsibilities.

Likely consequences of any decision in the long term	Throughout the year, the Board considered the long-term consequences of the decisions it made, focusing on the interests of relevant stakeholders as appropriate.	Examples of how these activities impacted some of the key decisions taken by the Board during 2021 are given below.
<div>Acquisition of the assets and business of Universal Refractories, Inc.</div> <div>Stakeholder alignment<ul style="list-style-type: none"><li>Shareholders</li><li>Employees</li><li>Customers</li><li>Suppliers</li></ul></div> <div>Strategic alignment</div>	The Board approved the acquisition of the assets and business of Universal Refractories, Inc. in December 2021. This is a strategically important acquisition for Vesuvius, supporting our commitment to shareholders to develop our technical service offering.	It significantly expands our North American presence among electric arc furnace steel producers, delivering further expertise to our core business in steel tundish applications, while also further strengthening our Foundry business. This allows us to enhance our customer offering and will provide further opportunities for our suppliers. We are delighted to welcome 140 of Universal's employees to the Group.
<div>Ongoing operational response to the COVID-19 pandemic</div> <div>Stakeholder alignment<ul style="list-style-type: none"><li>Employees</li><li>Shareholders</li><li>Customers</li><li>Suppliers</li></ul></div> <div>Strategic alignment</div>	Recognition of the impact of COVID-19 continued to play an important part in the Board's decision-making throughout 2021. With the primary focus remaining on protecting the health and safety of employees, the Board monitored the level of COVID-19 throughout the Group and the steps that were being taken in each country to enable employees to be vaccinated.	The Board also monitored the impact of the pandemic on global supply chains, in particular on the Group's ability to source and ship raw materials to fulfil customers' orders on a timely basis, and the increasing costs that resulted. The Board oversaw the Group's response to these challenges, and scrutinised the actions being taken to promote continuity of supply and ensure that the Group's financial position was protected by the pass-through of additional costs.
<div>Capital investment in VISO and slide-gate capacity</div> <div>Stakeholder alignment<ul style="list-style-type: none"><li>Shareholders</li><li>Employees</li><li>Customers</li><li>Suppliers</li><li>Communities</li></ul></div> <div>Strategic alignment</div>	The Board approved the investment in additional slide-gate capacity in Europe, and VISO and slide-gate capacity for South East Asia. The Board considered the current Group capacity and the need for expansion to ensure that the Group was able to continue to fulfil customers' orders on a timely basis.	The Board noted that the new equipment would produce products more efficiently, thus supporting the Group's sustainability objectives. Consideration was given to the appropriate geographical location for the extra capacity as well as the environmental consequences of increased production. The Board noted the actions taken to make adjustments to project planning and the additional improvements to legacy production processes at the nominated sites. The additional capacity will also create additional jobs in Poland and India.

Strategic alignment

Deliver profitable growth

Generate value for our shareholders

Maintain an efficient capital structure

Always put safety first

Think beyond in innovation

Run best-in-class sustainable operations

Foster talent, skill and motivation in our people

See more about Our strategy on p14 and 15



Section 172(1) Statement continued

Interests of the Company's employees

The Board takes the health and safety of our employees as its primary responsibility. Throughout 2021, it continued to monitor the impact of the COVID-19 pandemic on employees, focusing particularly on the roll-out of vaccinations around the world and any steps that Vesuvius' businesses could take to facilitate the availability of vaccinations for their staff.

At each Board meeting, the Board received a report on the Group's performance against Health and Safety KPIs and reviewed, in detail, the circumstances of any Lost Time Injuries that had been recorded since its last meeting.

As part of the regular schedule of business unit presentations, the Board reviewed progress against the specific HR objectives for each business unit and monitored the initiatives that are being implemented to enhance the career and personal development of employees, and talent development as a whole within the Group.

In October, the Company undertook its third global employee engagement exercise. The Board oversaw this process, which commenced with an engagement survey, aimed at canvassing the opinions of all of our >11,000 employees worldwide. The Board received feedback on the results, including comparator data versus the norm for other global manufacturing companies and considered what this indicated about the culture of the Group. It reviewed management's response to the outcome of the survey and the follow-up actions that would be undertaken throughout the Group. Further information about the survey can be found on pages 91 and 92.

Further information about the work of the Board's Committees in considering and supporting the interests of the Company's employees can be found in the Nomination and Remuneration Committee Reports on pages 125–153.

Need to foster the Company's business relationships with suppliers, customers and others

During 2021, the Board received regular updates from the Chief Executive on the actions being taken throughout the Group to ensure continuity of supply for the Group's customers despite the supply chain disruptions caused by the COVID-19 pandemic and the increased cost of raw materials and freight. The Board received regular updates on the impact of the pandemic on the Group's suppliers, and the availability and pricing of raw materials. The Board discussed the need to pass these increased costs through to customers to protect the Group's business and the Chief Executive was tasked with ensuring this was being appropriately actioned throughout the Group. The Board was then kept apprised of progress in the price negotiations being undertaken with customers.

The Board received presentations from the business unit Presidents, Head of Strategy and President Operations and Technology on end-markets, the Group's relationships with customers and key matters of concern to them. It discussed the steps being taken by the Group to respond to customers' ongoing requirements, and the research and development, marketing and new product launch strategies being actioned to respond to these. The Board regularly reviewed information on the Group's performance against key manufacturing quality targets and was updated at Board meetings on actions undertaken to rectify any significant quality issues or customer complaints. The Board considered market trends at each meeting and undertook a thorough review of macro trends and their likely long-term implications at the Board's annual strategy meeting.

Alongside the regular customer contact maintained by the Chief Executive the full Board visited a steel customer in Belgium in September. This provided the Directors with the opportunity to speak directly to one of our customers about their business and to hear from them first-hand about their immediate challenges and longer-term expectations.

In addition to understanding business unit-specific procurement and pricing issues during the year, the Board also received an update from the Group's Chief Purchasing Officer and discussed the Group's procurement organisation structure, raw material supply, relationships with its suppliers and its purchasing practices.

Impact of the Company's operations on the community and the environment

The Group's Sustainability initiative ensures that sustainability is consistently at the centre of the Group's strategy. A key tenet of Vesuvius' business has always been to support our customers' efforts to reduce their own environmental footprint and improve safety on the shop floor (especially exposure to hot metal). The Sustainability initiative provides further detail about the Group's efforts in this regard and the actions Vesuvius has committed to take to reduce its own environmental footprint and create a better tomorrow for our people and stakeholders.

The Board received bi-annual presentations from the VP Sustainability on the work of the Sustainability Council and the Group's progress against its sustainability targets. It also received specialist advice on the ongoing governance and regulatory changes to ESG disclosure requirements. The Board and Audit Committee monitored the Group's progress with TCFD compliance, reviewing the results of the Sustainability Council's detailed scenario and risks and opportunities analysis. Further details of the Board's oversight of the Group's sustainability activities can be found in the Sustainability section on pages 50–101.

The Board recognises that the success of the Group's operations is dependent on maintaining positive relations with the communities in which we operate. The Board encourages Vesuvius' sites to support their local communities through charitable activities and community events. As part of our commitment to encourage more young people to pursue careers in scientific and technical subjects, Vesuvius looks for opportunities to develop the next generation of leaders in our sector and supports training and education programmes. In 2021, this included partnering with the Polytechnic Faculty of Mons in Belgium, supporting their Mechatronic Award and operating a young apprentice programme in Piedade, Brazil to provide professional training to young people with minimal education. Further examples of the Group's activities can be found in the Community section on page 99.

Desirability of the Company maintaining a reputation for high standards of business conduct

The Group's Code of Conduct states that Vesuvius must maintain an unquestioned reputation for integrity. The Board takes seriously the Group's obligation to maintain this high standard of business conduct and assessed compliance with this requirement through a variety of mechanisms during 2021, including reports from Internal and External Audit, along with feedback from the Group's employee engagement survey.

Vesuvius agrees terms with its suppliers and seeks to pay in accordance with those terms.

When reviewing the Group's tax strategy, the Board ensured that the Group's approach to tax management reinforced the need for the Company to maintain a reputation for high standards of business conduct.

In addition, the Board received formal reports during 2021 on the Group's compliance activities, including the Group's risk assessment programme and training practices, and specific issues raised through the Group's Speak Up helpline and internal reporting processes. Further details of the Group's compliance activities can be found in the Our communities section on pages 97–101.

Need to act fairly as between members of the Company

The primary focus of the Board's business decisions is on ensuring the long-term sustainability of the Group. The Board recognises that, in seeking to maintain long-term profitability, the Group is reliant on the support of all of its stakeholders, including the Group's workforce, its customers, suppliers and the communities in which its businesses operate.

In taking capital allocation decisions during 2021, the Board was cognisant of the need to balance the interests of different stakeholders. Decisions on the Group's approach to investment opportunities, working capital, capex, R&D, investment in people, dividend policy and pension contributions, taken during the year, were all considered against this backdrop.

Relations with shareholders

The Board is committed to communicating with shareholders and other stakeholders in a clear and open manner and seeks to ensure effective engagement through the Company's regular communications, the AGM and other investor relations activities. During 2021, the Company undertook an ongoing programme of meetings with investors. The majority of these meetings were led by the Chief Executive and Chief Financial Officer, and during 2021 a large portion were conducted by virtual means.

In advance of each AGM, we write to our largest shareholders inviting discussion on any questions they might like to raise and making the Chairs of the Board, the Audit Committee and the Remuneration Committee available to meet shareholders should they so wish.

In addition, the Chair of the Remuneration Committee wrote to our largest shareholders and key governance agencies in early 2022, to provide additional detail on changes to the Group's executive remuneration proposals and invite further engagement. Feedback was received from the majority of shareholders and governance agencies and dialogue entered into with a number of them regarding the specifics of the proposals. As a result of this engagement, the Committee was pleased to be able to implement these changes with the support of shareholders. Further detail is contained in the Directors' Remuneration Report on pages 130–153.

The Company reports its financial results to shareholders twice a year, with the publication of its annual and half-year

financial reports. In addition, to maintain transparency in performance, we also issued a number of trading updates during 2021. Presentations or teleconference calls were held by the Chief Executive and Chief Financial Officer with institutional investors and analysts on each of these dates.

In a normal year all the Directors attend the Company's AGM, providing shareholders with the opportunity to question them about issues relating to the Group, either during the meeting or informally afterwards. In 2021 travel restrictions operating in the UK curtailed attendance at the AGM. It is hoped that the majority of Directors will be able to attend this year's AGM in person.

Section 172(1) Statement continued

Our Stakeholders

Why we engage	Types of engagement undertaken	Issues relevant to the stakeholder group
<p><b>Our people</b></p> <p>With our decentralised management model, the dedication and professionalism of our people, their capacity for owning their roles and their drive for results are the most significant contributors to Vesuvius' success. We focus on the health and safety of all our staff, and engage with our people, encouraging and rewarding high performance to create an environment where all can realise their individual potential.</p>	<p>Fundamental focus on health and safety and the care of all employees</p> <p>Continuing dialogue between employees and their managers, including the conduct of regular performance reviews</p> <p>Competitive remuneration and benefits strategy, emphasising talent development with tailored career-stage programmes. Living the Values and other award schemes celebrate individual achievements</p> <p>Global communication mechanisms include an internal intranet, global email communications and a Vesuvius app, alongside forums such as local 'town hall' meetings. The Group is reconstituting its European Works Council, operates local works councils and recognises trade unions</p> <p>Wide-ranging internal training is offered on key job-related issues, with programmes such as the Vesuvius University – HeaTt – and the Foseco University</p>	<p>Health and safety</p> <p>Diversity and inclusion</p> <p>Remuneration evolution</p> <p>International mobility</p> <p>Employee engagement</p> <p>Development and retention</p> <p>Career opportunities</p> <p>Sustainability performance</p>
<p><b>Students and graduates</b></p> <p>Attracting new talent to Vesuvius is vital. Recruiting new students and graduates feeds the talent pipeline and allows us to tap into new sources of up-to-date business ideas and innovation.</p>	<p>The Group maintains contact with universities to identify and develop talent and undertakes R&amp;D collaborations which complement our in-house R&amp;D capability</p> <p>Our businesses attend careers fairs and provide student work placements and internships</p> <p>Vesuvius' website provides prospective applicants with detailed information about the Group</p>	<p>Career opportunities, personal development, engagement and retention</p> <p>Research and innovation</p> <p>Training and mobility</p> <p>Business sustainability</p>
<p><b>Customers</b></p> <p>Engaging with our customers helps us to understand their needs and identify opportunities and challenges. Collaborating with our customers enables us to use our expertise to improve the safety and efficiency of their manufacturing processes, enhance their end-product quality and reduce their costs.</p>	<p>Senior-level dialogue is maintained with all key customers, including Directors' visits to customers' sites, as appropriate</p> <p>Our business model focuses on collaboration with customers, to provide customised solutions, and more than 2,500 Vesuvius representatives are embedded at customer locations</p> <p>The Group manages customer relationships on a global basis as required, complemented by diverse local servicing capability</p> <p>We engage with customers on safety leadership and support their training requirements. During the pandemic there has been a greater focus on virtual training</p> <p>We provide technical customer training, including the Foseco University, and participate in industry forums and events. In 2021, the majority of these interactions had to be conducted virtually with more focus on e-learning</p>	<p>Customer satisfaction</p> <p>Product quality and performance</p> <p>Innovation and provision of solutions</p> <p>Health and safety</p> <p>Sustainability performance</p>
<p><b>Suppliers and contractors</b></p> <p>Maintaining a flexible workforce through the use of contractors and cost-effective access to high-quality raw materials is vital to our success. Our contractors and suppliers are critical to our business.</p>	<p>In a normal year Vesuvius conducts regular visits to key suppliers. In 2021, opportunities for such visits were more limited</p> <p>Senior-level relationships are built with large suppliers. In 2021, the majority of these meetings were held virtually</p> <p>All suppliers/brokers have regular interaction with the Global Purchasing Team</p> <p>Dedicated category directors build long-term relationships and product expertise</p> <p>There is a rigorous and consistent supplier accreditation procedure</p> <p>Effective working protocols, including work risk assessments, are established with contractors</p>	<p>Operational performance</p> <p>Responsible procurement</p> <p>Trust and ethics</p> <p>Payment practices</p>

Why we engage	Types of engagement undertaken	Issues relevant to the stakeholder group
<p><b>Investors</b></p> <p>Continued access to funding is vital to the performance of our business. We work to ensure that our investors have a clear understanding of our strategy, performance and objectives. Supportive investors are more likely to provide the Company with funds for expansion.</p>	<p>Vesuvius' Investor Relations Strategy managed by the Group Finance Director and Chief Executive includes regular meetings with key and prospective investors</p> <p>The Group's Annual Report provides an overview of the Group. Regular announcements and press releases are published to provide updates on the Group's performance and progress</p> <p>The AGM provides all shareholders with an opportunity to directly engage with the Board</p> <p>There is ongoing dialogue with the Company's analysts to address enquiries and promote the business</p>	<p>Financial performance</p> <p>Strong governance and transparency</p> <p>Sustainability performance</p> <p>Diversity and inclusion</p> <p>Director remuneration</p> <p>Board performance</p>
<p><b>Lenders (banks and debt investors)</b></p> <p>The Group needs to access funding to ensure it has sufficient financing to run the business and fund future growth. We ensure that our relationship banks have a clear understanding of our strategy, performance and objectives. We engage with lenders to fulfil our compliance obligations and to ensure that we have clear knowledge and awareness of market sensitivities and trends.</p>	<p>Group Treasury maintains an ongoing dialogue with key lenders through the relationship banks and other local banks in the countries in which Vesuvius operates. In 2021, this dialogue was maintained by virtual means</p> <p>The Group Treasurer, Group Head of Corporate Finance and CFO hold regular meetings with key personnel from banks and other lenders who provide the Group's debt funding. In 2021, these meetings were held virtually</p> <p>Representatives from the banks are invited to the Group's results presentations</p> <p>Annual Report and Financial Statements</p>	<p>Financial performance</p> <p>Group internal control and audit processes</p> <p>Strategic planning and ability to repay debt</p> <p>Gearing and monitoring of financial covenant ratios</p> <p>Business continuity planning</p> <p>Transparency and ethical behaviour</p>
<p><b>Communities</b></p> <p>We are committed to maintaining positive relationships with the communities in which we operate. Our social responsibility activities complement our Values and we encourage our employees to engage with communities and groups local to our operations.</p>	<p>Provision of work experience and internships to local university students and school children</p> <p>Sponsoring of charitable activities</p> <p>Participation in local volunteering initiatives</p>	<p>Operational performance</p> <p>Transparency and ethical behaviour</p> <p>Environmental performance</p>
<p><b>Environmental agencies and organisations</b></p> <p>Good environmental management is aligned with our focus on cost optimisation and operational excellence. We engage with appropriate organisations to ensure that we are complying with regulatory requirements, and to publicise our performance.</p>	<p>Signatory to the UN Global Compact</p> <p>Online Sustainability Report published on the Vesuvius website</p> <p>Visits and inspection of sites by government agencies</p> <p>Annual Report and Financial Statements</p> <p>Response to environmental research as part of customer and supplier due diligence</p> <p>Participation in environmental and social responsibility research and questionnaires</p>	<p>Governance and transparency</p> <p>Operational performance</p> <p>Reporting on performance metrics</p> <p>Environmental performance</p>
<p><b>Governments and regulatory agencies</b></p> <p>National governments set the regulatory framework within which we operate. We engage where appropriate to ensure that we can help in shaping new policies, regulations and standards, and ensure compliance with existing requirements.</p>	<p>Transparent communication with government officials as required</p> <p>Participation in appropriate government and industry working groups</p> <p>Membership of industry associations and contribution to best practice guidance</p> <p>Lobbying and direct contact with appropriate bodies on key business issues</p>	<p>Trust and ethics</p> <p>Governance and transparency</p>
<p><b>Pensioners and deferred pensioners</b></p> <p>Providing for and managing future pension liabilities in our defined benefit schemes is an important part of financial planning.</p>	<p>Ongoing contact with members of the Group's pension plans, including annual member updates and contact on specific regulatory developments</p> <p>Contact with the trustees and custodians of the Group's defined benefit plan</p>	<p>Trust and ethics</p> <p>Financial performance</p>



Section 172(1) Statement continued

Employee involvement

Vesuvius adopts an open and honest approach to employee communications, with regular updates from senior management across businesses and operations within the Group. The Senior Leadership Group comprising the 160 most senior managers in the Group participates in monthly webcasts with the Group Executive Committee, to ensure clear communication of the Group's key targets and priorities. In September, this Group met for a three-day off-site leadership meeting to discuss the organisation's challenges and objectives for 2022.

The Board and Group Executive Committee usually visit operations throughout the year, touring the sites, meeting with employees and conducting 'town hall' meetings when they do. These activities were curtailed during the first half of 2021 by COVID-19-related travel restrictions, but some visits did take place in the second half. Other regular employee communications include direct email updates on the financial performance of the Group, the industrial

environment in which Vesuvius operates and other significant operational developments. The Company operates an employee intranet which distributes Company news and events, and an employee 'app' for information dissemination, as well as undertaking local initiatives for employee engagement on a site-by-site basis.

The HR department is the primary point of contact for employees on employment and workplace matters, operating with an open-door policy and advising employees of any local legal, tax, pension or other employment changes. There are numerous employee-sponsored and led representative bodies within Vesuvius which differ with respect to jurisdiction and geography.

The Group's agreement constituting its European Works Council (EWC) was terminated in 2020, following notice given by management, and with the subsequent departure of the United Kingdom from the European Union. Management has nominated Poland

as its representative country under the relevant legislation and has constituted a Special Negotiating Body which is engaged in discussions on the formation of a new EWC Agreement and Council.

Senior management, supported and facilitated by the HR department, encourages open dialogue and consults with all employee representative bodies, as appropriate.

All members of the Group Executive Committee participate in the Vesuvius Share Plan and receive awards of Performance Shares, which vest in accordance with measures set against financial and sustainability targets. For certain senior managers, awards are made under the Vesuvius Medium Term Plan (MTP). These managers participate in the MTP at varying percentage levels, and awards are made in shares and based on the same measures and targets as the Annual Incentive Plan. In this way, a broad cadre of management has incentives that are aligned with shareholders' interests.

Employee engagement

In accordance with the UK Corporate Governance Code, Jane Hinkley is the designated Non-executive Director responsible for overseeing engagement with the workforce.

Vesuvius is a diverse, multinational Group, with four business units, employing more than 11,000 people located in 40 different countries. The Board has adopted an approach that builds on existing engagement initiatives and targets specific issues for attention when considering employee engagement. These processes engage the entire Board and are overseen by Jane Hinkley.

The primary mode of engagement for Directors is through direct interaction with the workforce during the Directors' site visits.

During 2021, these engagement activities were again curtailed by the COVID-19-related travel restrictions. However,

during the latter part of the year, the Chairman and each of the Non-executive Directors were able to visit sites in Belgium, China, Germany, Poland and the US. The Non-executive Directors also held a 'virtual' Board visit with managers in Vesuvius India and South East Asia, to hear more about the activities of the Group there. During the visits the Directors were able to interact with a cross-section of different employees, from various functions and organisational levels. At most sites 'town hall' meetings were held, providing the Non-executive Directors with the opportunity to engage with the workforce to explain the function of the Board and also to explain how executive remuneration aligns with wider company pay policies. These meetings gave the Non-executive Directors the opportunity to hear the views of employees and answer their questions about the organisation. A more extensive

site visit schedule is currently being planned for 2022, as soon as travel restrictions allow.

In 2021, the Board also oversaw the launch of the Group's third employee engagement survey. This provided the Board with valuable insight into the attitudes, engagement and concerns of employees. The data was analysed in a number of different ways, identifying the results of various sub-groups of employees and providing the Board with a valuable opportunity to track areas of organisational strength and weakness. The Board considered the key workforce-related issues highlighted in the survey and other employee feedback in reviewing management actions with regard to employee engagement. Further information about the survey can be found on pages 91 and 92.

Risk, viability and going concern

The Board continually monitors the internal and external risks that could significantly impact the Group's long-term performance

The Group undertakes a continuous process to review and understand existing and emerging risks.

Risk management in 2021

Each year, the Board exercises oversight of principal risks through a specific review of the way in which the Group manages those risks. This process provides the Board with a clear understanding of the individuals within the business responsible for the management of each specific risk and the mitigation in place to address it. The Board also reviews and establishes the Group's risk appetite for those issues identified as principal risks and the associated adequacy of the steps being taken to mitigate them.

The Board has overall responsibility for establishing and maintaining a system of risk management and internal control, and for reviewing its effectiveness. The Group undertakes a continuous process of risk identification and review, which includes a formal process, conducted annually, for mapping risks from the bottom up, with each major business unit and key operational, senior functional and senior management staff identifying their principal risks. This assessment undergoes a formal review at half-year. The results are compiled centrally to deliver a coordinated picture of the key operational risks identified by the business. These risks are then reviewed by the Group Executive Committee. As part of this process, each Director contributes their individual view of the top-down strategic risks facing the Group – drawing on the broad commercial and financial experience they have gained both inside and outside the Group. The results of this assessment are then overlaid on the internal assessment of risks to build a comprehensive analysis of existing and emerging risk.

The process extends to cover both financial and non-financial risks, and considers the risks associated with the impact of the Group's activities on employees, customers, suppliers, the environment, local communities and society more generally. As in previous years, in 2021 the Group's assessment of principal risks was reviewed and considered against any emerging risks and uncertainties that were identified through our Board review process.

The Board continues to monitor the implications of emerging macro trends on the business, including automation in manufacturing, business digitalisation, automotive electrification, and in particular the significant steps being taken in our end-markets to combat climate change as businesses commit to future net zero emissions targets. All of these could act as disruptors to our business. Commentary on some of these areas is contained in the Our external environment section on pages 16 and 17 of this Report. No additional critical macro trends were identified in 2021.

The Board was able to return to conducting physical site visits in 2021, particularly in the latter part of the year. The Board continues to believe that this direct engagement with our staff is the most effective way to assess the 'temperature' of the organisation – hearing first-hand about issues, concerns and potential risks that might impact the Group.

The Directors' views on each of the above issues, and on emerging risks in general, were independently gathered and integrated into the management discussions and actions taken on risk.

Risk remains an integrated part of all business unit presentations to the Board, informing the Board of the operational approach taken to risk management on a day-to-day basis.

Changes to risk in 2021

The effects of the COVID-19 pandemic continued to be felt in certain geographies and disciplines of the business in 2021. Managing the physical risks to our staff and in our interactions with customers continued to be a priority, where our protocols for remote working, social distancing, and management of production processes continued to be followed. As with many companies, Vesuvius was exposed to post-COVID-19 disruptions in global trade, which placed supply chains under stress and affected elements of the Group's financial performance.

Against the backdrop of the continuing pandemic, and its development during the year, the Board continued to focus on the Group's existing risks, and the processes to mitigate and manage them. It also remained alert to other emerging risks. The Board noted again the increasing presence of cyber threats to business in general, further commentary on which is set out in the section on business continuity below. Other emerging risks were assessed, with the Board considering security of raw material supply, business disruption driven by increasing inflation and interest rates, and the continuing work required to ensure that the Group's decentralised management and talent pipeline can deliver the consistent profitable growth identified in the Group's strategy. It was noted that a number of these and other issues were already addressed in the Group's principal risks and by related mitigation activities.

Risk, viability and going concern continued

Issues identified in certain of the Group's principal risks materialised during the year. The Group's existing measures in mitigation were initiated and additional actions taken specific to the challenges posed by the continuing COVID-19 pandemic. These were most notably:

**Business interruption:** With the mandatory shutdowns of 2020 predominantly behind us, our manufacturing operations remained operational throughout the year with enhanced health and safety protocols in place, in each case in line with prevailing national rules. Remote working remained the norm in many countries, with more than 1,500 people still working from home at year end. Vesuvius also experienced the effects of the global trade disruption, seeing significant increases in price for freight and raw materials, and disrupted logistics, affecting the predictability of our global supply chain. Our central purchasing team focused on addressing these issues, but two product line supply interruptions were experienced.

**End-market risk:** Whilst end-markets began to pick up at the end of 2020, with overall demand continuing to grow during the year, our end-markets did not return fully to pre-pandemic levels. We also saw significant raw material price increases throughout the year. The Group's diversified sourcing strategy helped mitigate this challenge, with raw material costs offset by the implementation of price increases.

**People, culture and performance:** Across the Group, our people continued to work in difficult circumstances and lockdowns affected different parts of the business. The protocols put in place in 2020 – access to virtual IT tools to support remote working, increased PPE provision and changes to site working conditions – remained in force for all of the year. Internal communication remained a focus, building on the success of the processes put in place in early 2020. Once again, the focus on Values was maintained, with our Living the Values Awards competition running again on a 'virtual' basis, with the Group's senior leadership participating to celebrate the stories and achievements of our Values finalists. Our annual Senior Leaders' conference was held in person, with enhanced health and safety protocols in place for those who could travel, and with a significant number of staff who could not travel joining remotely.

**Health and safety:** Our very strong focus on health and safety and the consistency of its application across the Group continued to place us extremely well to respond to the pandemic's challenges. In certain jurisdictions our workforce was affected more acutely than in others with the development of the Omicron variant, but operations were managed carefully to ensure security of supply for our customers.

It is clear that the COVID-19 pandemic has introduced shifts in working patterns and trading environment that will not unwind for several months, and in some cases much longer. The Board continues to monitor these changes, and in particular the disruption that they could drive for global businesses and, in particular, for supply chain security. Consequently, the mitigations established by the Group to address its principal risks will remain strongly relevant as 2022 progresses.

Despite these challenges, the Board has not identified any overall material change to the Group's identified principal risks and uncertainties, albeit that within those risks a number of issues manifested themselves in 2021. No new principal risks were identified during the year. As such, the Group's statement of Principal Risk and Uncertainties was unchanged in 2021 from 2020.

The crisis unfolding in Ukraine since the end of the year has the potential to generate direct and indirect impacts that are reflected in our Principal Risks, namely End Market Risks, Protectionism and Globalisation and Business Interruption. Whilst we are concerned about the potential impact, we will put our mitigation strategies into action in order to minimise any impact on Vesuvius.

Climate change

The Group's overall risk management processes also incorporate consideration of the potential impact of climate-related risks on the Group. The Group does not regard climate change itself to represent a material stand-alone risk for the Group's operations.

Whilst a significant proportion of the Group's revenue is generated from steel manufacture and automotive castings, industries that are under transition as a result of their focus on improving environmental performance, we believe these changes will be positive for the Group. The opportunities in the Group's business strategy, which is founded on helping our customers to improve their manufacturing efficiency and the quality

of their products – and therefore reduce their climate impact – will play a critical part in the development of the Group going forward. The Group recognises that climate change could present further uncertainty for the Group in terms of increased regulation, evolution of the geographical distribution of our customer base and the costs of meeting more onerous disclosure requirements. Further information about the Group's consideration of climate-related risks and opportunities can be found in the Our planet section on pages 60–66.

The risks we associate with our sustainability performance and our end customers' sustainability transition – badged as ESG – are identified as a separate element of the Group risk register, recognising the work Vesuvius can do to mitigate the environmental impact of our customers' processes. Other elements of this risk are incorporated into the appropriate Principal Risk and Uncertainties that the Group has identified. The Group continues to focus internally on the action we can take to drive our business' sustainability. In 2021, the Group made further progress on its sustainability KPIs and continued work on the Sustainability initiative announced in 2020. Under this initiative the Group will seek to drive a lower CO<sub>2</sub> intensity, reduce energy usage, and take the steps necessary to meet the target set of being emissions net zero by 2050. Further information can be found in the Our planet section on pages 60–77.

Risk mitigation

The principal risks identified are actively managed in order to mitigate exposure. Senior management 'owners' have been identified for each principal risk, and they manage the mitigations of that specific risk and contribute to the analysis of its likelihood and materiality. This analysis is reported to the Board. The risks are analysed in the context of our business structure which gives protection against a number of principal risks we face with diversified currencies, a widespread customer base, local production matching the diversity of our markets and intensive training of our employees. Additionally, we seek to mitigate risk through contractual measures. Where cost-effective, the risk is transferred to insurers. Our processes are not designed to eliminate risk, but to identify our principal risks and seek to reduce them to a reasonable level in the context of the delivery of the Group's strategy.

Business continuity

In partnership with our risk management advisers and our insurers, we seek to identify the most effective means of reducing or eliminating insurable risks, through a combination of risk management and the placing of insurance cover.

Our insurer property loss control programme is based upon insurer loss modelling and focuses on insured losses. The insurer's loss control engineers undertake a series of on-site inspections focused on machinery breakdown, fire, natural catastrophe and other property damage and business interruption risks. These surveys yield a series of loss-reduction recommendations. The execution of these recommendations is agreed with site management and then followed through to completion.

In parallel, Vesuvius' own loss management programme focuses on strategic sites and sites not covered by insurers. Assisted by an independent consultant, we undertake property loss control and business continuity surveys using Vesuvius' bespoke risk and exposure-based protocol.

These reports yield further risk reduction recommendations, and improvement actions and timescales are agreed and followed through by site management. To support the Group's loss control activities, risk management workshops are conducted covering loss prevention, emergency planning, crisis management and business recovery. As the footprint of the Group develops and, in certain cases, production concentrates in a smaller number of flagship sites, business continuity planning is conducted to ensure that sufficient resilience remains in the manufacturing network to address projected supply interruptions.

With regard to fire safety, the Group monitors all fire-related near misses or minor dangerous occurrences. Any fires, including overheating, are reported and analysed both locally and by senior HSE management in order that safety improvement initiatives can be prioritised and communicated throughout the Group. Underlying causes are established with detailed analysis undertaken as a means of proposing improvement priorities in order that safety and process safety initiatives can be targeted on a risk-assessed basis.

The Group also focuses on cyber security issues in terms of business continuity. This is overseen by the Group's IT Committee which meets on a regular basis to review and progress the Group's plans for tackling cyber issues. The Audit Committee and Board receive regular updates on the Group's activities in this area including general developments and specific actions and activities within the Vesuvius business. A comprehensive plan was established in 2020 to further strengthen Vesuvius' overall IT security, which is well progressed. During 2021, we worked further to strengthen our IT security seeking to protect against the risks presented by developments in external cyber threats. A holistic approach is taken to addressing cyber challenges, focusing on the improvement of the Group's overall IT infrastructure, procedures and framework. The Group continues to run regular training programmes on cyber/IT security. See page 121 of the Audit Committee Report for further information.

Internal control

The Group's internal control system is designed to manage, rather than eliminate, the financial risks facing the Group and safeguard its assets. No system of internal control can provide absolute assurance against material misstatement or loss. The Group's system is designed to provide the Directors with reasonable assurance that problems are identified on a timely basis and are dealt with appropriately.

The Audit Committee assists the Board in reviewing the effectiveness of the Group's system of internal control, including financial, operational and compliance controls, and risk management systems. The key features of the Group's system of internal control are set out in the table on page 32.

Reviewing the effectiveness of risk management and internal control

The internal control system covers the Group as a whole and is monitored and supported by the Group's Internal Audit function, which conducts reviews of Vesuvius' businesses and reports objectively both on the adequacy and effectiveness of the system of internal control and on those businesses' compliance with Group policies and procedures. The Audit Committee receives reports from the Group Head of Internal Audit and reports to the Board on the results of its review.

The Group also conducts a self-certification exercise by which senior financial, operational and functional management certify the compliance throughout the year of the areas under their responsibility with the Group's policies and procedures and highlight any material issues that have occurred during the year.

As part of the Board's process for reviewing the effectiveness of the system of internal control, it delegates certain matters to the Audit Committee. Following the Audit Committee's review of internal financial controls and of the processes covering other controls, the Board annually evaluates the results of the internal control and risk management procedures conducted by senior management.

Since the date of this evaluation, there have been no significant changes in internal controls or other matters identified which could significantly affect them.

In accordance with the provisions of the UK Corporate Governance Code, the Directors confirm that they have carried out a robust assessment of the principal risks facing the Company, including those that threaten its business model, future performance, solvency or liquidity. They have also reviewed the effectiveness of the Group's system of internal control and confirm that the necessary actions have been taken to remedy any control weaknesses identified during the year and to the date of this report.

Further detail regarding the Audit Committee's review of the effectiveness of the Group's risk management and internal control systems is contained in the Audit Committee report on pages 120 and 121.



Risk, viability and going concern continued

Key features of risk management and internal control

Strategy and financial reporting	Comprehensive strategic planning and forecasting process
	Annual budget approved by the Board
	Monthly operating financial information reported against budget
	Key trends and variances analysed and action taken as appropriate
Vesuvius GAAP	Accounting policies and procedures formulated and disseminated to all Group operations
	Covers the application of accounting standards, the maintenance of accounting records and key financial control procedures
Operational controls	Operating companies and corporate offices maintain internal controls and procedures appropriate to their structure and business environment
	Compliance with Group policies on items such as authorisation of capital expenditure, treasury transactions, the management of intellectual property and legal/regulatory issues
	Use of common accounting policies and procedures and financial reporting software used in financial reporting and consolidation
	Significant financing and investment decisions reserved to the Board
	Monitoring of policy and control mechanisms for managing treasury risk by the Board
	Clearly delegated authority for capital expenditure, purchasing, customer contracts and hiring
Risk assessment and management	Continuous process for identifying, evaluating and managing any significant risks
	Risk management process designed to identify the key risks facing each business
	Reports made to the Board on how those risks are managed
	Each major Group business unit produces a risk map to identify key risks, and assess the likelihood of risks occurring, as well as their impact and mitigating actions
	Top-down risk identification undertaken at Group Executive Committee and Board meetings
	Board review of insurance and other measures used in managing risks across the Group
	The Board is notified of major issues and makes an annual assessment of whether risks have changed
	Ongoing assurance processes by the legal function and Internal Audit including the annual self-certification process
Internal Audit	Externally supported 'Speak Up' whistleblowing line
	Reviews Vesuvius' businesses and reports on the adequacy and effectiveness of their systems of internal control and compliance with Group policies and procedures
	Agrees action plans for the resolution of any improvement actions identified by their audits, and monitors with local management and the business unit Presidents, progression with their completion
	Reports to the Audit Committee on the results of each audit and provides regular updates on high-priority action items
	The Audit Committee discusses the key risks identified by Internal Audit

Principal risks

The risks identified on pages 34 and 35 are those the Board considers to be the most relevant to the Group in relation to their potential impact on the achievement of its Strategic Objectives. All of the risks set out on these pages could materially affect the Group, its businesses, future operations and financial condition, and could cause actual results to differ materially from expected or historical results. The Group continues to focus on risk mitigation, and whilst, as identified above, certain elements of the Group's risks have manifested in 2021 as a result of the continuing COVID-19 pandemic, the principal risks remain the same. These risks are not the only ones that the Group will face. Some risks are not yet known and some currently not deemed to be material could become so.

Viability Statement

In accordance with the UK Corporate Governance Code, the Directors have assessed the viability of the Group over a three-year period to 31 December 2024, taking into account the Group's current position and the potential impact of the principal risks and uncertainties. The Directors have determined that three years is an appropriate period over which to provide the Viability Statement because this is the Company's planning cycle and it is sufficiently funded by financing facilities with average maturity terms of approximately six years. The projected cash flows for the next three years have been based on the latest Board-approved budgets and strategic plans.

In making this statement, the Directors have carried out a robust assessment of the principal risks that may threaten the business model, future performance, solvency and liquidity of the Group. This is embodied in the annual review of a three-year business plan which includes a review of sensitivity to 'business as usual' risks, such as profit growth and working capital variances, severe but plausible events and the impact these could have on the Group's debt covenants and available

liquidity. The results take account of the availability and likely effectiveness of the mitigating actions that could be taken to avoid or reduce the impact or occurrence of the underlying risks. Whilst the review has considered all the principal risks identified by the Group, the following were selected for enhanced stress testing: an unplanned drop in customer demand; debt recovery risk due to customer default; business interruption due to the unplanned closure of several key plants; and raw material price inflation. The Group's prudent balance sheet management, flexible cost base, ability to react quickly to end-market conditions, access to long-term capital at acceptable financing costs and well diversified international businesses leave it well placed to manage these principal risks.

In performing the stress testing, certain assumptions were made, including that: customer failures result in write-offs of the full value of the receivables with no lost revenue replacement; and cash flow is supported by working capital releases, restricted capital expenditure and operating cost reductions. Under the enhanced stress testing described above, a potential breach of a covenant would only occur in the event of an unforeseen reduction in revenue of greater than 30%. Accordingly, the Directors confirm that they have a reasonable expectation that the Group will be able to continue in operation and meet its liabilities as they fall due over the three-year period to 31 December 2024. Furthermore, the Board believes that the Group continues to be well positioned for success in the longer term because of: our exposure to end-markets that are growing faster through the cycle than underlying global GDP; our market-leading position that is supported by ongoing investment in innovation and R&D; our strong degree of customer intimacy with around a quarter of our employees working at customer facilities; and the focus we have on building quality teams with clear organisational responsibility.

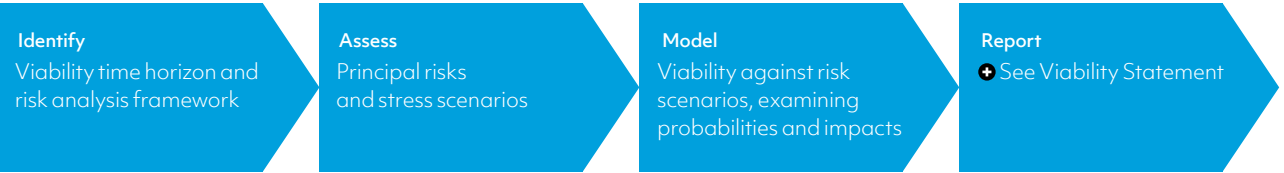
Going Concern Statement

The Directors have prepared cash flow forecasts for the Group for a period in excess of 12 months from the date of approval of the 2021 financial statements. These forecasts reflect an assessment of current and future end-market conditions and their impact on the Group's future trading performance.

The analysis undertaken includes a plausible but severe downside scenario, based on an assumed protracted COVID-19 related demand impact, despite emerging confidence that the worst of the pandemic may be behind us. This downside scenario assumes a decline in business activity and profitability in 2022 and 2023 to the level achieved in H2 2020, the period half-year most severely impacted by COVID-19. On a full-year basis relative to 2021, this implies a c.14% decline in sales and a c.34% decline in trading profit. Even in this downside scenario, the forecasts show that the Group's maximum net debt/EBITDA (pre-IFRS 16 in-line with the covenant calculation) does not exceed 1.3x, compared with a leverage covenant of 3.25x.

The forecasts show that the Group will be able to operate within the current committed debt facilities and show continued compliance with the Company's financial covenants. On the basis of the exercise described above and the Group's available committed debt facilities, the Directors consider that the Group and the Company have adequate resources to continue in operational existence for a period of at least 12 months from the date of signing of these financial statements. Accordingly, they continue to adopt a going concern basis in preparing the financial statements of the Group and the Company.

Viability process



Principal risks and uncertainties

Risk	Potential impact	Mitigation
<div><b>End-market risks</b> Vesuvius suffers an unplanned drop in demand, revenue and/or margin because of market volatility beyond its control.  <div>Strategic alignment</div></div>	<div>Unplanned drop in demand and/or revenue due to reduced production by our customers</div> <div>Margin reduction</div> <div>Customer failure leading to increased bad debts</div> <div>Loss of market share to competition</div> <div>Cost pressures at customers leading to use of cheaper solutions</div>	<div>Geographic diversification of revenues</div> <div>Product innovation and service offerings securing long-term revenue streams and maintaining performance differential</div> <div>Increase in service and product lines by the development of the Technical Services offering</div> <div>R&amp;D includes assessment of emerging technologies</div> <div>Manufacturing capacity rationalisation and flexible cost base</div> <div>Diversified customer base: no customer is greater than 10% of revenue</div> <div>Robust credit and working capital control to mitigate the risk of default by counterparties</div>
<div><b>Protectionism and globalisation</b> The Vesuvius business model cannot adapt or respond quickly enough to threats from protectionism and globalisation.  <div>Strategic alignment</div></div>	<div>Restricted access to market due to enforced preference of local suppliers</div> <div>Increased barriers to entry for new businesses or expansion</div> <div>Increased costs from import duties, taxation or tariffs</div> <div>Loss of market share</div> <div>Trade restrictions</div>	<div>Highly diversified manufacturing footprint with manufacturing sites located in 26 countries</div> <div>Strong local management with delegated authority to run their businesses and manage customer relationships</div> <div>Cost flexibility</div> <div>Tax risk management and control framework together with a strong control of inter-company trading</div>
<div><b>Product quality failure</b> Vesuvius staff/contractors are injured at work or customers, staff or third parties suffer physical injury or financial loss because of failures in Vesuvius products.  <div>Strategic alignment</div></div>	<div>Injury to staff and contractors</div> <div>Product or application failures lead to adverse financial impact or loss of reputation as technology leader</div> <div>Incident at customer plant causes manufacturing downtime or damage to infrastructure</div> <div>Customer claims from product quality issues</div>	<div>Quality management programmes including stringent quality control standards, monitoring and reporting</div> <div>Experienced technical staff knowledgeable in the application of our products and technology</div> <div>Targeted global insurance programme</div> <div>Experienced internal legal function overseeing third-party contracting</div>
<div><b>Complex and changing regulatory environment</b> Vesuvius experiences a contracting customer base or increased transaction and administrative costs due to compliance with changing regulatory requirements.  <div>Strategic alignment</div></div>	<div>Revenue reduction from reduced end-market access</div> <div>Disruption of supply chain and route to market</div> <div>Increased internal control processes</div> <div>Increased frequency of regulatory investigations</div> <div>Reputational damage</div>	<div>Compliance programmes and training across the Group</div> <div>Independent Internal Audit function</div> <div>Experienced internal legal function including dedicated compliance specialists</div> <div>Global procurement category management of strategic raw materials</div>
<div><b>Failure to secure innovation</b> Vesuvius fails to achieve continuous improvement in its products, systems and services.  <div>Strategic alignment</div></div>	<div>Product substitution by customers</div> <div>Increased competitive pressure through lack of differentiation of Vesuvius offering</div> <div>Commoditisation of product portfolio through lack of development</div> <div>Lack of response to changing customer needs</div> <div>Loss of intellectual property protection</div>	<div>Enduring and significant investment in R&amp;D, with market-leading research</div> <div>A shared strategy for innovation throughout the Group, deployed via our R&amp;D centres</div> <div>Stage gate process from innovation to commercialisation to foster innovation and increase alignment with strategy</div> <div>Programme of manufacturing and process excellence</div> <div>Quality programme, focused on quality and consistency</div> <div>Stringent intellectual property registration and defence</div>

Risk	Potential impact	Mitigation
<div><b>Business interruption</b> Vesuvius loses production capacity or experiences supply chain disruption due to physical site damage (accident, fire, natural disaster, terrorism), or other events such as industrial action, cyber attack or global health crises.  <div>Strategic alignment</div></div>	<div>Loss/closure of a major plant temporarily or permanently impairing our ability to serve our customers</div> <div>Damage to or restriction in our ability to use assets</div> <div>Denial of access to critical systems or control processes</div> <div>Disruption of manufacturing processes</div> <div>Inability to source critical raw materials</div>	<div>Diversified manufacturing footprint</div> <div>Disaster recovery planning</div> <div>Business continuity planning with strategic maintenance of excess capacity</div> <div>Physical and IT control systems security, access and training</div> <div>Cyber risks integrated into wider risk-management structure</div> <div>Well-established global insurance programme</div> <div>Group-wide safety management programmes</div> <div>Dual sourcing strategy and development of substitutes</div>
<div><b>People, culture and performance</b> Vesuvius is unable to attract and retain the right calibre of staff, fails to instil an appropriate culture or fails to embed the right systems to drive personal performance in pursuit of the Group's long-term growth.  <div>Strategic alignment</div></div>	<div>Organisational culture of high performance is not achieved</div> <div>Staff turnover in growing economies and regions</div> <div>Stagnation of ideas and development opportunities</div> <div>Loss of expertise and critical business knowledge</div> <div>Reduced management pipeline for succession to senior positions</div>	<div>Internal focus on talent development and training, with tailored career-stage programmes and clear performance management strategies</div> <div>Contacts with universities to identify and develop talent</div> <div>Career path planning and global opportunities for high-potential staff</div> <div>Internal programmes for the structured transfer of technical and other knowledge</div> <div>Clearly defined Values underpin business culture</div>
<div><b>Health and safety</b> Vesuvius staff or contractors are injured at work because of failures in Vesuvius' operations, equipment or processes.  <div>Strategic alignment</div></div>	<div>Injury to staff and contractors</div> <div>Health and safety breaches</div> <div>Manufacturing downtime or damage to infrastructure from incident at plant</div> <div>Inability to attract the necessary workforce</div> <div>Reputational damage</div>	<div>Active safety programmes, with ongoing wide-ranging monitoring and safety training</div> <div>Independent safety audit team</div> <div>Quality management programmes including stringent manufacturing process control standards, monitoring and reporting</div>
<div><b>Environmental, Social and Governance criteria</b> Vesuvius fails to capitalise on the opportunity to help its customers significantly reduce their carbon emissions as environmental pressure grows on the steel industry or Vesuvius fails to meet the expectations of its various stakeholders including employees and investors.  <div>Strategic alignment</div></div>	<div>Loss of opportunity to grow sales</div> <div>Loss of opportunity to increase margin</div> <div>Loss of stakeholder confidence including investors</div> <div>Reputational damage</div>	<div>Development and implementation of a new Sustainability initiative, which includes stretching targets focused on reducing the Group's Energy usage, CO<sub>2</sub> emissions, waste and recycled materials</div> <div>R&amp;D focus on products that assist customers to reduce carbon emissions and improve their own sustainability measures</div> <div>Skilled technical sales force to develop efficient solutions for our customers</div> <div>Globally disseminated Code of Conduct sets out standards of conduct expected and ABC Policy adopted with a zero tolerance regarding bribery and corruption</div> <div>Internal Speak Up mechanisms to allow reporting of concerns</div> <div>Extensive use of due diligence to assess existing and potential business partners and customers</div>
<div><div>Strategic alignment</div><div><div><div><div><div></div><div>Deliver profitable growth</div></div><div><div></div><div>Generate value for our shareholders</div></div><div><div></div><div>Maintain an efficient capital structure</div></div><div><div></div><div>Always put safety first</div></div><div><div></div><div>Think beyond in innovation</div></div><div><div></div><div>Run best-in-class sustainable operations</div></div><div><div></div><div>Foster talent, skill and motivation in our people</div></div></div></div><div>See more about Our strategy on p14 and 15</div></div></div>		



## Our performance

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		46	Steel Advanced Refractories
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We think beyond  
today's industrial processes




and shape the future  
through research and  
development








Key Performance Indicators

Financial KPIs\*

Strategic alignment	KPI	Purpose	Link to remuneration
Deliver profitable growth 	<b>Underlying revenue growth %</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>18.1</div><div>-12.7</div><div>-5.7</div></div>	Provides an important indicator of organic (like-for-like) growth of Group businesses between reporting periods. This measure eliminates the impact of exchange rates, acquisitions, disposals and significant business closures	
	<b>Trading profit £m</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>142.4</div><div>101.4</div><div>181.4</div></div>	Used to assess the trading performance of Group businesses	
	<b>Return on sales %</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>8.7</div><div>7.0</div><div>10.6</div></div>		
Generate value for our shareholders 	<b>Headline profit before tax £m</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>137.3</div><div>91.6</div><div>171.4</div></div>	Used to assess the financial performance of the Group as a whole	
	<b>Headline EPS p</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>35.3</div><div>23.2</div><div>45.1</div></div>	Used to assess the underlying earnings performance of the Group as a whole	🔗 Annual Incentive Plan and Vesuvius Share Plan – Read more about these on p145–150
	<b>Return on invested capital %</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>7.5</div><div>4.9</div><div>8.6</div></div>	Used to assess the financial performance of the Group	🔗 Annual Incentive Plan and Vesuvius Share Plan – Read more about these on p145–150
	<b>Free cash flow £m</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>-0.3</div><div>113.5</div><div>121.5</div></div>	Used to assess the underlying cash generation of the Group	
	<b>Average working capital to sales %</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>20.9</div><div>23.2</div><div>24.0</div></div>	One of the factors driving the generation of free cash flow is the average working capital to sales ratio, which indicates the level of working capital used in the business	🔗 Annual Incentive Plan – Read more about this on p145–147
Maintain an efficient capital structure 	<b>Interest cover</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>30.5x</div><div>14.5x</div><div>22.9x</div></div>	Interest cover and Net debt to EBITDA are used to assess the financial position of the Group and its ability to fund future growth	
	<b>Net debt to EBITDA</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>1.4</div><div>1.2</div><div>1.1</div></div>		

\* For definitions of alternative performance measures, refer to Note 4 of the Group Financial Statements.

Non-financial KPIs

Strategic alignment	KPI	Target/description	Link to remuneration
Always put safety first 	<b>Lost Time Injury Frequency Rate</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>1.06</div><div>1.16</div><div>1.55</div></div>	LTIFR of below 1  Work-related illness or injuries which resulted in an employee being absent for at least one day – measured per million hours worked	🔗 Annual Incentive Plan and Vesuvius Share Plan – Read more about these on p145–150
	<b>Total R&amp;D spend £m</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>30.3</div><div>26.7</div><div>27.6</div></div>	At constant 2021 currency	
	<b>New product sales %</b> <div><div>21</div><div>20</div><div>19</div></div> <div><div>15.3</div><div>12.4</div><div>16.3</div></div>	Sales of products launched within the last five years as a % of total revenue	🔗 Annual Incentive Plan – Read more about this on p145–147
Think beyond in innovation 	<b>Total energy consumption</b> kWh per metric tonne of product packed for shipment  <b>-9.0%</b>	10% reduction of energy consumption per metric tonne of product packed for shipment by 2025 (vs 2019)	
	<b>Energy CO<sub>2</sub>e emissions</b>  <b>-16.5%</b>	10% reduction of Scope 1 and Scope 2 Energy CO <sub>2</sub> e emissions per metric tonne of product packed for shipment by 2025 (vs 2019)	🔗 Annual Incentive Plan and Vesuvius Share Plan – Read more about these on p145–150
	<b>Wastewater</b>  <b>-2.8%</b>	25% reduction of wastewater per metric tonne of product packed for shipment by 2025 (vs 2019)	
	<b>Solid waste</b>  <b>-21.8%</b>	25% reduction of solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment by 2025 (vs 2019)	🔗 Annual Incentive Plan – Read more about this on p145–147
	<b>Recycled material</b>  <b>6.2%</b>	7% of raw materials used in production to be recycled materials from external sources by 2025	
	<b>Compliance training</b>  <b>100%</b>	At least 90% of targeted staff to complete Anti-Bribery and Corruption training annually	🔗 Annual Incentive Plan – Read more about this on p145–147
	<b>Supply chain</b>  <b>52%</b>	By the end of 2023, conduct sustainability assessments of suppliers covering at least 50% of Group spend	
Foster talent, skill and motivation in our people 	<b>Gender diversity</b>  <b>21%</b>	30% female representation in Top Management by 2025 (Group Executive Committee plus key direct reports)	🔗 Annual Incentive Plan and Vesuvius Share Plan – Read more about these on p145–150



Financial review

A strong recovery in operating performance despite pricing and logistics challenges

The following review considers a number of our financial KPIs and sets out other relevant financial information.

Revenue

£1,642.9m

Reported change 12.7%

Underlying<sup>1</sup> change 18.1%

Trading profit<sup>2</sup>

£142.4m

Reported change 40.4%

Underlying<sup>1</sup> change 50.4%

Statutory EPS

37.7p

Reported change 146%

Return on Sales<sup>2</sup>

8.7%

Reported change 170bps

Underlying<sup>1</sup> change 190bps

1. Underlying basis is at constant currency and excludes separately reported items and the impact of acquisitions and disposals.

2. For definitions of alternative performance measures, refer to Note 4 of the Group Financial Statements.

Basis of preparation

All references in this financial review are to headline performance unless stated otherwise. See Note 4.1 to the Group Financial Statements for the definition of headline performance.

Introduction

The year 2021 was still impacted by the continued global pandemic and while we are not yet free from the effects, we are pleased with the performance of the Group during the year.

The combination of a recovery in our operating performance and focus on working capital management provided the capital for allocation across all of our priority areas. We invested in organic and inorganic growth, while also paying an attractive dividend to our shareholders. This was possible despite a backdrop of challenging raw material price increases and global supply chain disruption.

2021 performance overview

Positive trends in our key end-markets of steel and foundry led to an increase in reported revenue of £184.6m over the prior year and by £251.2m on an underlying basis (+18.1%).

Key challenges this year were the implementation of price increases to offset the significant raw material cost increases

and management of temporary supply chain related friction costs. Alongside this we continued to deliver on our planned restructuring programme in support of reducing operating expenses.

Trading profit for the year 2021 was £142.4m, 50.4% higher than the prior year on an underlying basis. Return on sales was 8.7%, higher than the prior year by 190 bps on an underlying basis.

The aforementioned supply chain disruptions led to a conscious build-up of inventory to ensure security of supply but despite this our average trade working capital to sales ratio for the prior 12 months improved further to 20.9% at December 2021.

The Group's cash conversion in 2021 of 32% was lower largely due to the impact of the increase in absolute working capital to sustain revenue growth as well as higher investments in capex.

Dividend

The Board has recommended a final dividend of 15.0 pence per share to be paid, subject to shareholder approval, on 27 May 2022 to shareholders on the register at 19 April 2022. When added to the 2021 interim dividend of 6.2 pence per share paid on 17 September 2021, this represents a full-year dividend of 21.2 pence per share.

Revenue	2021 Revenue			2020 Revenue			% change	
	As reported	Acquisitions/(disposals)	Underlying	As reported	Currency	Acquisitions/(disposals)	Underlying	
£m								
Steel	1,171.5	(2.1) <sup>3</sup>	1,169.4	1,045.4	(48.9)	–	996.5	12.1% 17.4%
Foundry	471.4	–	471.4	412.9	(19.8)	–	393.1	14.2% 19.9%
Total Group	1,642.9	(2.1)	1,640.8	1,458.3	(68.7)	–	1,389.6	12.7% 18.1%

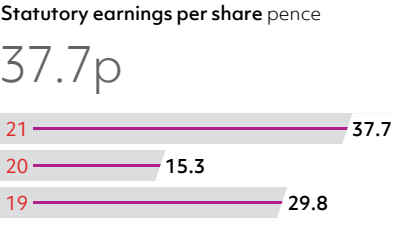
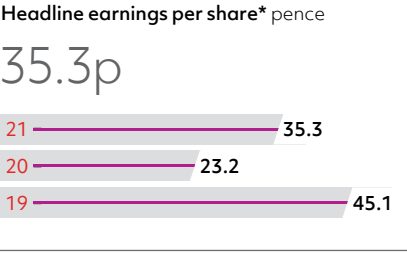
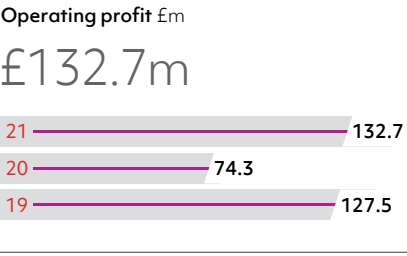
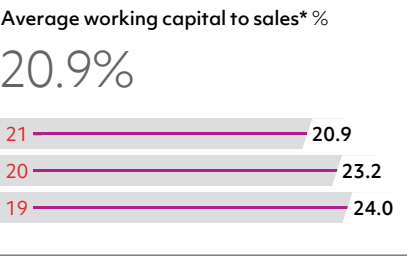
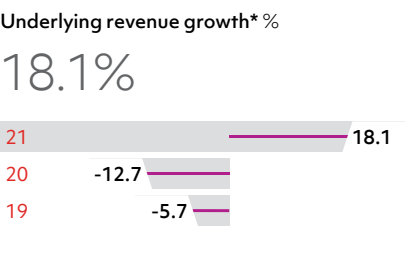
Trading profit	2021 Trading profit			2020 Trading profit			% change	
	As reported	Acquisitions/(disposals)	Underlying	As reported	Currency	Acquisitions/(disposals)	Underlying	
£m								
Steel	102.0	0.2 <sup>3</sup>	102.2	76.4	(4.2)	–	72.2	33.6% 41.6%
Foundry	40.4	–	40.4	25.0	(2.4)	–	22.6	61.3% 78.7%
Total Group	142.4	0.2	142.6	101.4	(6.6)	–	94.8	40.4% 50.4%

3. Impact of Universal acquisition.



Guy Young  
Chief Financial Officer

Positive trends in our key end-markets of steel and foundry led to an increase in revenue and trading profit



\* For definitions of alternative performance measures, refer to Note 4 of the Group Financial Statements.

It remains the Board's intention to deliver long-term dividend growth, provided this is supported by underlying earnings, cash flows, capital expenditure requirements and the prevailing market outlook.

Key Performance Indicators

We have identified a number of KPIs against which we have consistently reported. As with prior years, we measure our results on an underlying basis, where we adjust to ensure appropriate comparability between periods, irrespective of currency fluctuations and any business acquisitions and disposals.

This is done by:

- Restating the previous period's results at the same foreign exchange (FX) rates used in the current period
- Removing the results of disposed businesses in both the current and prior years
- Removing the results of acquired businesses in both the current and prior years

Therefore, for 2021, we have:

- Retranslated 2020 results at the FX rates used in calculating the 2021 results
- Removed the results of Universal, which was acquired during 2021

Objective: Deliver profitable growth

KPI: Underlying revenue growth

Reported revenue for 2021 was £1,642.9m, which equated to £1,640.8m on an underlying basis. Reported revenue for 2020 was £1,458.3m, which equated to £1,389.6m on an underlying basis. 2021 underlying revenue increased by 18.1% year-on-year. The increase in revenue has been driven by a recovery across most geographies in both steel and foundry end-markets versus 2020, and by price increases.

Objective: Generate value for our shareholders

KPI: Trading profit and Return on Sales

We continue to measure underlying trading profit of the Group as well as trading profit as a percentage of sales, which we refer to as our Return on Sales or RoS.

Trading profit for 2021 was £142.4m and Return on Sales was 8.7%. On an underlying basis, trading profit increased by 50.4% and Return on Sales by 190 bps. The increase in trading profit and Return on Sales is due to higher revenue, ongoing delivery of benefits from the restructuring programme and income from recurring recovery of overpaid taxes to and from the Brazilian entities partially offset by temporary friction costs linked to supply chain disruptions.

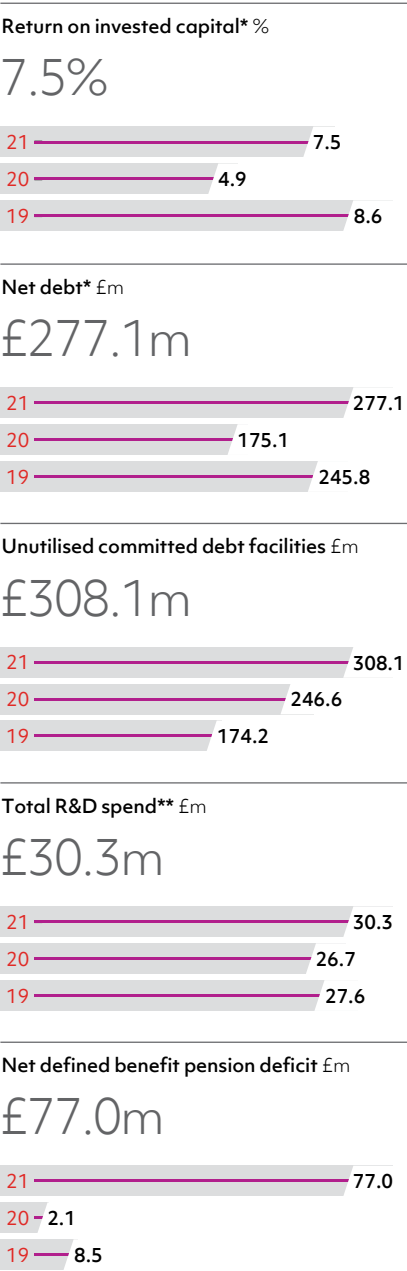
The Steel Division recorded Return on Sales of 8.7%, a 150 bps underlying improvement from 2020. Trading profit increased by 41.6% on an underlying basis, to £102.0m during the period. Return on Sales in the Foundry Division increased by 280 bps year-on-year on an underlying basis, to 8.6% in 2021. Trading profit was £40.4m representing a 78.7% increase on an underlying basis versus prior year.

KPI: Headline PBT and Headline EPS

Headline profit before tax (PBT) and headline earnings per share (EPS) are used to measure the underlying financial performance of the Group. The main difference between trading profit and PBT is net finance costs which were £6.4m in 2021, £4.5m lower than 2020.

Our Headline PBT was £137.3m, 49.9% higher than last year on a reported basis. After the inclusion of separately reported expenses of £9.7m (2020: £27.1m) our PBT of £127.6m was 97.8% higher than last year on a reported basis. Headline EPS from continuing operations at 35.3p was 52.3% higher than 2020.

Financial review continued



\* For definitions of alternative performance measures, refer to Note 4 of the Group Financial Statements.

\*\* At constant 2021 currency.

**KPI: Return on invested capital (ROIC)**

From 2022 onwards, the Group intends to use ROIC as its key measure of return from the Group's invested capital. The RONA performance measure will be replaced with ROIC which provides a more complete measure of Vesuvius' returns. ROIC is calculated as trading profit less amortisation of acquired intangibles, plus share of post-tax profit of joint ventures and associates for the previous 12 months after tax, divided by the average invested capital (total assets excluding cash plus non interest bearing liabilities), at constant currency (being the average over December and the previous year end invested capital).

Our ROIC for 2021 was 7.5% (2020: 4.9%).

**Objective: Maintain an efficient capital structure**

**KPI: Free cash flow and working capital**

Fundamental to ensuring that we have adequate capital to execute our corporate strategy is converting our profits into cash, partly through strict management of our working capital. The Group generated adjusted operating cash flow of £45.6m (2020: £172.9m), and a cash conversion rate of 32% (2020: 173%) in the period. 2021 cash conversion was impacted by growing working capital to sustain revenue growth and higher investments in capex. Free cash flow from continuing operations was £(0.3)m in 2021 (2020: £113.5m).

We measure working capital both in terms of actual cash flow movements, and as a percentage of sales revenue. Trade working capital as a percentage of sales in 2021 was 20.9% (2020: 23.2%), measured on a 12-month moving average basis. In absolute terms on a constant currency basis trade working capital increased by £106.0m in 2021.

**KPI: Net debt and interest cover**

Following the refinancing of the Group's syndicated bank facility on 5 July 2021, the Group had committed borrowing facilities of £706.3m as at 31 December 2021 (2020: £586.6m), of which £308.1m was undrawn (2020: £246.6m).

Net debt at 31 December 2021 was £277.1m, a £102.0m increase from 31 December 2020. The increase is mainly comprised of £45.6m from operations and a favourable foreign exchange impact of £13.8m, offset by payments of income taxes of £30.1m, net finance costs of £7.6m, the acquisition of the business of Universal Refractories, Inc for £43.6m,

including related excess working capital, payments of dividends of £55.5m and £17.1m of additional leases.

At the end of 2021, the net debt to EBITDA ratio was 1.4x (2020: 1.2x) and EBITDA to interest was 30.5x (2020: 14.5x). These ratios are monitored regularly to ensure that the Group has sufficient financing available to run the business and fund future growth.

The Group's debt facilities have two financial covenants: the ratios of net debt to EBITDA (maximum 3.25x limit) and EBITDA to interest (minimum 4x limit). Certain adjustments are made to the net debt calculations for bank covenant purposes, the most significant of which is to exclude the impact of IFRS 16.

During 2021, Vesuvius recognised a further £3.5m (2020: £1.7m) of income and interest of £1.9m (2020: £1.2m) in relation to further recoveries of overpaid indirect taxes, and interest, by the Brazilian entities within the Group. The amounts recognised do not represent the full amount of income and interest claimed as we do not yet have clarity on the ability of the Group to fully utilise these credits. The amounts recognised have been presented as headline trading profit and finance income given their recurring nature as the original indirect tax expenses were incurred over a prolonged period and partial recovery has taken place in the past two years.

**Objective: Think beyond in innovation**

**KPI: R&D spend**

We believe that our market-leading product technology and services deliver fundamental value to our customers and that the primary mechanism to deliver that value is to invest significantly in research and development. In 2021, we spent £30.3m on R&D activities (2020: £26.7m at constant 2021 currency), which represents 1.8% of our revenue (2020: 1.9%).

**Financial risk factors**

The Group undertakes regular risk reviews and, as a minimum, a full risk assessment process twice a year. As in previous years this included input from the Board in both the assessment of risk and the proposed mitigation. We consider the main financial risks faced by the Group as being those posed by a decline in our end-markets, leading to reduced revenue and profit as well as potential customer default. We also monitor carefully the challenges that come

from broader financial uncertainty, which could bring lack of liquidity and market volatility. Important but lesser risk exists in interest rate movements, foreign exchange rate movements and cost inflation, but these are not expected to have a material impact on the business after considering the controls we have in place. See Note 25 to the Group Financial Statements.

Our key mitigation of end-market risk is to manage the Group's exposure through balancing our portfolio of business geographically and to invest in product innovation. We do so through targeted capital investment in new and growing businesses and a combination of capital and human resource in emerging markets. When considering other financial risks, we mitigate liquidity concerns by financing, using both the bank and private placement markets. The Group also seeks to avoid a concentration of debt maturities in any one period to spread its refinancing risk. Following the refinancing of the Group's syndicated bank facility on 5 July 2021, our liquidity stood at £455.7m at 31 December 2021. We define liquidity as undrawn committed debt facilities plus our cash on balance sheet, less the cash in China which is used as collateral against an equivalent loan from Standard Chartered.

**Restructuring**

In 2021, we benefited from £4.1m of restructuring savings related to a full period impact of actions taken during 2020. During the year, we reported nil restructuring costs (2020: £6.1m) within separately reported items. We are carrying forward a restructuring provision of £5.0m.

**Vacant site remediation**

The Group owns a number of disused properties in the US, which do not form part of our trading operations. In 2020, costs of £10.3m (2021: nil) were incurred at one of these sites to address the significant increase in the volume of water run-off occurring in recent years. We engaged waste management specialists and have taken action to reduce the level of water. We are in contact with the relevant regulatory authorities and are currently implementing remediation solutions, including installation of a treatment facility. These non-recurring costs were treated as a separately reported item in 2020. There was no impact upon headline performance.

**Taxation**

A key measure of tax performance is the Headline Effective Tax Rate (ETR), which is calculated on the income tax associated with headline performance, divided by the headline profit before tax and before the Group's share of post-tax profit of joint ventures. The Group's headline ETR, based on the income tax costs associated with headline performance of £35.9m (2020: £24.4m), was 26.4% (2020: 26.9%).

The Group's total income tax costs for the period include a credit on separately reported items of £16.2m (2020: £5.7m) which primarily relates to a credit of £16.0m (2020: £nil) following the recognition of certain US deferred tax assets.

A tax credit reflected in the Group Statement of Comprehensive Income in the year amounted to £13.0m (2020: £3.2m debit) which primarily comprises a £12.5m credit (2020: £2.8m debit) in respect of tax on net actuarial gains and losses on employee benefits, inclusive of the buy-in of the UK pension scheme and the restatement of UK deferred tax from 19% to 25%.

We expect the Group's headline effective tax rate on headline profit before tax and before the share of post-tax profits from joint ventures to be between 27% and 28% in 2022.

**Capital expenditure**

Capital expenditure in 2021 was £67.4m (2020: £59.0m) of which £47.2m was in the Steel Division (2020: £45.9m) and £20.2m in the Foundry Division (2020: £13.1m). Capital expenditure on revenue-generating customer installation assets, primarily in Steel, was £5.7m (2020: £8.7m).

**Pensions**

The Group has a limited number of historical defined benefit plans located mainly in the UK, USA, Germany and Belgium. The main plans in the UK and USA are largely closed to further benefits accrual and all of the liabilities in the UK have now been insured following a buy-in agreement with Pension Insurance Corporation plc (PIC) during December 2021. The Group's net pension liability at 31 December 2021 was £77.0m (2020: £2.1m liability).

The increase in the liability and resulting charge of £80m through other comprehensive income, is largely due to the reduction of the surplus for the UK Plan following the pension insurance buy-in agreement with PIC. This final buy-in agreement secures an insurance asset from PIC that matches the remaining pension liabilities of the UK Plan, with the result that the Company no longer bears any investment, longevity, interest rate or inflation risks in respect of the UK Plan. This increase in liability has been partially offset by an increase in bond yields resulting in a reduction in the value of German and US liabilities.

**Corporate activity**

In December 2021, the Group acquired the assets and substantially all of the liabilities of Universal Refractories, Inc. ("Universal"), a specialty refractory producer based in Pennsylvania, USA, which is focused on tundish (steel continuous casting) applications as well as consumable products for the foundry industry.

Universal's unaudited revenue and EBITDA in the trailing 12 months to October were US\$40.5m and US\$8.6m, respectively. The acquisition will generate attractive synergies and will be accretive to Group Returns on Sale even before synergies are considered.

The transaction valued Universal at US\$57.1 million (£42.6 million) on a cash and debt free basis and was funded from Vesuvius' internal resources.

The Group expects the acquisition to be highly synergistic. The acquisition significantly expands Vesuvius' North American presence among electric arc furnace steel producers in the Group's focus area of steel tundish applications, while also further strengthening the Foundry business.

In the period since acquisition, Universal has contributed £2.1m to revenue and £(0.2)m to operating profit. In accordance with IFRS3, the acquired inventory was revalued to fair value less costs to sell, resulting in a reduction to operating profit of £0.6m.

**Guy Young**  
Chief Financial Officer  
3 March 2022



Operating reviews

Vesuvius comprises two Divisions, Steel and Foundry. The Steel Division operates as three business lines: Steel Flow Control, Steel Advanced Refractories, and Steel Sensors & Probes.



Steel Division



Steel production in the world excluding China and Iran, which accounts for approximately 90% of Vesuvius' sales, increased by 13% year-on-year with all geographies recording positive volume growth. Production growth was especially strong in India (+18%), South America (+18%) and NAFTA (+17%).

Vesuvius' Steel Division reported revenues of £1,171.5m in 2021, an increase of 12% compared with 2020. On an underlying basis, Steel Division revenue was up 17%, with particularly strong performance in the growing markets of South America, India, Vietnam and EEMEA (EMEA excluding EU 27+UK), where we grew 55%, 34%, 32% and 18%, respectively.

Flow Control strongly outperformed the steel market in all regions, with underlying sales growth of 21.5% (3.5% price impact), versus global steel production growth of 13% (excluding China and Iran). In Advanced Refractories, we prioritised prices over volumes.

As a whole, Steel Division revenues incorporate a moderate average positive price impact in 2021, as price increases were progressively implemented during the year to compensate for inflation in raw materials and freight costs.

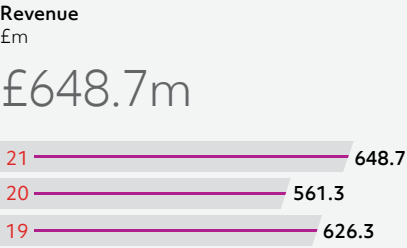
Steel Division trading profit improved 34% to £102.0m, with return on sales expanding 140bps to 8.7%. Raw material and freight inflation were fully compensated for by year-end in both Flow Control and Advanced Refractories.

Steel Division	2021 (£m)	2020 (£m)	Change (%)	Underlying change (%)
Steel Flow Control revenue	648.7	561.3	15.6%	21.5%
Steel Advanced Refractories revenue	489.1	458.6	6.7%	11.0%
Steel Sensors & Probes revenue	33.7	25.5	32.0%	42.7%
Total Steel revenue	1,171.5	1,045.4	12.1%	17.4%
Total Steel trading profit	102.0	76.4	33.6%	41.6%
Total Steel Return on Sales	8.7%	7.3%	140 bps	150 bps

Crude steel production year-on-year change	2021/2020	2021/2019
China	-3.0%	3.1%
India	17.8%	6.1%
NAFTA	16.6%	-1.6%
South America	17.9%	9.3%
EMEA ex Iran	11.8%	4.2%
EEMEA ex Iran	9.2%	6.6%
EU 27+UK	14.8%	1.6%
World	3.7%	5.6%
World ex China & Iran	13.0%	8.5%

Source: World Steel Association (month-to-date totals may include revised data not available on a monthly basis).

Steel Flow Control



Pascal Genest  
President,  
Flow Control



The Flow Control business unit supplies the global steel industry with consumable ceramic products, systems, robotics, digital services and technical services. These products are used to contain, control and monitor the flow of molten steel in the continuous casting process. The consumable ceramic products that Vesuvius supplies have a short service life (often a matter of a few hours) due to the significant wear caused by the extremely demanding environment in which they are used. These products must withstand extreme temperature changes, whilst resisting liquid steel and slag corrosion. In addition, the ceramic parts in contact with the liquid steel must not in any way contaminate it. The quality, reliability and consistency of these products and the associated robotic solutions and digital services we provide are therefore critical to the quality of the finished metal being produced and the productivity, profitability and safety of our customers' processes.

In 2021, underlying revenues in the Group's Steel Flow Control business increased by 21.5% year-on-year to £648.7m, driven by strong market recovery and market share gains in all regions.

In EMEA excluding Iran, revenues grew 26% compared to 2020 on an underlying basis, versus steel production growth of 12%. This outperformance was broad-based, with revenue growth exceeding 20% in both the EU 27+UK and EEMEA (EMEA excluding EU 27+UK).

Steel Flow Control revenue	2021 (£m)	2020 (£m)	Change (%)	Underlying change (%)
Americas	217.0	182.9	18.7%	28.8%
Europe, Middle East & Africa (EMEA)	247.7	204.7	21.0%	26.2%
Asia-Pacific	184.0	173.7	6.0%	8.7%
Total Steel Flow Control revenue	648.7	561.3	15.6%	21.5%

Strategic highlights from the year

In 2021, we announced a £28m capacity expansion, to be operational from late 2022, to support future organic growth and market share gains. At our Skawina, Poland plant, we will increase EMEA capacity in VISO\* products by 35% and ladle slide-gates by 100%. This is intended to serve EMEA, and in particular fast-growing markets in EEMEA. At our Kolkata, India plant, we will increase capacity in VISO\* products by 50%, to serve the fast-growing markets of both India and South East Asia.

We launched nine new products during 2021. Among them, the Air-Shield\* technology, a technology that creates a better seal between the two plates of our ladle slide-gate mechanism to increase both the yield and quality of steel produced.

We launched a new Composite Design Technology (CDT) solution, the Surface Layer CDT, which allows us to offer high-performing products with a greater flexibility in design, while also enabling a greater use of recycled materials.



\* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

In the Americas, underlying revenues grew 29%, outperforming steel production growth of 17%. This outperformance was mostly driven by revenue growth of 47% in South America, while revenue growth of 23% in NAFTA also outperformed steel production.

In Asia-Pacific, revenues grew 9% on an underlying basis, versus steel production growth of 1%. Revenues in Vietnam, India and China grew 38%, 31% and 7%, respectively, versus steel production growth of 18%, 18% and -3%.

A new generation of tundish shroud was also launched, allowing our customers to improve their productivity, whilst also reducing usage of other consumables, resulting in positive sustainability benefits.

In terms of mechatronics, we continue to develop additional features for our robotic offering, helping customers to reduce the exposure of their operators.

Looking forward

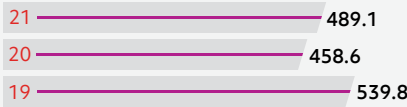
The successful completion of the expansion projects at Skawina and Kolkata will be a key focus in the coming year, with the target that the expanded capacity will be operational from late 2022. This expansion will support our market share gains objectives from 2023.

We will also continue our efforts to develop products with superior sustainability characteristics, to help our customers drive efficiency and reduce their environmental footprint.

## Steel Advanced Refractories

Revenue  
£m

£489.1m



Thiago Avelar  
President,  
Advanced  
Refractories



The Steel Advanced Refractories business unit supplies complete value-added solutions to its customers including specialist refractory materials and advanced installation technologies which harness mechatronic solutions, computational fluid dynamics capabilities and lasers. The specialist refractory materials are subject to extreme temperatures, corrosion and abrasion, they are in the form of powder mixes, which are spray-applied or cast onto the vessel to be lined ('monolithics') and refractory shapes (e.g. bricks, pads, dams and other larger precast shapes). The service life of the products that Advanced Refractories supplies into the steel-making process can vary (some a matter of hours and others for a period of years) based upon the type of refractory and the level of wear caused by the demanding environment in which they are used. An integral part of our success depends on our best-in-class installation technologies which improve the consistency and performance of installed Vesuvius refractories, as well as the high level of collaboration with our customers.

Steel Advanced Refractories reported revenues of £489.1m in 2021, an increase of 11% on an underlying basis. In a number of markets our growth lagged steel production increases, as priority was given to price increases over volumes, resulting in a temporary loss of market share.

On an underlying basis, revenues grew 13% in the Americas, with strong outperformance in South America, which grew 68% versus steel production growth of 18%.

In EMEA excluding Iran, revenues grew by only 3% during the period as we continued to exit unprofitable contracts and also led

price increases during the first half of the year in product lines that were impacted by higher raw material costs.

In Asia-Pacific, revenues grew 21% on an underlying basis driven by strong outperformance in India (+36%), Vietnam (+30%) and China (+13%).

Volumes in H2 were negatively impacted in NAFTA as we had to declare force majeure as a result of disruptions to raw material supply brought on by Hurricane Ida in the US. Alternative raw material supply and logistics support was obtained and no customer suffered interruption as a result.

Steel Advanced Refractories revenue	2021 (£m)	2020 (£m)	Change (%)	Underlying change (%)
Americas	165.3	153.0	8.0%	13.4%
Europe, Middle East & Africa (EMEA)	187.7	187.8	-0.1%	3.1%
Asia-Pacific	136.1	117.9	15.5%	20.6%
Total Steel Advanced Refractories revenue	489.1	458.6	6.7%	11.0%

### Strategic highlights from the year

In December 2021, we acquired the assets and substantially all of the liabilities of Universal Refractories, Inc., a specialty refractory producer based in Pennsylvania, USA, which is focused on tundish (steel continuous casting) applications as well as consumable products for the foundry industry. Universal is a strategically important acquisition for Advanced Refractories, which reinforces our core tundish business and expands our North American presence among electric arc furnace (EAF) steel producers.

We made significant progress with the roll-out of our mechatronics products and services across key regions. In Asia, we commissioned a New Generation of Tundish SMART Robots (Next Gen TSR\*). We continue to gain traction in marketing our Gunning Robot combined with our leading laser scanner technology in North America (EAF) and Europe.

In 2021, we introduced five new value-added products, including MgO-carbon bricks with an enhanced binder system for better heat-life and new Tundish Spray technology, increasing our customers' productivity and reducing their energy costs and CO<sub>2</sub> emissions.

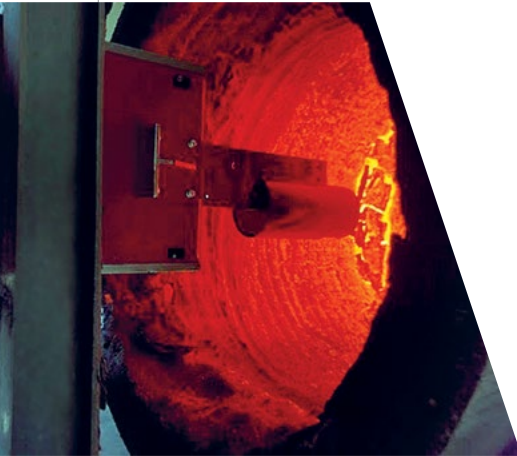
### Looking forward to 2022

In January 2022, we commissioned our new mechatronic Centre of Excellence in Ghlin, Belgium. Our differentiated technology is at the core of our strategy as we continue to develop combined robotic and laser technologies that further enhance the efficiency of our high-performance refractory products.

Integrating Universal into our NAFTA manufacturing footprint will be a key project during the course of 2022.

In R&D, we will increase the focus on delivering new products that improve our customers' environmental footprint.

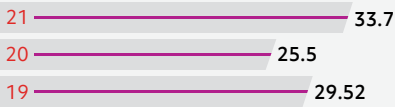
\* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.



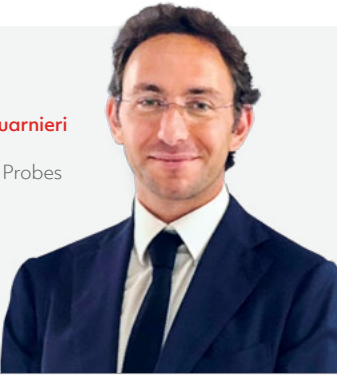
## Steel Sensors & Probes

Revenue  
£m

£33.7m



Davide Guarneri  
Director,  
Sensors & Probes



The Steel Sensors & Probes business unit offers products to our customers to enable them to make their underlying processes more efficient and reliable. The business unit focuses on providing a range of products that enhance the control and monitoring of our customers' production processes, complementing Vesuvius' strong presence and expertise in molten metal engineering. This aims to create new technologies that can be integrated into expert process management systems. These products include temperature sensors, oxygen, hydrogen and substance probes, iron oxide and metal sampling for the steel, aluminium and foundry industries.

By using these technologies, customers can focus on critical parameters within their processes, enabling them to refine their production methods to improve quality, lower production costs and maximise efficiency.

Revenues in Steel Sensors & Probes were £33.7m in 2021, representing an underlying increase of 43% year-on-year. The strong performance in the Americas was driven by new customer wins, especially in South America. In EMEA, we also performed well and continued to gain traction.

Steel Sensors & Probes revenue	2021 (£m)	2020 (£m)	Change (%)	Underlying change (%)
Americas	23.2	16.4	41.1%	56.3%
Europe, Middle East & Africa (EMEA)	10.1	8.9	13.6%	17.8%
Asia-Pacific	0.4	0.2	109.1%	116.5%
Total Steel Sensors & Probes revenue	33.7	25.5	32.0%	42.7%

### Looking forward to 2022

In 2022, we will continue to execute our revenue growth strategy. In particular, our new facility in Mexico will increase our service level and operational efficiency in the NAFTA market. A reinforced structure in Asia will drive growth in this important region. We will continue to invest in new products and seek to integrate them with robotic solutions to bring greater safety and both operational and sustainability efficiencies to our customers.





Foundry Division

Revenue  
£m

£471.4m

Trading profit  
£m

£40.4m

The Foundry Division is a world leader in the supply of consumable products, technical advice and application support to the global foundry industry to improve the performance and quality of ferrous and non-ferrous castings. Vesuvius operates under the brand FOSECO in the foundry market. The foundry process is highly sequential and is critically dependent on consistency of product quality and productivity optimisation. Working alongside customers at their sites, our engineers provide on-site technical expertise in addition to advanced computational fluid dynamics capabilities to develop the best customised solutions. The conditioning of molten metal, the nature of the mould used and, especially, the design of the way metal flows into the mould are key parameters in a foundry, determining both the quality of the finished castings and the labour, energy and metal usage efficiency of the foundry. Vesuvius' products and associated services to foundries improve all of these parameters.



Foundry Division	2021 (£m)	2020 (£m)	Change (%)	Underlying change (%)
Foundry revenue	471.4	412.9	14.2%	19.9%
Foundry trading profit	40.4	25.0	61.2%	78.7%
Foundry Return on Sales	8.6%	6.1%	250 bps	280 bps

Foundry revenue	2021 (£m)	2020 (£m)	Change (%)	Underlying change (%)
Americas	100.4	85.6	17.4%	27.1%
Europe, Middle East & Africa (EMEA)	199.3	177.0	12.6%	17.3%
Asia-Pacific	171.7	150.3	14.2%	19.1%
Total Foundry revenue	471.4	412.9	14.2%	19.9%

Non-automotive Foundry end-markets across all regions saw significant growth in 2021, with production in the mining & construction and general engineering end-markets up 19% and 13%, respectively, according to Oxford Economics data. This was in contrast to global production of light vehicles and medium & heavy commercial vehicles which remained weak with growth of only 2% and 0.5%, respectively, according to IHS data. The disappointing automotive markets (representing c.36% of Foundry Division sales) reflect the persistent global shortage of semi-conductors, which constrained the ability of OEMs to ramp-up production.

Compared to 2019, mining & construction and general engineering are both up 12%, while global light vehicle production is down 14% and medium & heavy commercial vehicles is down 4%.

Vesuvius' Foundry Division reported revenues of £471.4m in 2021, an increase of 14% compared to 2020. On an underlying basis, Foundry Division revenue was up 20%.

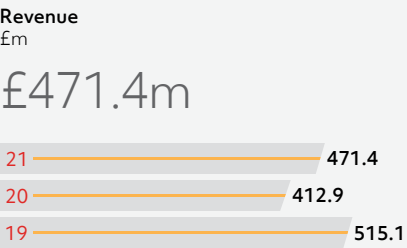
The Foundry Division also achieved meaningful margin recovery, with trading profit growing 79% on an underlying basis to £40.4m, as Return on Sales increased 250bps to 8.6% in 2021. Profitability was impacted by the time lag we experienced between cost increases and selling price rises, although this was successfully eliminated by year-end.

In H2 our volumes were negatively impacted as automotive production slowed further. In addition, we experienced operational issues at two important plants in Germany and the USA. Both these factors are temporary in nature and are expected to be eliminated during 2022.

Foundry revenues in the Americas grew 27% year-on-year on an underlying basis, driven by 15% growth in NAFTA, and very strong performance in South America, which was up 68%.

In EMEA, underlying revenues increased by 17%, with EEMEA (EMEA excluding EU 27+UK) growing at 18%.

In Asia-Pacific, we benefited from continued strong performance in China, where revenues grew 12% and India where revenues grew 36%.



Karena Cancilleri  
President, Foundry



Strategic highlights from the year

In 2021, the Foundry Division launched a number of important new products which delivered both product performance improvements as well as sustainability performance improvements for our customers.

The new FEEDEX<sup>\*</sup> FEF sleeve range supports foundries in reducing harmful emissions and hazardous waste while maintaining high thermal and feeding performance. We launched the STELEX<sup>\*</sup> Pureflow filter, a filter for small castings which improves the metal purity for highly demanding casting applications, such as automotive turbochargers. We also launched the SEMCO<sup>\*</sup> formaldehyde-free coating, which helps our customers reduce emissions of harmful substances generated in the casting process.

The Foundry Division continued to focus on digitisation, developing simulation tools to provide further thermal and physical data modelling to optimise casting quality. We also launched an app for our leading aluminium melt treatment equipment and implemented a digital product selection tool, to assist our application engineers.

Looking forward

We expect 2022 to be a record year in terms of new product launches, as a result of our extensive new product development efforts to support the manufacture of lighter-weight, high-performance metals and components. We are focusing on developing products for high growth end markets such as wind turbines, turbo-chargers and electric vehicles. We will further complement our new product development with simulation and equipment solutions to create a complete offering to respond to increasingly complex technical customer requirements. The technical work will be further supported through several meaningful external research partnerships, several of which were initiated in 2021.



<sup>\*</sup> Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.



Sustainability

52	Non-financial information statement	56	Our principles, approach and governance
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		97	Our communities

We think beyond today’s customer expectations

and shape the future through application expertise





Introduction:  
Towards a better tomorrow

Progress on our  
sustainability roadmap

Alexander  
Laugier-Werth  
VP Sustainability,  
HSE & Quality



Non-financial  
information statement

This non-financial information statement provides information on the Group's activities and policies in respect of:

<b>Environmental matters</b>	
Our planet	p60–77 ➔
<b>The Company's employees</b>	
Our people	p82–96 ➔
<b>Social matters</b>	
Our communities	p97–101 ➔
<b>Respect for human rights</b>	
Our communities	p97 ➔
<b>Anti-corruption and anti-bribery matters</b>	
Our communities	p98 ➔

The statement also details, where relevant, the due diligence processes implemented by the Company in pursuance of these policies.

Further information, disclosed in other sections of the Strategic Report, is incorporated into this statement by reference, including:

<b>Information on the Group's principal risks</b>	
Details of the Group's principal risks relating to these non-financial matters are detailed in the Group's schedule of Principal risks and uncertainties.	p34–35 ➔
<b>Risk, viability and going concern</b>	
	p29–35 ➔
<b>Details of the Group's business model</b>	
	p20–21 ➔
<b>Details of the Group's non-financial KPIs</b>	
	p39 ➔

We believe that we can create more value for our customers, our shareholders and our employees by embedding sustainability in all aspects of our business and strategy. Our long-term success is tightly bound to our sustainability initiative, with its primary focus on helping our customers improve their operational performance to enable them to deliver on their own sustainability agenda. At the same time we seek to benefit the communities in which we operate and develop our people to build diverse, engaged and high-performing teams to promote our work.

We launched our formal Sustainability strategy at the end of 2020 to bring together all our environmental, social and governance initiatives into one coordinated programme. We developed a new governance structure to support our objectives and a new set of targets to direct our efforts. The strategy was built on four pillars: our planet, our customers, our people and our communities, identifying ten key areas of focus across these pillars.

Areas of focus

- Reducing Scope 1 and 2 emissions, measuring Scope 3 emissions and creating action plans to minimise these
  - Determining CO<sub>2</sub> emissions avoided by customers, and creating further action plans to maximise this
  - Switching to carbon-free electricity on our sites wherever possible
  - Assessing new product developments and technologies based on their safety and environmental benefits
  - Supporting education for women in scientific fields
- Increasing gender diversity in the Group Executive Committee and top management
  - Increasing employee engagement
  - Undertaking environmental impact analysis of capital expenditure; with the internal price of CO<sub>2</sub> emissions reviewed every year
  - Seeking ISO 14001 certification of manufacturing sites
  - Undertaking sustainability assessments of suppliers

In 2021, despite the difficulties created by the COVID-19 pandemic and the operational challenges facing the business, we continued to deliver on our commitments. The progress shown in our key performance indicators illustrates the engagement of our teams around the world.

- Key initiatives launched in 2021 included:
- Further embedding sustainability into the Group and business unit strategic plans, via a more detailed analysis of the risks and opportunities presented by climate change and the evaluation of three long-term scenarios
  - Building a methodology and tools to evaluate CO<sub>2</sub> emissions avoided at customers by using our products
  - Building a scorecard and assessing the sustainability performance of our existing products and new product pipeline
  - Launching our Sustainable Procurement Policy and Supplier Assessment programme

During the year we were very pleased to see our efforts and progress recognised externally. In particular, our MSCI rating progressed from BBB to A, and our EcoVadis rating progressed from Silver to Gold. Vesuvius was also honoured to be included in the *Financial Times*’ European Climate Leaders list.

In December 2021, Vesuvius completed the acquisition of the assets and business of US-based Universal Refractories, Inc. (“Universal”). In 2022, we will integrate these operations into our sustainability programme. All statements and figures in this Sustainability section therefore do not include the Universal business.

2022 will be dedicated to consolidating and strengthening our sustainability plans. We will continue educating and engaging our employees at every level, detailing and implementing action plans to progress our strategy. Emphasis will be placed on further defining our roadmap to net zero and developing the support we provide to our customers in their own sustainability journey.

The content of the Sustainability section is primarily based on our materiality analysis, feedback from our internal and external stakeholders, and requirements of the UN Global Compact. We are committed to transparent and thorough reporting on our sustainability performance. We would welcome any input or feedback to: [sustainability@vesuvius.com](mailto:sustainability@vesuvius.com).

Alexander Laugier-Werth  
VP Sustainability, HSE & Quality

Our Sustainability strategy and objectives

Creating a better tomorrow  
for our planet, our customers,  
our people and our communities

We create innovative solutions that enable our customers to reduce their manufacturing costs, improve quality and safety performance, and help them to become more efficient in their processes.

We aim to deliver sustainable, profitable growth to provide our shareholders with a superior return on their investment, whilst providing our employees with a safe workplace where they are recognised, developed and properly rewarded.

Our Sustainability initiative embodies this purpose. It sets out the Group's formal

objectives and targets for supporting our customers, our employees and our communities, and for protecting our planet for future generations. It is embedded in the Group's overall strategy and informs how we deliver on the Group's Execution Priorities.

The key objectives and priorities of our Sustainability initiative are outlined here.

They were defined following the identification and analysis of the Group's most important and material sustainability risks and opportunities.

Our planet

- To tackle climate change by reducing our CO<sub>2</sub> emissions and help our customers reduce theirs with our products and services. We are committed to reaching a net zero carbon footprint at the latest by 2050.
- To engage in the circular economy by reducing our waste, recovering more of our products after they have been used and increasing the usage of recycled materials.



P60 ➔

Our customers

- To support our customers' efforts to improve safety on the shop floor, especially exposure to hot metal.
- To help customers improve their operational performance and thereby reduce their environmental footprint, and especially their CO<sub>2</sub> emissions.



P78 ➔

Our people

- To ensure the safety of our people and everyone else who accesses our sites. This is our first priority. We take safety very seriously and are constantly striving to improve.
- To offer growth opportunities to all our employees through training and career progression to develop diverse, engaged and high-performing teams.



P82 ➔

Our communities

- To support the communities in which we operate, with a focus on promoting and supporting women's education in scientific fields.
- To ensure ethical business conduct both internally and with our trading partners.
- To extend our sustainability commitment to our suppliers and encourage them to progress.



P97 ➔

Our sustainability targets

The Board has identified eleven significant non-financial KPIs for the business. For nine of these we have set stretching targets for the Group to reach within set timeframes, which are set out below. The table below illustrates how achieving each target will contribute to achieving our objectives.

KPI	Measure	Target	2021 progress vs 2019	Our planet	Our customers	Our people	Our communities	UN Sustainable Development Goals
Safety	Lost Time Injury Frequency Rate below 1	<1	1.06					3, 8
Energy consumption	By 2025, reduce energy consumption per metric tonne of product packed for shipment (vs 2019)	-10%	-9.0%					9, 13
Energy CO <sub>2</sub> e emissions	By 2025, reduce (Scope 1 and Scope 2) energy CO <sub>2</sub> e emissions per metric tonne of product packed for shipment (vs 2019)	-10%	-16.5%					9, 12, 13
Wastewater	By 2025, reduce wastewater per metric tonne of product packed for shipment (vs 2019)	-25%	-2.8%					6, 9, 12
Solid waste	By 2025, reduce solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment (vs 2019)	-25%	-21.8%					9, 12
Recycled material	By 2025, increase the proportion of recycled materials from external sources used in production	7%	6.2%					9, 12
Gender diversity	By 2025, increase female representation in the top management (GEC plus their key direct reports <sup>1</sup> )	30%	21%					5
Compliance training	Increase the percentage of targeted staff who complete anti-bribery and corruption training annually	90%	100%					16
Supply chain	By the end of 2023, conduct sustainability assessments of suppliers covering at least 50% of Group spend	50%	52%					8, 10, 17

1. The Board has resolved to expand the Group to which the gender diversity target applies for 2022, to focus on the Senior Leadership Group of the Company which comprises c. 160 individuals.

United Nations Global Compact

In October 2020, Vesuvius became a signatory to the United Nations Global Compact. We have committed to base our business approach on its ten Principles on human rights, labour, environment, and anti-corruption, and to engage in activities which advance the development of the UN Sustainable Development Goals (SDGs).

Communication on progress

Vesuvius reports annually on its sustainability activities, commitments and progress in the Annual Report and also in a separate Sustainability Report published each year.

This covers the environmental, social and governance issues defined in the four dimensions of the Group's Sustainability Charter: Our Planet, Our Customers, Our People, Our Communities. In particular, we include updates on key performance indicators and progress against targets.

Human rights

**Principle 1** Businesses should support and respect the protection of internationally proclaimed human rights within the scope of their influence

**Principle 2** Businesses should make sure that they are not complicit in human rights abuse

Labour standards

**Principle 3** Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining

**Principle 4** Businesses should uphold the elimination of all forms of forced and compulsory labour

**Principle 5** Businesses should uphold the abolition of child labour

**Principle 6** Businesses should uphold the elimination of discrimination in respect of employment and occupation



Environment

**Principle 7** Businesses should support a precautionary approach to environmental challenges

**Principle 8** Businesses should undertake initiatives to promote greater environmental responsibility

**Principle 9** Businesses should encourage the development and diffusion of environmentally friendly technologies

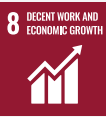
Anti-corruption

**Principle 10** Businesses should work against corruption in all its forms, including extortion and bribery

Sustainable Development Goals


Vesuvius has identified the practices within its operations that can directly or indirectly contribute to the SDGs. We will focus our efforts on the following seven SDGs – four priority goals and three supporting goals – which are particularly relevant to our business and where we believe we can make the most meaningful contribution.

Priority SDGs



**8 DECENT WORK AND ECONOMIC GROWTH**

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all




**12 RESPONSIBLE CONSUMPTION AND PRODUCTION**

Ensure sustainable consumption and production patterns



**9 INDUSTRY, INNOVATION AND INFRASTRUCTURE**


Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation



**13 CLIMATE ACTION**


Take urgent action to combat climate change and its impacts

Supporting SDGs




**3 GOOD HEALTH AND WELL-BEING**

Ensure healthy lives and promote well-being for all at all ages



**6 CLEAN WATER AND SANITATION**

Ensure availability and sustainable management of water and sanitation for all



**5 GENDER EQUALITY**

Achieve gender equality and empower all women and girls



Our principles, approach and governance

Vesuvius is a geographically and culturally diverse group, employing more than 11,000 people in 40 countries.

Our geographical diversity places us close to our customers around the globe. It also highlights the importance of maintaining and applying strong and consistent values and ethical principles in our worldwide approach to business. Our employees' engagement with our Values and culture is vital to our success and the sustainable delivery of the Group's strategy.

Vesuvius has established a framework for explaining and embedding the culture and principles we consider to be fundamental to our success. To do this we communicate openly and transparently within the organisation, through 'town hall' meetings, senior management visits, management feedback, performance evaluation, measuring staff engagement and responding to the feedback we receive. Critically, there is ongoing and consistent communication of our CORE Values and the principles of our Code of Conduct. This is underpinned by engaging staff across the Group in both general and targeted training, to ensure a consistent understanding of our policies and procedures.

This transparency of communication also extends to our stakeholders. We want to increase the knowledge and understanding of our stakeholders, through internal and external reporting and transparent and meaningful disclosure. Our Sustainability Report is a key part of this.

Our CORE Values

The Group's CORE Values – Courage, Ownership, Respect and Energy – are actively supporting the Group's priorities, encouraging consistent behaviours across the Group to sustain our business success in the future.

These Values, and the behaviours underpinning them, convey the mindset and attitudes we expect each employee to show every day. They are at the heart of the culture of the Group, promoting our image to external stakeholders, and underpinning the commercial promise we provide to our customers. The Values are reinforced through our performance management systems and are celebrated each year through our Living the Values Awards which select regional and global winners for each Value.

At each of our sites we display CORE Values posters in local languages and use tools such as screen savers as a constant reminder of the behaviours our people display.

Code of Conduct

Our Code of Conduct sets out the standards of conduct expected, without exception, of everyone who works for Vesuvius in any of our worldwide operations.

The Code of Conduct emphasises our commitment to ethics and compliance with the law, and covers every aspect of our approach to business, from the way that we engage with customers, employees, the markets and other stakeholders, to the safety of our employees and workplaces.

Everyone within Vesuvius is individually accountable for upholding its requirements. We recognise that lasting business success is measured not only in our financial performance, but in the way we deal with our customers, business associates, employees, investors and local communities.

The Code of Conduct is displayed prominently at all our sites and is published in our 29 major functional languages. It is available to view at: [www.vesuvius.com](http://www.vesuvius.com).

We continue to enhance the policies that underpin the principles set out in the Code of Conduct. These assist employees to comply with our ethical standards and the legal requirements of the jurisdictions in which we conduct our business. They also give practical guidance on how this can be achieved.

Vesuvius materiality assessment

Our Sustainability initiative focuses on our most significant sustainability issues and opportunities. These are defined by our ongoing materiality assessment, which identifies and prioritises issues based on two criteria: the impact or likely impact on the achievement of Vesuvius' Strategic Objectives; and the impact or potential impact on Vesuvius' stakeholders and their interests. Our materiality assessment is informed by our risk management processes, which not only consider immediate risks to the Group, but also longer-term emerging macro trends such as the electrification of light vehicles, accelerating growth in demand for renewable energies, technological developments in iron and steel making and policy changes impacting the cost of CO<sub>2</sub> emissions, all of which could profoundly affect our markets.

This report has been prepared in accordance with the GRI Standards: Core option.

In preparing our assessment, and developing our Sustainability initiative, we engage with various stakeholders, formally and informally. Details of these engagements and the parties involved are described in our s172 disclosures on pages 22 to 28. We undertake regular

surveys of Vesuvius' operational teams to collect data on management approaches, systems, and performance relating to environmental, safety, and human resource management.

The Board of Directors formally reviews all significant sustainability programmes and signs off the content of all sustainability reporting disclosures. Our Sustainability Council and VP Sustainability ensure that we have a clear set of KPIs and targets to track the Group's progress.

Material sustainability topics

The material topics have been validated as material by the Board; they apply in our own operations and to varying degrees in those of our suppliers. No change in the relative prioritisation of topics was recorded in 2021.

The exclusion of topics from this list does not mean that they are not considered important to Vesuvius or are not being managed, but only that we have chosen not to address them in detail in this report. Where appropriate we have incorporated some commentary on these additional topics into our report. Details of water stress and water consumption, biodiversity, conflict minerals and environmental compliance are all included.

Material topics	
Climate change	– energy efficiency – CO <sub>2</sub> e emissions – renewable energy – sustainable products
Circular economy	– solid waste – recovered and recycled materials
Protection of the environment	– wastewater – solid waste – environmental management – responsible procurement
Human rights	– modern slavery – gender diversity – employee well-being – responsible procurement
Employee work relationships and conditions	– health and safety – employee representation – engagement and development – values
Communities	– education – business practices – supply chain
Governance	– Code of Conduct – anti-bribery and corruption – privacy and data security – responsible procurement

CORE Values









Courage
I systematically say, decide and do what is right for Vesuvius including when it is difficult, unpopular, or not consensual
I express my opinions openly during discussions, but I also defend Group decisions once they've been taken, even if they do not correspond to my initial position
I proactively take leadership responsibility on difficult projects and topics that are important to the Group's performance, motivated by the perspective of success rather than paralysed by the risk of personal failure

Respect
I demonstrate respect for other people's ideas and opinions even if I disagree with them
I welcome open debate
I listen to others, foster esteem and fairness with customers, suppliers, co-workers, shareholders and the communities where we operate
I communicate my objectives clearly and take time to explain all decisions. I behave with the highest level of integrity
I promote diversity at all levels of the Company

Ownership
I am personally accountable for the consequences of my actions and for the performance of the Group in my area of responsibility or oversight, without blaming external circumstances or the actions of others
I demonstrate an entrepreneurial spirit, looking for and seizing business opportunities and I immediately address problems that come up as soon as I become aware of them
I manage the Group's money and resources as though they were my own

Energy
I work hard and professionally in pursuit of excellence
I constantly raise the bar and challenge the status quo. For me, the sky is the limit
I lead by example, inspiring and motivating my team to go the extra mile. I promote a positive and energising work environment. I continuously deliver outstanding customer experience and innovative solutions
I never underestimate competitors and permanently strive to reinforce the Group's leadership position

Code of Conduct

The Code covers:	
	Health, safety and the environment
	Trading, customers, products and services
	Anti-bribery and corruption
	Employees and human rights
	Disclosure and investors
	Government, society and local communities
	Conflicts of interest
	Competitors

Materiality assessment process

Step 1	Step 2	Step 3	Step 4	Step 5
– Survey of key internal and external stakeholders – Review of external agency ratings – Benchmark of current policies, targets, reporting practices vs peers and customers – Interviews with senior managers and experts	– Evaluation of current activities and reporting – Selection and definition of a broad set of metrics – Assessment of capabilities – Selection of key KPIs covering the most important objectives	– Identification of metrics and setting of targets by Group Executive Committee – Approval by Board of directors	– Strategy launch with Senior Leadership Group – Constitution of Sustainability Council – Deployment throughout the Group	– Ongoing dialogue with internal and external stakeholders – Building action plans and monitoring progress – Reporting of performance against targets and review of objectives

Task Force on Climate-related Financial Disclosures

The Taskforce on Climate-related Financial Disclosures (TCFD) has developed a disclosure framework to help companies improve and increase the understanding of their reporting of climate-related financial information. We have therefore aligned the reporting of our existing Sustainability initiatives to the risk management and reporting recommendations of the TCFD.

The Board is pleased to confirm that, for the year ended 31 December 2021, the Group's environmental disclosures are reported in a TCFD framework. The table below sets out where you can find information on how we have applied each of the recommendations of the TCFD.

For a number of years we have disclosed the metrics and targets we use to assess and manage relevant climate-related risks and opportunities. The core of our Sustainability initiative remains our commitment to continuing our progress to create a better tomorrow for our planet.

Topic		Disclosure summary	Vesuvius disclosure	
Governance	Disclose the organisation's governance around climate-related risks and opportunities.	a Describe the board's oversight of climate-related risks and opportunities.	Sustainability: TCFD	p59 ➡
			Risk, Viability and Going Concern	p29–33 ➡
		b Describe management's role in assessing and managing climate-related risks and opportunities.	Sustainability: TCFD	p59 ➡
			Risk, Viability and Going Concern	p29–33 ➡
Strategy	Disclose the actual and potential impacts of climate-related risks and opportunities on the organisation's businesses, strategy, and financial planning where such information is material.	a Describe the climate-related risks and opportunities the organisation has identified over the short, medium and long term.	Sustainability: Our planet	p60–63 ➡
		b Describe the impact of climate-related risks and opportunities on the organisation's businesses, strategy and financial planning.	Sustainability: Our planet	p60–77 ➡
			Our external environment	p16 and 17 ➡
			Sustainability: Our customers	p80 and 81 ➡
		c Describe the resilience of the organisation's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.	Sustainability: Our planet	p64–66 ➡
Risk management	Disclose how the organisation identifies, assesses and manages climate-related risks.	a Describe the organisation's processes for identifying and assessing climate-related risks.	Sustainability: Our planet	p60–63 ➡
			Risk, Viability and Going Concern	p29–33 ➡
		b Describe the organisation's processes for managing climate-related risks.	Sustainability: Our planet	p60–63 ➡
			Risk, Viability and Going Concern	p30 ➡
		c Describe how processes for identifying, assessing and managing climate-related risks are integrated into the organisation's overall risk management.	Sustainability: Our planet	p60–63 ➡
			Risk, Viability and Going Concern	p29–33 ➡
Metrics and targets	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.	a Disclose the metrics used by the organisation to assess climate-related risks and opportunities in line with its strategy and risk management process.	Sustainability	p54 ➡
		b Disclose Scope 1, Scope 2 and, if appropriate, Scope 3 GHG emissions, and the related risks.	Sustainability: Our planet	p68, 69 and 71 ➡
		c Describe the targets used by the organisation to manage climate-related risks and opportunities and performance against targets.	Sustainability: Our planet	p68–75 ➡

Governance structure

Board oversight

The Board holds overall accountability for all matters related to sustainability and the management of all risks and opportunities, including the impact of climate change on the Group. The Group's Audit Committee supports the Board in ensuring climate-related issues are integrated into the Group's risk management process and reviewing the Group's TCFD reporting. As the Executive Director with key responsibility for the delivery of the Group's strategy, our Chief Executive, Patrick André, is ultimately responsible for the Sustainability initiative.

The Board's oversight of the Group's response to climate change is integrated both into its monitoring of the Group's broader Sustainability strategy and initiatives, and its approach to significant capital and other investments. The Board formally discusses sustainability, including reviewing the Group's performance and progress against the targets embedded in our Sustainability initiative, particularly those relating to climate, twice per year. In 2021, the Board undertook a more detailed assessment of the Group's climate-related risks and opportunities, including reviewing an analysis of the Group's physical and transition risks. It also considered the formulation of three different climate-related scenarios constructed to assess the potential financial implications of climate change and assessed the impact of climate-related risks and opportunities on the Group's strategy. Every capital expenditure above £5m requiring Board approval includes a sustainability assessment, which includes climate-related parameters.

The Remuneration Committee supports the Group's Sustainability initiative and climate-change-related objectives, through the alignment of the Group's remuneration strategy. All business unit Presidents and each of the regional business unit Vice Presidents have a part of their annual incentive compensation tied to performance targets on CO<sub>2</sub> emissions reduction. In addition, the Remuneration Committee has determined that commencing in 2022 the Group's Long-term Incentive Plan should also include three ESG measures, focused on a reduction in the Group's Scope 1 & 2 CO<sub>2</sub> emissions, a reduction in the Lost Time Incident Frequency Rate and an improvement in the gender representation in senior management.

Management oversight

In 2020, with the launch of the Group's new Sustainability initiative, a new governance structure was established, comprising a Sustainability Council, supported by the new role of VP Sustainability, and a clear set of KPIs and targets delineated. The Vesuvius Sustainability Council is chaired by the Chief Executive, and comprises the Group Executive Committee, VP Sustainability and regional Vice Presidents from each business unit. It meets on a quarterly basis and oversees the Group's sustainability activity, monitors progress against our targets and assists the Group with identifying and assessing the implications of long-term climate-related risks and opportunities. The Council reports to the Board twice per year. In 2021, it was integral in preparing a complete climate change risk and opportunities assessment for the Group, exploring the potential impact of climate change on business strategy and evaluating the associated financial projections.

Scope 1, 2 and 3 CO<sub>2</sub> and CO<sub>2</sub>e emissions

Scope 1 covers direct emissions from owned or controlled sources. Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the Company. Scope 3 includes all other indirect emissions that occur in the Company's value chain.

To illustrate the strategic alignment of our sustainability agenda at Vesuvius, as of 1 January 2022, the VP Sustainability reports directly to the Chief Executive.

The VP Sustainability leads the Group's sustainability activities, coordinating the work of the Sustainability Council including the Group's assessment of climate-change risks and opportunities and formulation of climate-related scenarios. He is also responsible for the collation of data to assess the Group's performance against its sustainability targets and KPIs, producing quarterly performance reports and managing Group-wide communications.

Responsibility for the progress of the Group against its sustainability objectives lies with the Group Executive Committee and, operationally, each business unit President. These BU Presidents and the Regional business unit Vice Presidents are also responsible for communicating the sustainability targets inside their organisations and for implementing plans – including overseeing capital allocation and the selection of R&D priorities – to achieve these targets and address the climate-related risks and opportunities.

The VP Sustainability is responsible for overseeing reporting on the Group's sustainability matters and metrics. Formal channels for reporting a range of data points are embedded in the organisation. Escalation mechanisms, routine reviews, and internal controls such as auditing and due diligence are in place to ensure transparency, consistency and completeness of information. For certain topics these are supported by independent third-party verification.



Our planet

Vesuvius takes seriously its responsibility for managing the impact of its operations and its supply chain on the environment. We recognise the finite nature of the majority of natural resources and the obligation we have to preserve the environment for future generations.

Tackling climate change



We are committed to reducing the environmental footprint of both our own and our customers’ operations and to growing our engagement in the circular economy by reducing the amount of waste we generate, recovering more of our products after they have been used and increasing the usage of recycled materials.

Supporting policy development

To transition to a low-carbon global economy, Vesuvius supports the call for policymakers to:

- Build a level global playing field, including carbon border adjustments and robust and predictable carbon pricing for companies. This will strengthen incentives to invest in sustainable technologies and to change behaviours
- Develop the necessary energy production and distribution infrastructure to provide access to abundant and affordable clean energy

Reducing our impact

Vesuvius actively participates in measures to tackle climate change by reducing our CO<sub>2</sub> emissions and use of raw materials, and helping our customers reduce their own CO<sub>2</sub> footprint thanks to the use of our products and services. We have set ourselves the goal of reaching a net zero carbon footprint at the latest by 2050. Vesuvius embraces society’s expectations for greater transparency around climate change, expressed by initiatives such as the recommendations of the TCFD.

Supporting our customers

According to estimates from the World Steel Association (WSA), on average for 2020, 1.89 metric tonnes of CO<sub>2</sub> were emitted for every tonne of steel produced. The WSA also estimated that the steel industry generates between 7% and 9% of global direct emissions from the use of fossil fuels.

The iron and steel industries are taking action to address the decarbonisation challenge. We want to support them and will work in partnership with them to develop more sustainable solutions. With around 10kg of refractory material required per tonne of steel produced, the careful selection and use of energy-saving refractories can beneficially impact on the net emission of CO<sub>2</sub> in the steel manufacturing process. In the foundry process, the amount of metal melted versus the amount sold as finished castings is the critical factor impacting a foundry’s environmental efficiency. Vesuvius continuously works with its customers to increase this metal yield.

Climate-related risks and opportunities

The actions being taken by governments and society around the world to mitigate climate change, and the changes in temperature and weather patterns resulting from it, present both opportunities and risks to Vesuvius. In its broadest context, we believe that the need for climate change initiatives will create ever greater opportunities for the Group to support our customers – to improve their efficiency and reduce their environmental impact. Each year the Group undertakes a robust assessment of the principal risks which could have a material impact on the Group. A number of sustainability risks are recorded in this analysis (see the Risk, Viability and Going Concern section on p29–35). In line with the recommendations of the TCFD, Vesuvius also undertakes a review of the key climate-related opportunities and risks that we foresee impacting the Group over the short, medium and long term.

The completed climate-related risk and opportunity register was reviewed and approved by the Audit Committee in 2021 and the significance of climate-related risks was considered in relation to risks identified in the standard risk management process. Climate-related risks are reviewed every six months as part of the Group’s standard risk management process, to ensure the register reflects any material changes in the operating environment and business strategy, and to ensure that the management of climate-related risks is integrated into our overall principal risk management framework.

The business units use the analysis of risks and opportunities to inform their business development priorities and focus their R&D project portfolios. They factor climate change risks and opportunities into their business planning processes assessing the long-term impacts on profitability of both the risks and opportunities.

Sustainability has always been at the heart of Vesuvius’ business and the Group’s analysis concludes that the opportunities for the Group manifested by the global pressure to mitigate climate change outweigh the risks. Our technology helps our customers improve their process efficiency and their environmental footprint.

We describe the Group’s strategy for addressing the climate-related opportunities impacting our business in ‘Our external environment’ p16 and 17 ➡

Then, in more detail, we describe how practically we are maximising those opportunities to help our customers in the ‘Our customers’ section p80 and 81 ➡

Physical risks and business continuity

Thanks to significant restructuring efforts carried out since 2017, Vesuvius now operates in a highly optimised global footprint. Proximity with customers limits transportation and associated CO<sub>2</sub> emissions, ensures higher flexibility and reactivity, and reduces working capital. Yet, a significant amount of redundancy for most product lines remains, providing backup in case of local disruption and ensuring continuity of supply for our customers.

Vesuvius operates in 54 manufacturing sites and six R&D centres of excellence located in 40 countries, and from time to time our operations can be subject to physical damage driven by weather events, such as severe storms and flooding, water shortages or wildfires whose frequency and intensity may be exacerbated by climate change. Such events may also impact the manufacturing capabilities of our customers, our tier 1 and lower tier suppliers and our supply chain logistics.

Vesuvius has undertaken a comprehensive analysis of our sites’ susceptibility to physical risks arising from climate change. In 2021, we built a weather event risk map covering our 30 most material manufacturing sites and R&D centres of excellence. Of these, 18 were identified as being high risk for at least one type of weather event (flooding, hailstorm, lightning, storms and tornadoes), and three are located in areas of very high water stress.

We anticipate that the occurrence of adverse weather events will continue to increase and we therefore manage our business to prepare for them and mitigate their impact when they do occur.

As the Group has restructured and concentrated its manufacturing footprint on a reduced number of locations, our strategy to address short-term risks has transitioned from a focus on redundant capacity to improved prevention and risk management. Sites are routinely audited by our insurers and our external risk manager. Their reports are combined with water stress analyses (based on the Aqueduct water risk atlas) covering all our manufacturing sites and R&D centres of excellence, to create our physical risks map.

Local and product line business continuity plans are maintained by our manufacturing sites and are regularly reviewed. Vesuvius sites maintain and exercise emergency plans to deal with such events as part of their normal risk management and business continuity processes. Exercises and drills are organised covering IT disaster recovery, fire, explosion, weather and geophysical events, and our processes are improved based on the lessons learned.

In 2021, a Vesuvius manufacturing site in Malaysia suffered damage from flooding due to an abnormally intense rain storm. This disrupted operations for a few days but sound emergency and business recovery planning meant there was

no material impact on the Vesuvius business and assets. Customer operations were unaffected.

**Transition risks**

We believe that the main climate change transition risks facing the Group relate to:

- 1 the potential for carbon taxing or emissions rights trading schemes to be introduced or increased, without effective border adjustment mechanisms to accompany them, in Europe and the US but not uniformly elsewhere; and
- 2 the rapid transition from iron to aluminium for light vehicles castings.

An increase in the cost of carbon emissions would affect our manufacturing costs. We are addressing this through our energy efficiency improvement initiatives and conversion to non-fossil fuels wherever possible.

A very rapid transition from iron to aluminium for light vehicle castings would affect our revenue in the iron castings market. We expect this to be compensated for by increased sales for aluminium castings, and growing sales of products for thin-section automotive component iron castings and turbo-charger castings for hybrid vehicles.

Sites with the highest exposure to weather events

Country	Site	Water stress	Flood – water bodies	Flood – precipitation	Hailstorm	Lightning	Wind – tropical storms	Wind – extra tropical storms	Tornado
China	Anshan	●							
	Changshu		●						
Belgium	Ostend							●	
Italy	Muggio				●				
Netherlands	Hengelo		●						
South Africa	Johannesburg				●	●			
India	Kolkata		●	●			●		
	Mehsana	●							
	Puducherry	●							
	Pune	●							
	Vizag						●	●	
USA	Champaign				●				●
	Charleston		●						●
	Chicago Heights				●				●
	Wurtland					●			
Japan	Toyokawa						●	●	
Taiwan	Ping Tung						●		
Brazil	Piedade				●	●			
	Resende		●	●					
	Sao Paulo				●	●			





Tackling climate change

Climate-related risks and opportunities analysis

Vesuvius considers the key climate-related opportunities and risks that we foresee impacting the Group over the following short, medium and long-term time horizons.

Short term (2025)	Medium term (2035)	Long term (2050)
Our current strategic plans operate within this timeframe. Most of the intermediate sustainability targets approved by the Board were set with 2025 as a deadline. This horizon encompasses our capital expenditure cycle, allowing time to decide, implement and measure the progress of actions.	This is the most likely horizon for the regulatory frameworks (such as the EU Emissions Trading System and Carbon Border Adjustment Mechanism) currently being defined in many regions to reach their full effect. We anticipate that the major adjustments to customers' footprints and technology investments will be in full swing by then.	This deadline has been retained by the United Nations and many policy-making bodies to set decarbonisation goals. Vesuvius is committed to reaching net zero by 2050 at the latest.

Opportunities			Potential annual impact on trading profit in the short, medium and long term		
Opportunity	Description	Impact	Short term 2025	Medium term 2035	Long term 2050
Products and services					
Ability to diversify business activities	Commercialise refractory solutions for low-CO <sub>2</sub> emitting processes in the production of aluminium to replace carbon-based products	Increased revenue and trading profit	Minor	Minor to moderate	Minor to very high
	Commercialise refractory solutions for hydrogen based Direct Reduction Iron production and steel to replace traditional refractory products		Insignificant	Insignificant to minor	Insignificant to high
Markets					
Access to new markets	Accelerated growth of the wind turbine market	Increased revenue and trading profit	Minor	Minor	Minor to high
	Accelerated growth of the aluminium castings market for electric vehicles and light-weighting		Minor	Minor	Minor to high
	Accelerated growth of ferrous castings for hybrid vehicles (turbo-chargers) and thin-section castings for internal combustion engines		Insignificant to minor	Minor to moderate	Minor to moderate
	Accelerated growth of the high technology steel segment		Minor	Minor to high	High to very high

Impact categories (trading profit)

We have assessed our risks and opportunities, and sorted them according to the following classification:

Opportunities		Risks	
Very high (>£25m)		Catastrophic (>£25m)	
Major (£15–25m)		Major (£15–25m)	
High (£10–15m)		High (£10–15m)	
Moderate (£5–10m)		Moderate (£5–10m)	
Minor (£1–5m)		Minor (£1–5m)	
Insignificant (£0–1m)		Insignificant (£0–1m)	

Risks				Potential annual impact on trading profit in the short, medium and long term		
Risks	Description	Impact	Mitigating actions being undertaken	Short term 2025	Medium term 2035	Long term 2050
Physical risks						
Increased frequency and severity of extreme weather events (heatwaves, rain and river flooding, cyclones, snow)	Physical damage to Vesuvius locations and people	Increased cost due to physical damage	Mitigating actions for severe weather events and the associated risks are included in the business continuity plans of plants and property, and insurance is purchased	Minor	Minor	Minor
	Business disruption due to natural disaster	Reduced revenue from business interruption				
Transition risks – Policy and legal						
Carbon taxing/ emissions rights trading/ border adjustment mechanisms introduced or extended	Increase in manufacturing costs	Increased operating costs (main risk in Europe)	Capex to improve energy efficiency and conversion to non-fossil fuels to eliminate CO <sub>2</sub> emissions. Relocation of manufacturing to reflect movements in customer base	Minor	Insignificant to moderate	Insignificant to high
Transition risks – Market						
Rapid transition from iron to aluminium for light vehicle castings	Reduced volume of internal combustion engine castings and so risk of revenue loss for the Foundry Division	Reduced revenue from shrinking market as some iron castings will disappear or be converted to aluminium (due to conversion to electric vehicles)	In ferrous, push to develop sales of feedex and coatings for thin-section automotive components, and products for turbo-charger casting. Invest in R&D, marketing and sales force	Minor	Moderate to high	Moderate to major
Transition from Blast Furnaces – Blast Oxygen Furnaces converted to Direct Reduction Iron or Electric Arc Furnaces (EAF) for iron and steel making	Share of EAF in total steel production increases	Reduced size of market where Vesuvius is strongest, leading to weaker positions in the steel market	Adjust R&D and product development priorities. Redeploy sales force, focusing on EAF market	Insignificant	Minor to moderate	Minor to moderate

Tackling climate change continued

Scenario analysis

Vesuvius has undertaken scenario analysis to seek to quantify the likely impact of climate change on the business and to test the resilience of the Group's strategy to the changes that lie ahead.

We considered three scenarios, modelling the potential financial impact of 2°C, 3°C and 4°C temperature increases on our business.

Best cases scenario

In formulating our scenarios, we took as our 'best case' a 2°C scenario. This was based on the premise that despite the tremendous acceleration of public awareness, regulation, technology development and capital allocation in recent years, we doubt that there is sufficient time for the 1.5°C target to be achieved. We therefore identified our most optimistic scenario as 2°C. Our assumption is that any further acceleration which would allow the planet to get back onto a 1.5°C course would reinforce the main characteristics and accelerate the timeline of our 2°C scenario, without fundamentally changing its features.

From assumptions to strategy

The scenarios take as their starting point the regulatory and macro-economic assumptions underpinned by the International Energy Agency's WEO 2020 Stated Policies Scenario and Sustainable Development Scenario. Supplementing this we have identified, for each scenario, the areas of our business in which changes may occur, such as the evolution of end-markets, customer footprint, pace and breadth of technology transition in iron and steel making, pace of conversion from fossil fuels to clean electricity and hydrogen, and evolution of the aluminium market. We then evaluated the potential magnitude of the risks and opportunities in each scenario. We analysed the implications for Vesuvius and considered our strategic response in terms of our manufacturing and our commercial footprint, our portfolio of products

and services, the conversion of our manufacturing processes to clean energy and the prospects for our aluminium casting business. With this approach, the impacts on all key areas of the business were covered (sales, R&D, manufacturing and procurement). The outcomes of the scenario analyses have been taken into account in formulating plans for achieving the Group's strategy.

Three long-term scenarios

4°C warming scenario 'Good intentions hampered by fear of economic war'	3°C warming scenario 'Closed doors'	2°C warming scenario 'Global accord'
Incomplete policy and fiscal packages distort competition, slowing down technology development and leading to geographic shifts in steel supply	Regional/national self-interest drives economic policy, competition wins over cooperation, regulatory framework and technologies evolve differently	High cooperation and commitment to limit emissions facilitates technology development and the transition to a low carbon world

	4°C warming scenario – 'Good intentions hampered by fear of economic war'	3°C warming scenario – 'Closed doors'	2°C warming scenario – 'Global accord'
1 Regulatory and macro-economic environment	The European Union and United States implement carbon pricing mechanisms (taxation or cap on trade), but no Carbon Border Adjustment Mechanism or Tariffs (or insufficient to prevent the transfer of manufacturing away from these regions)	The European Union and United States implement carbon pricing mechanisms (taxation or cap on trade), and Carbon Border Adjustment Mechanisms or Tariffs to protect their industries from delocalisation	All major economies implement carbon pricing mechanisms. The cost of CO <sub>2</sub> increases in all regions at a comparable pace
2 Conversion of power generation from fossil fuels to clean electricity and hydrogen	<ul style="list-style-type: none"><li>– Fast growth of non-CO<sub>2</sub> emitting electricity sources (nuclear and renewable) in Europe</li><li>– The cost of fossil fuels increases significantly in Europe</li><li>– Coal reduces progressively, but does not disappear. Natural gas continues to grow outside Europe</li><li>– Hydrogen does not become available on a wide scale and economically competitive until well after 2040</li></ul>	<ul style="list-style-type: none"><li>– Fast growth of non-CO<sub>2</sub> emitting energy sources in Europe</li><li>– The cost of fossil fuels increases significantly in Europe. Coal reduces progressively, but does not disappear, natural gas continues to grow outside Europe</li><li>– Hydrogen becomes available on a wide scale in the USA and Europe and economically competitive between 2030 and 2040</li></ul>	<ul style="list-style-type: none"><li>– Fast growth of non-CO<sub>2</sub> emitting energy sources (nuclear and renewable) in all regions</li><li>– The cost of fossil fuels increases significantly (taxation), coal as a source of energy disappears, natural gas starts to reduce</li><li>– Hydrogen becomes available on a wide scale and economically competitive between 2030 and 2040</li><li>– Fast electrification of the automotive industry</li></ul>
3 Technology transition – iron and steel making	<ul style="list-style-type: none"><li>– The transition in blast furnaces to clean processes (e.g. Direct Reduction Iron (DRI), hydrogen, Carbon Capture Storage (CCS), Carbon Capture Utilisation Storage (CCUS)) does not happen on a large scale</li><li>– US steel producers convert blast furnaces to DRI and Electric Arc Furnaces (EAF) to benefit from the low cost and high availability of natural gas</li></ul>	<ul style="list-style-type: none"><li>– European iron making transitions to clean processes (e.g. hydrogen, DRI, CCS, CCUS). The speed of the transition is dictated by the availability of green hydrogen in large quantities</li><li>– Some US blast furnaces are converted to hydrogen, others to DRI+EAF</li><li>– Chinese steel plants convert to clean iron and steel making processes, albeit at a slower pace</li><li>– Little or no transition outside China, the EU and USA</li></ul>	<ul style="list-style-type: none"><li>– Fast transition of iron making to clean processes in all regions; blast furnaces are revamped ahead of their normal schedule</li><li>– European and Chinese integrated steel making will grow primarily in hydrogen-based iron production, implementing CCS and CCUS technologies as well</li><li>– DRI + EAF will grow in the US (benefiting from the availability of low cost shale gas) and Europe</li><li>– Customers also invest to increase the performance of furnaces, including downstream of casting</li></ul>
4 High technology steel market	High technology steel market grows at 0.9% per year	High technology steel market grows at 1.2% per year (light weighting and material efficiency efforts by downstream industries accelerate shift from lower to higher performance grades)	High technology steel market grows at 1.6% per year (light weighting and material efficiency efforts by downstream industries accelerate shift from lower to higher performance grades)
5 Aluminium market	Aluminium market grows at 3% per year	Aluminium market grows at 5% per year (driven by the demand for transportation, construction and packaging) until 2035. It accelerates afterwards as the demand for hybrid vehicles shifts to electric vehicles	Aluminium market grows at 7% per year (driven by the demand for transportation, construction and packaging) until 2035. It accelerates afterwards as the demand for hybrid vehicles shifts to electric vehicles
Potential financial impact by 2035 (profit before tax)	£-5m to £0	£5m to £10m	£15m to £20m





Tackling climate change continued

Key factors impacting Vesuvius' three climate change scenarios

1 Regulatory and macro-economic drivers differentiate our scenarios

Firstly, effective border adjustment mechanisms to accompany carbon taxation, or cap and trade systems in regions with ambitious emissions reduction objectives, will greatly support the implementation of technologies required to decarbonise steel making (including the development of hydrogen as the reducing agent). Conversely, the absence or ineffective implementation of border adjustments would lead to significant delocalisation of the steel industry and a displacement of CO<sub>2</sub> emissions to other countries rather than a significant reduction on a worldwide scale. This shift in our customer footprint would lead to the need to adapt our own manufacturing footprint.

Secondly, public policy will significantly affect the relative cost and availability of non-CO<sub>2</sub> emitting energy sources vs fossil fuels and respective infrastructures. These will greatly influence the pace of deployment of various technologies and industries (electric vehicles, green hydrogen, decarbonised steel making). Infrastructure, construction and other downstream markets will also be incentivised to reduce steel consumption, accelerating the shift towards high technology steel.

Finally, the level of international cooperation to encourage and support less developed economies to engage in the technology transition will also affect our customer manufacturing footprint.

2 The future of steel

All three scenarios assume that the strong connection between world GDP and world steel output will continue as there is no significant substitute for steel. The fight against climate change is expected to have a far-reaching impact on many different industries translating into the accelerated growth of the high-technology steel segment in which Vesuvius has a key presence. For example, solar and wind power plants, where investment is growing fast, are far more steel intensive per kWh of installed capacity than their fossil fuel equivalents. Likewise, hydrogen transportation, another area of rapid growth, also requires considerable amounts of special grades of steel for new pipelines and ships.

3 Technology transition

Our scenarios consider the pace and extent of the technology transition in iron and steel making. The Blast Furnace – Basic Oxygen Furnace (BF-BOF) route for steel making is significantly more CO<sub>2</sub> intensive than the Electric Arc Furnace (EAF) route. However, EAFs cannot currently be used to produce all higher quality steel grades and they rely on the availability of scrap steel (itself a function of the level of economic development). Going forward, quality levels produced by EAFs will continue to improve.

Various technologies to decarbonise the BF-BOF route are being developed, including solutions which seek to capture the carbon as it is emitted and either store or use it, or its replacement, by a combination of Direct Reduction of Iron (DRI) and EAF.

Hydrogen-based DRI associated with EAFs has the potential to be nearly carbon-free if carbon-free electricity and hydrogen are available. We anticipate that there will be a gradual reduction in steel production via the BF-BOF route and growth in the EAF route. The extent and pace of this will depend on technologies coming to maturity, the availability of infrastructure (carbon-free electricity and hydrogen), and regulatory frameworks.

Conclusion on strategic resilience

We estimate the financial impact of the opportunities and risks on the Group will be most adverse under a 4° scenario and most positive under a 2° scenario. Under all three scenarios, we expect to benefit from the continuing growth in the production of steel in line with GDP, along with the accelerating shift towards higher performance iron and steel castings, as we support customers to maximise the efficiency and quality of their production. With our technological expertise, strong customer relationships and broad manufacturing footprint, we expect to play a key role in supporting our customers' efforts to decarbonise their operations.

We also believe there is a low downside for Vesuvius in all three scenarios as approximately 75% of our business in Steel is in the steel casting part of the operation which, as a standalone process, is low CO<sub>2</sub> emitting (1% to 3% of a steel plant's CO<sub>2</sub> emissions), and which we do not expect to be affected by technology shifts that the decarbonisation of iron and steel making will require.

Whilst the electrification of light vehicles and ongoing light-weighting efforts are expected to translate into a shrinking of the market for certain iron castings, it is anticipated that this will be more than compensated for by the growth in other markets such as wind turbines and aluminium castings.

Energy conservation and CO<sub>2</sub>e emissions reduction

Vesuvius launched its Energy Conservation Plan in 2011 and significant progress has been made. Between 2019 and 2021 the Group achieved an overall reduction in normalised (measured per metric tonne of product packed for shipment) energy consumption of 9% and a 15.5% reduction in normalised CO<sub>2</sub>e emissions (Scope 1 and Scope 2, market based), comprising a 16.5% reduction in normalised Energy CO<sub>2</sub>e usage and a 12.6% reduction in normalised Process CO<sub>2</sub>. Our energy conservation plan is now in its third cycle of improvement.

Managing our energy intensity not only has an environmental benefit but is also part of our long-term strategy to enhance our cost-competitiveness.

2025 energy targets

In 2020, the Board set a new objective targeting a 10% improvement in the Group's normalised energy consumption, measured per metric tonne of product packed for shipment between 2019 and 2025.

2019 was selected as the baseline for all GHG emissions data and targets, absolute and relative, as this was the last year of normal trading prior to the COVID-19 pandemic.

The Board also set a related target for the Group to achieve a 10% reduction in Energy CO<sub>2</sub>e emissions per metric tonne of product packed for shipment (Scope 1 and Scope 2) vs 2019. This target covers 100% of Vesuvius' operations and is to be achieved without the use of any offsets. The Group Energy CO<sub>2</sub>e emissions reduction 2025 target has been cascaded to all business units, which have built action plans accordingly.

Each site monitors and reports its energy consumption on a quarterly basis. Performance and variation are analysed, and improvement plans built accordingly.

Focus areas

In seeking to meet these new targets and decarbonise our manufacturing processes, the Group is focusing on five main areas:

- Modernising and upgrading installed equipment to reduce our energy consumption
- Investing to renew equipment to the best available technologies and converting to less CO<sub>2</sub> intensive energy sources
- When possible, replacing high CO<sub>2</sub>e emission electricity (generated from coal) with greener electricity or other sources of energy
- Reducing our energy wastage, recovering heat to feed processes and hot water
- Generating clean energy

Key Group initiatives for energy conservation and for increasing energy efficiency

1 Carbon-free energy sources

The Group supports the transition towards renewable energy sources and cleaner carbon-free technology when possible. Our energy strategy includes an ongoing effort to convert to carbon-free electricity contracts whenever practical and economically manageable, invest in solar panels, and the conversion of processes to electricity as soon as the technology is cost-effective.

In 2021, nine sites converted to carbon-free electricity contracts, taking the total number to 12, representing 20% of our manufacturing sites and R&D centres of excellence.

We also inaugurated a solar panel installation in our plant in Igorre in 2021 and launched projects in our Kolkata and Vizag plants. 19 manufacturing sites and R&D centres of excellence are also investigating solar panel projects.

In 2021, 51% of the grid electricity consumed in our sites was generated using processes that did not emit CO<sub>2</sub>, of which 41% was generated from renewable sources. At the end of 2021, four sites were equipped with renewable energy installations, and one had invested in a combined heat and power installation.

2 Capital commitments and internal CO<sub>2</sub> pricing

In 2020, we took the decision to include an environmental impact analysis in the evaluation of each of our capital expenditure projects as these are the key decisions that drive long-term future sustainability performance, and CO<sub>2</sub> emissions in particular.

Our Environmental policy, which is the responsibility of the Chief Executive and the Group Executive Committee, covers all our operations and states that all our investment decisions will include an analysis of their environmental impact. An internal price for CO<sub>2</sub> emissions (Scope 1 and Scope 2) is included in the calculation of payback for all investments reaching the threshold for approval by the BU Presidents or Chief Executive.

Vesuvius views this shadow pricing mechanism as a key mechanism to ensure that the environmental impact of long-term investment decisions is understood. It seeks to ensure that the best available technology is adopted, even in locations where no external cost for carbon is in place or foreseen.

The internal price of CO<sub>2</sub> was initially set at €30 per tonne of CO<sub>2</sub>. This price is reviewed annually and is applicable across all business units and all regions for the full year. It has been increased to €90 per tonne of CO<sub>2</sub> for 2022.

Key progress since 2019

Since 2019, four major projects have helped significantly reduce the Scope 1 CO<sub>2</sub> emissions of the Group by addressing some of its most CO<sub>2</sub>e intensive installations – closure of the Skawina bricks plant, elimination of dirty coke oven gas as a fuel in Wuhan with a new natural gas-fired tunnel kiln, transfer of the Tyler plant activity to Monterrey, and replacement of the burner system of the Olifantsfontein rotary kiln.

We endeavour to use the best available technologies to reduce CO<sub>2</sub> emissions in all our major capital expenditure projects.

For example, we are taking advantage of the closure of our Chinese plant at Kuatang and relocation of its activity, to replace all drying ovens and kilns with new ones with an energy efficiency improvement target of 20%.

Many other projects are being undertaken to upgrade or retrofit equipment to improve energy efficiency and reduce CO<sub>2</sub> emissions. These include new refractory furniture and installation of heat recovery systems in ovens and kilns, upgrades of compressors, replacement of light sources with LED lights, solar panel installation and the purchase of electric forklift trucks.

In 2021, the Board approved major capacity expansion capital expenditure projects totalling more than £20m. Available technologies and their impacts in terms of energy efficiency and CO<sub>2</sub>e emissions were systematically considered, and the most efficient technologies for the purpose selected. In addition, new capital expenditure worth circa £1.7m dedicated to 25 incremental improvement projects with energy efficiency and CO<sub>2</sub> emissions reduction in their prime objectives was approved in 2021.

In 2021, we analysed our CO<sub>2</sub> emissions in detail (Scope 1 and Scope 2), evaluated our Scope 3 emissions (using the GHG approved Scope 3 Evaluator), initiated a comprehensive survey of technologies in development and of their level of maturity, and started engaging with our suppliers of key raw materials on their CO<sub>2</sub> emissions levels and reduction plans.

Next steps

Our goal in 2022 will be to translate our commitment to net zero into a precise road map including short, medium and long-term milestones. We also intend to submit our first CDP Climate Change questionnaire in 2022.

In the short term (2025), various projects are being studied, including the installation of further solar panels, retrofitting of ovens and kilns or replacement of older and less efficient ones, and burner settings, loading and cycle optimisation. We will also continue the conversion of our electricity supply to carbon-free sources.

In the medium term (2035), we anticipate that further emissions reduction will be possible through further upgrades to our ovens and kilns, and possibly the combination of natural gas and renewable energy such as green hydrogen to fire refractory materials.

In the longer term (2050), various technologies are promising candidates for the near zero emissions curing and firing of refractory products (electricity, green hydrogen, synthetic gas, biomass).

Tackling climate change continued

Energy consumption and Scope 1 and Scope 2 CO<sub>2</sub>e emissions

While Vesuvius' products differ significantly in the energy intensity of their manufacture, most of our manufacturing processes are not energy intensive nor do they produce significant quantities of waste and emissions. Two of our 32 main manufacturing processes (VISO and Dolime production) account for 41% of our energy consumption and 58% of our location based CO<sub>2</sub>e emissions. (We report in metric tonnes of CO<sub>2</sub> equivalents CO<sub>2</sub>e.)

A further five processes consume 34% of the Group's total energy consumption and represent 24% of our location based CO<sub>2</sub>e emissions, giving a clear focus for 75% of our energy and 82% of our emissions-reduction initiatives.

The Group has clear targets for energy saving, with ongoing efforts focused on increasing the efficiency of our production processes. Dolime production, which uses coal to calcine dolomite, is our major emitter of CO<sub>2</sub> and, building on the successes of previous years, continues to be a clear focus for our investment to reduce CO<sub>2</sub> emissions.

Vesuvius' 2021 total energy costs of £40.6m are c.2.5% of revenue. Only 1.3% of the total energy requirements across the Group are consumed in the UK, producing less than 0.7% of the Group's CO<sub>2</sub>e location based emissions.

South Africa is the only country where we exceed the threshold to be submitted to a Carbon Tax or an Emissions Trading Scheme.

**Scope 1** covers emissions from fuels used in our factories and offices, fugitive emissions and non-fuel process emissions.

**Scope 2** relates to the indirect emissions resulting from the generation of electricity, heat, steam and hot water we purchase to supply our offices and factories.

Normalised energy consumption and CO<sub>2</sub>e emissions decrease

In 2021, the Group's normalised energy consumption decreased by 5.3% to 1,177 kWh per metric tonne (2020: 1,243), and the Group's normalised CO<sub>2</sub>e emissions reduced to the lowest level ever recorded:

- Location based: by 5.6% to 0.418 metric tonnes CO<sub>2</sub>e per metric tonne product packed for shipment (2020: 0.443)
- Market based by 9.4% to 0.40 metric tonnes CO<sub>2</sub>e per metric tonne product packed for shipment (2020: 0.44)

These reductions which countered the effect of the 13% increase in energy consumed were primarily driven by changes in product mix to lower energy intensity products and the significant increase in production volumes (19.3%). Natural gas use increased by 14.7%, electricity consumption by 6.6% and coal (a CO<sub>2</sub> intensive fuel) consumption by 9.8%, to 30.3 thousand metric tonnes in 2021 from 27.6 thousand metric tonnes in 2020 . During 2021, the Group also consumed 352 cubic metres of diesel (+32.2% 2020: 266) primarily in the operation of forklift trucks on its sites and 157 cubic metres of fuel oil, an increase of 26% (2020: 124). In total 509 cubic metres of oils were used as fuel in 2021 (2020:390).

Vesuvius plc long-term energy consumption and normalised energy consumption (aggregate of Scope 1 and Scope 2)

	2021	2020	2019	2018	2017
Total Energy consumption (million kWh)	1,159	1,026	1,176	1,339	1,410
Energy consumption per metric tonne of product packed for shipment (kWh/MT)	1,177	1,243	1,293	1,294	1,400

Greenhouse gas reporting

In reporting GHG emissions, we have used the GHG Protocol Corporate Accounting and Reporting Standard (revised edition) methodology to identify our Location based GHG inventory of Scope 1 (direct) and Scope 2 (indirect) CO<sub>2</sub>e. We report in metric tonnes of CO<sub>2</sub> equivalent (CO<sub>2</sub>e).

Our energy-related greenhouse gas (GHG) emissions, reported as carbon dioxide equivalents (CO<sub>2</sub>e), include direct emissions of the three main GHGs (Carbon Dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>) and nitrous oxide N<sub>2</sub>O).

Process related emissions of the following in CO<sub>2</sub> equivalent and in metric tonnes are not significant:

- Direct methane CH<sub>4</sub> Emissions
- Direct nitrous oxide N<sub>2</sub>O Emissions

Emissions of the following in CO<sub>2</sub> equivalent and in metric tonnes are not significant:

- Direct Sulphur Hexafluoride (SF<sub>6</sub>) Emissions
- Direct HFC Emissions
- Direct PFC Emissions

The Group also meets all its obligations in relation to the Producer Responsibility Packaging Waste regulations and the Energy Saving Opportunity Scheme by which the UK implemented the EU Energy Efficiency Directive.

All sites report their energy consumption and GHG emissions on a quarterly basis. Figures are verified for consistency and coherence.

Fuel consumption, emissions and normalised emissions for the main fuels consumed across the Group (location based statutory reporting)

Location based statutory reporting of global GHG emissions (metric tonnes CO<sub>2</sub>e) and energy consumption ('000 kWh) by type of fuel and emission.

Fuel and emission category	Energy used '000 kWh 2021	Energy used '000 kWh 2020	% change	CO <sub>2</sub> e '000 metric tonnes 2021	CO <sub>2</sub> e '000 metric tonnes 2020	% change	CO <sub>2</sub> e metric tonnes per metric tonne of product 2021	CO <sub>2</sub> e metric tonnes per metric tonne of product 2020	% change
Coal	224,846	204,693	10%	73	66	11%	0.074	0.079	-7%
Electricity	207,238	194,441	7%	100	92	8%	0.101	0.112	-10%
Ext.Heat	3,177	2,324	37%	1	1	40%	0.001	0.001	0%
LPG	77,379	61,605	26%	17	13	26%	0.017	0.016	5%
Natural Gas	641,168	559,011	15%	117	103	14%	0.119	0.124	-4%
Other Fuels	5,643	4,308	31%	1	1	30%	0.001	0.001	9%
Total Fuels	1,159,451	1,026,382	13%	309	276	12%	0.314	0.334	-6%
Non-Fuel Process Emissions				101	89	14%	0.103	0.107	-4%
Fugitive Emissions				1	1	30%	0.001	0.001	9%
Grand Total	1,159,451	1,026,382	13%	411	365	13%	0.418	0.443	-6%

1. All fuel consumption is converted to '000 kWh for reporting.
2. In 2021, the Group consumed 58,288 thousand m<sup>3</sup> of natural gas.
3. Vesuvius does not use any alternative fuels (% used zero).
4. Heat from biomass 0.01%.
6. Fugitive emissions are leaks of greenhouse gases, for example from refrigeration and air-conditioning units.
7. Location based Statutory Reporting of Global GHG emissions (metric tonnes of CO<sub>2</sub>e) and energy consumption ('000 kWh).

Global GHG emissions (kg of CO<sub>2</sub>e) and energy consumption ('000 kWh) (Location based statutory reporting)

Emissions and energy sources	UK and Offshore CO <sub>2</sub> e '000 metric tonnes 2021	Global CO <sub>2</sub> e '000 metric tonnes 2021	Proportion relating to the UK and Offshore Area	UK and Offshore CO <sub>2</sub> e '000 metric tonnes 2020	Global CO <sub>2</sub> e '000 metric tonnes 2020	Proportion relating to the UK and Offshore Area	UK and Offshore energy used '000 kWh 2021	Global energy used '000 kWh 2021	Proportion relating to the UK and Offshore Area	UK and Offshore energy used '000 kWh 2020	Global energy used '000 kWh 2020	Proportion relating to the UK and Offshore Area
Combustion of fuel and operation of facilities including fugitive emissions (Scope 1)	2,433	311	0.8%	2,196	272	0.8%	12,688	949,036	1.3%	11,442	829,617	1.4%
Electricity, heat, steam and cooling purchased for own use (Scope 2)	0,480	101	0.5%	0,503	93	0.5%	2,503	210,415	1.2%	2,619	196,765	1.3%
Total GHG emissions and energy	2,914	411	0.7%	2,699	365	0.7%	15,191	1,159,451	1.3%	14,061	1,026,382	1.4%
Change	8.0%	12.6%					8.0%	13.0%				

Vesuvius' chosen intensity measurement (location based statutory reporting)	Metric tonnes CO <sub>2</sub> e per metric tonne of product packed for shipment				kWh of energy per metric tonne of product packed for shipment			
	UK and Offshore 2021	Global 2021	UK and Offshore 2020	Global 2020	UK and Offshore 2021	Global 2021	UK and Offshore 2020	Global 2020
Emissions and energy reported above normalised to metric tonnes CO <sub>2</sub> e per metric tonne of product packed for shipment	3.304	0.418	2.607	0.443	17,223	1,177	13,586	1,243
Change	26.7%	-5.6%			26.8%	-5.3%		
Metric tonnes of CO <sub>2</sub> e per £m revenue								
Total GHG emissions as metric tonnes CO <sub>2</sub> e per £m revenue (location based)	26	250	27	251				
Change	-1.0%	-0.1%						

**Methodology**  
We have reported to the extent reasonably practicable on all the emission sources required under Part 7 of the Accounting Regulations which fall within our Group Financial Statements.  
Statutory Reporting is location based according to the GHG Protocol.  
Scope 1 covers emissions from fuels used in our factories and offices, fugitive emissions and non-fuel process emissions.

Scope 2 relates to the indirect emissions resulting from the generation of electricity, heat, steam and hot water we purchase to supply our offices and factories.  
We have used emission factors from the UK Government's (DBEIS) and the IEA GHG Conversion Factors for Company Reporting 2021 in the calculation of our GHG.  
Scope 1 and Scope 2 emissions were verified by Carbon Footprint Ltd.



Tackling climate change continued

Globalelectricityusage

	2021	2020	2019
Total electricity consumption ('000 kWh)	207,238	194,441	214,336
Electricity from non-CO <sub>2</sub> emitting sources ('000 kWh)	105,258	75,629	79,910
Electricity from non-CO <sub>2</sub> emitting sources (% of total)	51%	39%	37%
Electricity from renewable sources ('000 kWh)	84,641	55,873	55,512
Electricity from renewable sources (% of total)	41%	29%	26%
Energy from renewable sources ('000 kWh)	84,796	56,011	55,688

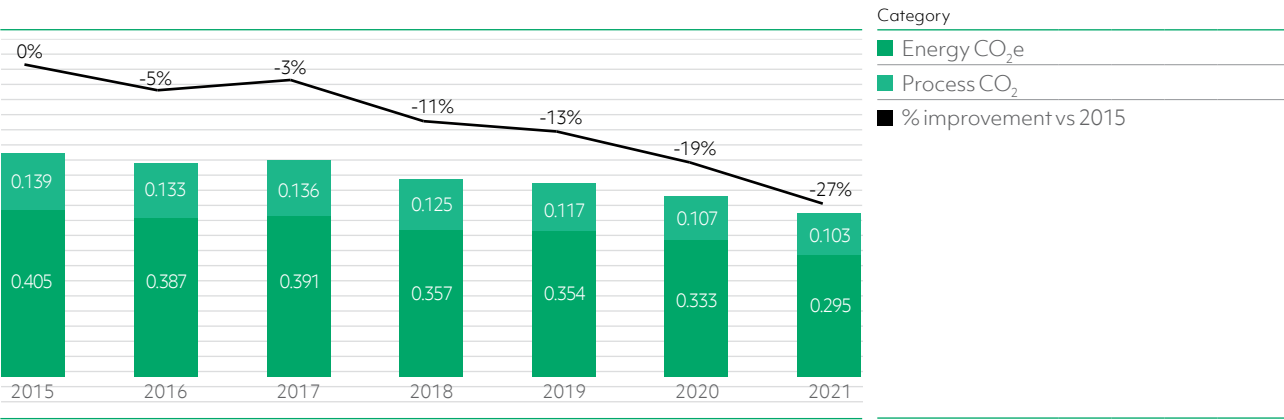
2021 CO<sub>2</sub>e emissions per region (market based)

Category	CO <sub>2</sub> e '000 metric tonnes	% of total
Europe	260.5	66%
China & NA	59.7	15%
India & SA	19.9	5%
South America	9.4	2%
US, Mexico, Canada	42.4	11%

5-year evolution of Scope 1 and Scope 2 CO<sub>2</sub>e emissions (market based)

	2021	2020	2019	2018	2017
CO <sub>2</sub> e '000 metric tonnes	393	364	429	499	531
CO <sub>2</sub> e metric tonnes per metric tonne of product packed for shipment	0.398	0.440	0.471	0.482	0.528
CO <sub>2</sub> e metric tonnes per million £ revenue (Scope 1 & 2)	238	249	250	277	315

Metric tonnes CO<sub>2</sub>e per metric tonne of product packed for shipment



2021 energy consumption by fuel type %

Category	Energy used '000 kWh 2021	%
Natural gas	641,168	55.3%
Coal	224,846	19.4%
Electricity	207,238	17.9%
LPG	77,379	6.7%
Other fuels	5,643	0.5%
External heat	3,177	0.3%

Scope 1, Scope 2 and Scope 3 emissions

Metric tonnes CO <sub>2</sub> e	2021		2020		2019	
	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%
Scope 1 Process CO <sub>2</sub> e emissions	101,121	5.4%	88,516	5.9%	106,737	6.0%
Scope 1 Energy CO <sub>2</sub> e emissions*	209,592	11.2%	183,741	12.2%	215,836	12.0%
Scope 1 CO <sub>2</sub> e emissions	310,713	16.6%	272,257	18.0%	322,573	18.0%
Scope 2 CO <sub>2</sub> e emissions (market based)	82,519	4.4%	92,145	6.1%	106,681	5.9%
Scope 3 CO <sub>2</sub> e emissions	1,483,438	79.0%	1,147,557	75.9%	1,363,709	76.1%
Total	1,876,670	100%	1,511,959	100%	1,792,963	100%

\* Includes fugitive emissions.

In 2021, Vesuvius' total Scope 1, Scope 2 and Scope 3 CO<sub>2</sub>e emissions were 1,876,670 metric tonnes. This represented 1,140 metric tonnes per million £ revenue.

Scope 3 emissions

Metric tonnes CO <sub>2</sub> e	2021		2020		2019	
	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%
Purchased goods and services	1,159,810	78.2%	871,993	76.0%	1,039,766	76.3%
Capital goods	62,004	4.2%	53,736	4.7%	68,461	5.0%
Fuel- and energy-related activities (not included in Scope 1 or 2)	94,182	6.4%	86,493	7.5%	101,979	7.5%
Upstream transportation and distribution	48,791	3.3%	30,762	2.7%	31,937	2.3%
Waste generated in operations	5,833	0.4%	5,660	0.5%	6,312	0.5%
Business travel	15,488	1.0%	13,574	1.2%	31,373	2.3%
Employee commuting	20,400	1.4%	20,400	1.8%	20,400	1.5%
Upstream leased assets	6,375	0.4%	6,375	0.6%	6,375	0.5%
Downstream transportation and distribution	37,761	2.5%	25,770	2.2%	27,231	2.0%
Processing of sold products	32,794	2.2%	32,794	2.9%	29,875	2.2%
Total Scope 3 CO <sub>2</sub> e emissions	1,483,438	100.0%	1,147,557	100.0%	1,363,709	100.0%

Scope 3 emissions

Vesuvius' Scope 3 CO<sub>2</sub>e emissions, mainly upstream, contribute to a greater part of our total CO<sub>2</sub>e emissions than our Scope 1 and Scope 2 emissions. In 2021, we assessed the most relevant and influenceable elements of our Scope 3 emissions, with a goal to set material science-based targets.

Scope 3 CO<sub>2</sub>e emissions for 2019, 2020 and 2021 were evaluated using the Quantis Scope 3 Evaluator software, approved by the GHG protocol. The evaluation covered 100% of operations.

The categories in the table above represent more than 95% of Vesuvius' total estimated Scope 3 emissions.

Purchased goods and services represent the largest category of Scope 3 CO<sub>2</sub>e emissions. In 2021, we also undertook a more focused evaluation of emissions associated with raw materials using publicly available average CO<sub>2</sub>e emissions

factors. In addition, we started collecting information on energy source, CO<sub>2</sub>e emissions data and reduction plans from our raw materials suppliers as part of the RFQ process. Suppliers representing 25% of the raw material spend have responded to our requests.

Parallel to this, various initiatives have been launched to reduce our Scope 3 CO<sub>2</sub>e emissions. A few examples include:

- Returnable packaging solutions being implemented both with suppliers and customers
- Policies aimed at limiting the CO<sub>2</sub>e emissions of company fleet vehicles are being deployed in various countries. More than 1,800 Vesuvius employees benefit from bus or other forms of collective transportation for their commute to work

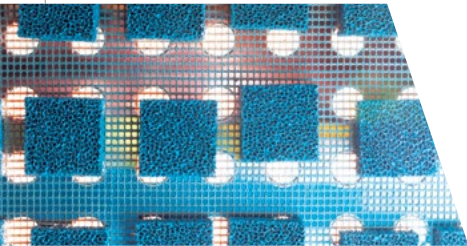
Vesuvius plc statement of verification

Scope 1, Scope 2 and Scope 3 carbon footprint reporting and supporting evidence contained herein for the period 1 January 2019 to 31 December 2021 were verified by Carbon Footprint Ltd in accordance with the 'ISO 14064 Part 3 (2019): Greenhouse Gases: Specification with guidance for the verification and validation of greenhouse gas statements'.

A copy of the full assurance statement can be found on our website: [www.vesuvius.com](http://www.vesuvius.com).



Growing our engagement in the circular economy



The drive to improve the sustainability performance of Vesuvius and the refractory industry's products was initiated many decades ago. The continuous improvements both in the durability of our products and in their disposal after usage have led to considerable reductions in both the raw materials used and the quantity of product shipped to landfill.

As the amount of refractory material per tonne of steel cast continues to level off, the purpose and value of the use of refractory materials will move from delivering insulation to an even greater emphasis on helping to improve steel quality and process efficiency.

Product durability

Our first, and preferred, strategy to reduce the depletion of resources is the extension of product durability. The amount of refractory material required per tonne of steel cast has been reduced by 80% since 1960, and the average product lifetime multiplied by as much. Approximately 10kg of refractory material are now consumed per tonne of steel cast, with some customers requiring as little as 7kg.

We are continuously working to extend the lifetime of our consumable products. Strategies include the development of advanced materials, the design of shapes that allow dual usage of products, and product repair and remanufacture. For mechanisms and equipment, we also offer wear monitoring and maintenance services to our customers to ensure their optimum performance and extend their lifetime. We have introduced innovative refractory lining monitoring, to enable repairs to be made only where needed. Our i-GVARD\* system automates the monitoring of slide-gate wear, providing decision-makers with critical data to choose when to renew refractory plates. We have developed longer life Duraflex\* ladle shrouds, and methodologies to reuse bottom slide-gate plates as top plates. Each of these systems and processes drives production efficiency and reduces refractory volumes.

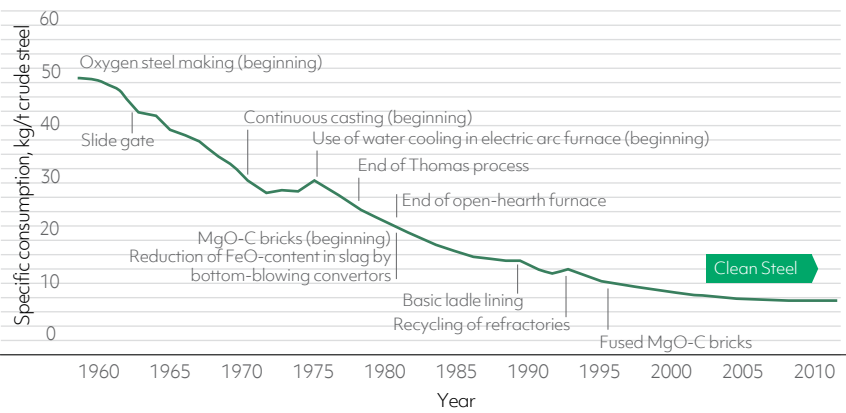
Product recyclability

At the same time as reducing the quantity of raw materials required for each casting, technical solutions and economic cycles have grown to enable the recycling of refractory materials after usage in the production of iron and steel. Whereas in the early 1970s nearly all refractory materials were disposed of after use, it is estimated that more than half is now recycled. In Europe, as little as 5% of refractory materials now go to landfill.

A large portion of this is open loop recycling, with spent refractories used in low value-adding applications such as aggregates for roadbed materials. Closed loop recycling will allow greater substitution of virgin material by secondary material, with a positive impact on Scope 3 CO<sub>2</sub> emissions. It is estimated that only 7% of spent refractories currently enter closed loop recycling.

Many factors such as consistency of material quality, cost of sorting and mineral processing, transportation costs, and the administrative burden associated with the transportation of waste, have prevented the wide adoption and investment in closed loop recycling. We therefore support initiatives being pursued by authorities to improve the regulatory framework for the circulation of waste materials across borders, making it easier for them to be recovered and recycled in different countries.

Amount of refractory consumed per tonne of steel cast in Germany



Source: Statistisches Jahrbuch der Stahlindustrie.

\* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

Vesuvius' use of recovered and recycled materials

Vesuvius is determined to increase the usage of recovered and recycled materials in its product formulations. A comprehensive quarterly reporting system for the use of recovered and recycled materials by all manufacturing sites was launched in 2019. It includes the reporting of recovered and recycled materials from sources external to Vesuvius and across Vesuvius facilities. In 2020, the Board set a target for 7% of the raw materials used by the Group in production, to be recycled materials from external sources by 2025 (measured by weight of materials).

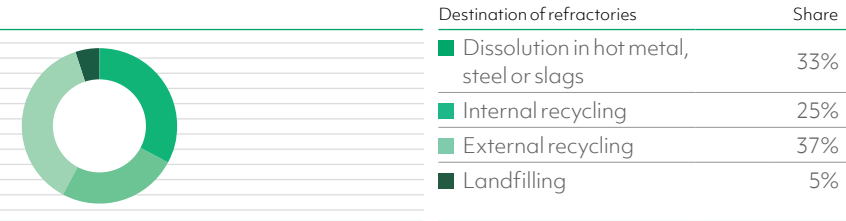
In 2021, 75,516 metric tonnes of recycled materials were used in our products. The percentage of recovered or recycled materials from external sources used in production was 6.2% (5.6% in 2020). 25.0% of our revenue was generated from products that include recycled materials (23.3% in 2020). We estimate that more than 70,000 metric tonnes of Scope 3 CO<sub>2</sub>e emissions were avoided by using recycled materials in lieu of virgin materials.

Increasing the share of recovered and recycled materials in product formulations poses multiple challenges, in terms of availability, consistency of quality, competitiveness versus virgin material whose prices fluctuate, regulatory frameworks for the transportation of end-of-life waste materials, and validations to ensure that product performance and reliability remain unaffected.

Cross-functional teams incorporating experts from R&D, Purchasing, and Manufacturing are working to identify and analyse opportunities in order to increase the share of recovered and recycled materials.

We have implemented programmes with some of our customers to recover and recycle refractory products, with new initiatives being discussed. We also offer our customers various options with regard to mechanisms and equipment, including rental.

Distribution of refractory material after use in the steel industry in Europe

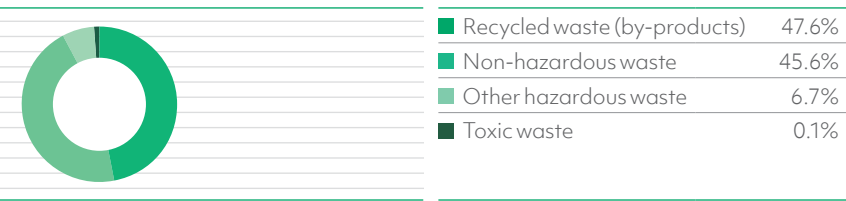


Source: A review of recycling of refractories for the iron and steel industry, Researchgate November 2017.

	2021	2020	2019
Amount of recycled materials used in Vesuvius products (metric tonnes)	75,516	56,599	67,900
Amount of recovered materials that are not recycled used in Vesuvius products (metric tonnes)	0	0	0
Percentage of recycled materials in Vesuvius products from total materials	6.2%	5.6%	5.9%
Percentage of revenue from products including recycled materials	25.0%	23.3%	22.6%

All recovered materials undergo some processing before their usage in our products. Therefore, they are all included in the recycled materials category, and the recovered materials category is empty.

Breakdown of 2021 solid waste



Material waste

Alongside the monitoring of recovered and recycled materials, a quarterly reporting system for material waste from all manufacturing sites was implemented in 2019. This was enhanced in 2020 by introducing the separate reporting of toxic and other hazardous waste.

Our system now includes the reporting of waste to landfill, toxic and other hazardous waste, waste for recycling, waste to sewers and by-products (materials recovered and recycled outside the site where they were generated). 100% of our manufacturing sites report the various categories of waste and by-products they generate.

The Board has set a target of a 25% reduction of our solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment by 2025 (vs the 2019 baseline).

Action plans were implemented at ten pilot sites in 2020, with an increased sharing of action plans and results. In 2021, the programme was extended, and manufacturing sites started building action plans covering both hazardous and non-hazardous waste to eliminate, reduce and recycle waste.

Our plants in Mülheim and Třinec received Circular Economy Awards from the European Refractory Producers Association (PRE) in recognition of the success of their waste reduction and recycling programmes.





Growing our engagement in the circular economy continued

Hazardous and toxic waste

We are committed to the reduction of toxic and other hazardous waste. In 2021, 13.0% of our solid waste (excluding recycled waste), was classified as hazardous (2020: 14.7%), while toxic waste represents 0.16% of solid waste (excluding recycled waste).

Whenever relevant, action plans to reduce hazardous waste are incorporated by manufacturing sites into their solid waste reduction action plans.

Manufacturing sites ensure that hazardous and toxic materials, and waste, are stored in protected containers and kept in delineated storage areas, with sufficient retention capability to prevent any release in case of accidental spillage.

Out of our manufacturing sites and R&D Centres of Excellence handling hazardous and toxic waste, 89% have defined emergency plans including provisions relating to toxic and hazardous waste and materials. Of these 72% have tested them through simulation exercises in 2021.

Raw materials and waste

Manufacturing site raw materials & waste/(metric tonnes)	2021	2020	Variation
Raw materials			
Recycled materials used (from external sources)	75,516	56,599	33.4%
Recovered materials used (from external sources)	0	0	0.0%
Raw materials and intermediates used excluding recycled (from external sources)	1,133,807	949,615	19.4%
Total raw materials and intermediates used	1,209,323	1,006,214	20.2%
% Recycled materials (from external sources)	6.2%	5.6%	10.0%
% Recovered materials (from external sources)	0%	0%	0.0%
Waste (solid waste, by-products and wastewater)			
Solid waste and by-products	56,755	58,524	-3.0%
Ratio of solid waste and by-products in metric tonnes per tonne of product packed for shipment	0.058	0.071	-18.7%
Solid waste (hazardous and sent to landfill)	29,747	26,607	11.8%
– Non-hazardous waste	25,894	22,695	14.1%
– Tailings waste	0	0	0
– Hazardous waste	3,853	3,912	-1.5%
– Toxic waste	48	28	72.6%
– Other hazardous waste	3,805	3,885	-2.0%
– Ratio of hazardous waste to total solid waste	13.0%	14.7%	-11.9%
Ratio of solid waste per tonne of product packed for shipment (in metric tonnes)	0.030	0.032	-6.3%
By-products (recycled waste)	27,008	31,917	-15.4%
Ratio of by-products per tonne of product packed for shipment (in metric tonnes)	0.023	0.036	-36.0%
Wastewater*	165,965	131,366	26.3%
Ratio of wastewater per tonne of product packed for shipment (in metric tonnes)	0.168	0.159	5.9%
Total solid waste, by-products and wastewater	222,720	189,890	17.3%

\* 1 m³ wastewater = 1 metric tonne.

Reducing consumption, waste and emissions



The Board has set a target for the Group to reduce the amount of wastewater per metric tonne of product packed for shipment by 25% by 2025 (vs the 2019 baseline).

Water consumption

Out of 745,000 metric tonnes of fresh water consumed in total, 728,000 metric tonnes (97.7%) were consumed in our manufacturing sites, the remaining 17,000 tonnes (2.3%) in our R&D centres of excellence, offices and warehouses.

28,326 metric tonnes were incorporated into our finished products (3.8% of total fresh water), the balance being consumed as part of our manufacturing processes and social water (96.2%). Our objective is to reduce both the amount of water consumed in our manufacturing process and social water usage. The main area of focus is the reduction of wastewater.

Water stress

Location of manufacturing sites	Number of main manufacturing sites	Percentage of revenue			Manufacturing site fresh water use (m³)		
		2021	2020	2019	2021	2020	2019
Very high-water stress	4	4%	4%	4%	56,393	48,529	58,507
Moderate to high water stress	19	42%	41%	39%	262,836	280,314	289,120
Low to moderate water stress	31	54%	55%	56%	374,986	361,011	420,577

This data covers 100% of our manufacturing sites. Water stress classification based on World Resources Institute Aqueduct Water Risk Atlas.

5-year evolution of fresh water consumption

	% change 2021/2019	2021	2020	2019	2018	2017
Water in m³	-12.7%	745,369	747,439	853,381	896,785	864,996
Water in m³ used per metric tonne of product packed for shipment	-19.4%	0.757	0.905	0.939	0.866	0.859
Water in m³ used per £million revenue	-9.1%	454	513	499	499	514

Emissions into the air

Some Vesuvius manufacturing processes can lead to low levels of emissions into the air. These include post thermal treatment residual Volatile Organic Compounds (from the curing and firing of products including solvents and resin binders, or pitch impregnation), residual GHGs from the combustion of fuels and process emissions, and residual dusts post capture and filtration.

Vesuvius’ emissions of VOC, residual GHGs, and residual dusts are at levels too low to warrant any form of continuous measurement and reporting of quantities emitted, but all manufacturing plants monitor their levels of emissions into the air through regular sampling, and actively work to reduce them.

Actions to reduce emissions include the upgrade of equipment to the best available technologies, and the implementation of filtration, vapour extraction and regenerative thermal oxidiser systems.



Protecting the environment



Vesuvius employee photography competition  
Michel Wissink – see inside back cover

Vesuvius takes seriously its obligations to its local communities and to ecological preservation. Environmental compliance at our sites, reduction in waste, increased recycling and treatment of emissions are key to Vesuvius’ operations, and can be a significant differentiator for our business.

Environmental policy

All employees are expected to adhere to the Group’s Environmental policy, which is translated into local languages and displayed prominently in all locations. The policy is supported by standards and procedures which are reviewed and updated on an ongoing basis. A copy is available to view on our website at: [www.vesuvius.com](http://www.vesuvius.com).

Environmental monitoring and environmental regulation

Vesuvius operates sites in some developing markets where environmental concerns have become politically significant as air quality deteriorates, and residential expansion takes people closer to areas historically reserved for manufacturing.

In addition, some of the sites Vesuvius operates have known ecological sensitivities, being in the vicinity of watercourses or environmentally sensitive areas.

All our factory emissions to air, ground and water, as well as waste are proactively managed in accordance with local regulations. All our manufacturing operations monitor key environmental indicators.

Regular analysis

Regular analysis enables us to act to reduce our emissions where possible and to operate more efficiently. Environmental performance records are kept for the period of time required to comply with local regulations.

Manufacturing plants maintain and test emergency plans to ensure compliance with local regulations and Vesuvius standards in the event of an accidental release.

Reports from external inspections, including those with findings, are centrally stored and shared internally with executive and senior management. Where local authorities carry out routine inspections, observations, recommendations and actions are recorded and acted upon appropriately.

Local compliance

Vesuvius is committed to addressing exceedances and complying with local regulations. All exceedances are reported in a central database. In 2021, Vesuvius recorded 52 minor environmental incidents. Of these, four related to emissions to air, two to emissions to water and 46 to ground.

Total environmental releases across the Group in 2021 are estimated to have totaled 10 metric tonnes (including 2.9 metric tonnes of water-based materials) and 7.4 m³ hydrocarbons. All releases to water and to the ground were fully contained apart from one incident in Ostend where an intermediate bulk container leaked c. 15 litres of hydrocarbons in water onto the ground, this was remedied and the result confirmed by analysis.

Where incidents occur, they are managed via Vesuvius’ site environmental response plans and reported through the Vesuvius incident reporting system. We comply with local reporting requirements in respect of such incidents. In Germany a slightly increased legionella contamination was detected in showers and remedial action taken. An existing earlier action in relation to a disused US property for wastewater exceedances remains open. Two regulatory actions issued in 2021 against Vesuvius in Belgium remain open. No other action was taken by any authority in relation to an environmental incident in 2021 which resulted in financial penalties against Vesuvius. The Group does not operate any mines and consequently the Group generates zero tailings waste.

Environmental management/ certifications

We have 20 manufacturing sites, one customer location and one warehouse certified to ISO 14001:2015, representing 37% of our 54 manufacturing sites. External annual compliance audits are carried out by the global assurance provider, LRQA. 100% of our ISO 14001:2015 certifications cover the handling of waste and hazardous materials, including regular environmental impact audits and implemented risk prevention procedures (including emergency planning and testing) relating to waste and hazardous materials handling.

Where previously the decision to pursue ISO 14001 certification was taken at a local level, Group policy is now for all production sites to seek ISO 14001 certification. A list of certified sites is available above and may also be viewed on the Vesuvius website: [www.vesuvius.com](http://www.vesuvius.com).

Biodiversity and greenery

Whilst risks to biodiversity were not considered as material by the internal and external stakeholders we engaged with, we nonetheless initiated a survey of all manufacturing sites. This did not highlight any risks from our ongoing operations, other than accidental environmental releases and emissions into the air as detailed elsewhere in this report.

The very limited footprint of Vesuvius’ sites contributes significantly to limiting our Company’s impact on biodiversity and greenery.

Actions have been taken in various manufacturing sites to improve greenery and biodiversity on their grounds and neighbouring communities, including planting trees.

ISO 14001:2015 certifications

Country	Company name	Site
Australia	Fosco Pty Ltd	Sydney
Belgium	Vesuvius Belgium N.V.	Ostend
Brazil	Fosco Industrial e Comercial Ltda	Sao Paulo
China	Vesuvius Advanced Ceramic (China) Co., Ltd	Suzhou
China	Vesuvius Advanced Ceramics (Anshan) Co., Ltd	Anshan
Czech Republic	Vesuvius Česká Republika, a.s.	Trinec
Germany	SIR Feuerfestprodukte GmbH	Siegen
Germany	SIR Feuerfestprodukte GmbH	Kreuztal
Germany	Vesuvius Europe GmbH & Co.KG., Vesuvius Mülheim GmbH & Co.KG.	Mülheim an der Ruhr
Germany	Vesuvius GmbH	Grossalmerode
Germany	Vesuvius GmbH	Borken
India	Fosco India Limited	Puducherry
India	Fosco India Limited	Pune
Indonesia	P.T.Fosco Indonesia	Jakarta
Japan	Fosco Japan Limited	Toyokawa
Netherlands	Fosco Nederland BV	Hengelo
Poland	Vesuvius Poland Sp. z o.o.	Skawina
South Africa	Vesuvius South Africa (Pty) Limited	Olifantsfontein
South Korea	Fosco Korea Limited	Gyeonggi-do
Sweden	Vesuvius Scandinavia AB	Amal
Taiwan	Fosco Golden Gate Co. Limited	Ping Tung
United Kingdom	Vesuvius UK Limited	Tamworth







Our customers

Our technology helps our customers improve their processes and their environmental footprint. Advancements in material science, pioneered by Vesuvius, have helped to ensure that the amount of refractory material required to cast one tonne of steel has reduced by 80% in the past 60 years.

Product safety and quality



Our core business is to help our customers protect their employees and improve their operational performance and efficiency. Customers rely on the quality of our products, and their structural integrity, to control the flow of molten metal safely in their facilities.

The reliability and performance of our products are critical to our customers in terms of overall equipment effectiveness, labour productivity and metal yield, and their environmental impact (reducing energy consumption, CO<sub>2</sub> emissions and refractory material waste).

Many of our products allow our customers to achieve improved metallurgical properties in their products, thereby allowing the production of wind turbine components, the light weighting of vehicles and other environmentally friendly products that benefit society.

Building safety into our products

At all times, our goal is to serve customers’ needs in the safest, most secure and compliant manner possible.

Many of our products – robotics, systems and consumables – are critical to the safety of our customers’ operators. Therefore, product safety is paramount to us. We have implemented a wide range of practices to optimise the performance of our products, reduce failures and increase their lifetime.

We follow a strict stage gate process for the development of new products, ensuring that safety performance objectives are defined from the initial stages and progressively completed up to the product launch. Key deliverables include risk assessments, preparation of user and maintenance documentation, manufacturing control plans, and Vesuvius and customer operator training. We undertake extensive testing through rigorous alpha and beta trials with systematic trial reports to confirm that targeted performance and robustness objectives are met and to allow for fine-tuning before product launch.

Automated systems

Our automated and robotic systems are fully customised and embedded into our customers’ processes. Their design and implementation require additional precautions to ensure optimum safety during the project and in operations. Teams working on their development and installation at customers therefore receive targeted safety training focused on the specific risks at various project stages. Development projects follow the ISO 10218-2 norm (Safety requirements for industrial robots). External expert consultancy support is provided along with regular audits, and all follow the rules required for CE conformity or equivalent.

The development of these human-centred robotic solutions for steel shops, reduces the ergonomic strain on our customers’ operators together with their exposure to high temperatures.

Compliance today and tomorrow

For the development and production of consumable products, we have implemented R&D screening of raw materials and chemicals to avoid introducing unwanted substances into the recipes and processes. Where potentially hazardous substances are nonetheless required, strict validation checklists have been defined to ensure adequate protection measures are taken at every step of the process. We document regulatory compliance through Safety Data Sheets for all raw materials consumed and all products manufactured, and share these with customers.

REACH regulation

Our objective is to remain fully compliant with our registration obligations under the Registration, Evaluation, Authorization and restriction of Chemicals (REACH) regulation. Since 2007, Vesuvius has appointed REACH managers for its Steel and Foundry Divisions, implementing an ongoing process to identify the REACH impacted raw materials based on their Safety Data Sheets. These substances are then monitored throughout the production process in Vesuvius. This also allows us to track the quantities consumed and verify that these remain within the limits of our registrations. Results are documented in a central database. We routinely organise training sessions for employees in the R&D, Sales, and Purchasing organisations to ensure that any new substance included in a new product recipe or otherwise purchased will be incorporated into our monitoring and registration process.

Updates to the lists of substances under REACH regulation issued by the European Chemicals Agency (ECHA) are continuously reviewed and our internal monitoring adapted whenever necessary. Vesuvius also monitors projected changes to the list of substances under REACH regulation, to proactively take into account future evolutions in our product development processes. Whenever relevant, we also participate in the consultations led by ECHA to define the most appropriate status for substances.

In 2018, we launched a programme of formal assessments of our suppliers, with an objective to assess all relevant suppliers of raw materials by the end of 2022. Following the UK’s departure from the EU in 2021, we adapted our registrations and purchasing organisation and systems, to ensure that we remain fully compliant with our obligations both in the United Kingdom and in the European Union.

A learning organisation

After product launch, whenever a safety-related incident (an injury or a dangerous occurrence) occurs at one of our customers, that may have involved a Vesuvius product or service, it is systematically reported and investigated. The outcome of the investigation, including root causes and corrective actions, is shared with the customer. It is also presented to the Group Executive Committee and the Board.

Each of our product managers is tasked with responsibility for collecting feedback on our products and managing improvements. Routine debriefing is organised after projects are completed. Field trial reports and incident reports are routinely reviewed to collect information on failures and improvement opportunities.

Whenever relevant, subsequent changes made to the design of products are deployed to installations in service at other customers and lessons learned are incorporated into the design of following generations of products. We monitor the number of CCARs (Customer Corrective Action Requests), severity 1 CCARs (safety-related incidents or quality issues affecting the customer of our customer), and repeat CCARs.

In 2021, no product failures led to lost time injuries at customers. Two minor injuries (a shoulder strain and a minor finger cut) did occur however, and the sources of the injuries were fully investigated, and corrective actions implemented.

Vesuvius places a high value on ISO 9001:2015 certification and the business assurance that this quality management system brings. We have 66 certified Vesuvius and customer sites, employing quality professionals to maintain and develop quality systems under our quality policy. 100% of the management systems used to make our products are covered by ISO 9001:2015. A list of certified sites is available to view on the Vesuvius website: [www.vesuvius.com](http://www.vesuvius.com).

Reliability and performance

Our constant performance monitoring develops deep and lasting relationships with our customers. Issues are dealt with through a rigorous problem-solving methodology and in-depth investigation. This ensures we learn from problems and prevent them recurring, as well as enabling us to constantly evolve and update our services in line with changing customer expectations and technological developments.

All issues raised by the Vesuvius field teams or by customers are systematically reported, documented and classified, based on their nature and severity. They are then investigated, with the following objectives:

- Implementing immediate containment actions to protect customers
- Identifying the root causes
- Implementing corrective actions
- Learning lessons and providing feedback for the development of future products

Regional business unit management teams are responsible for organising problem-solving teams to address issues and lead routine reviews of ongoing quality performance. Quality performance, including the number of customer complaints, the number of repeat complaints for the same issue and their severity is reported to the Board on a regular basis, and reviewed during each Group Executive Committee meeting. The most serious issues and those that affect, or could potentially affect, multiple customers are reviewed in detail during these meetings. Adverse trends result in prompt, clearly defined initiatives to permanently solve issues and prevent repeats.

Along with our focus on the completeness and quality of reporting, a strong emphasis is placed on the effectiveness of our problem-solving. Our cross-functional teams involve sales, research and development, and manufacturing experts, who work collaboratively to address the most challenging technical issues.

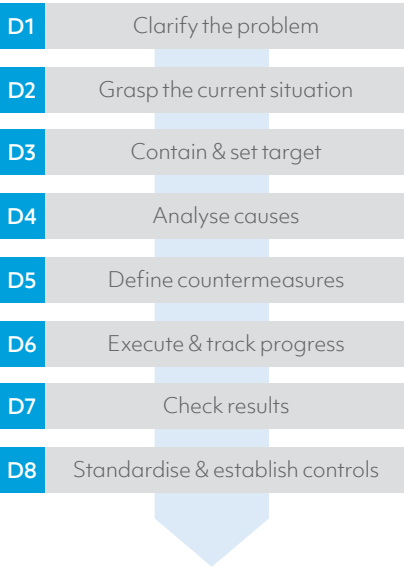
Problem-solving

We use the 8D practical problem-solving methodology. In 2021, our teams recorded, reported and investigated 2,756 issues.

In 2020, we undertook a thorough assessment of the problem-solving capabilities and practices in each of our business units regionally, identifying the gaps and required actions to reinforce them where necessary, especially in terms of staffing and training. In 2021, we started implementing these plans despite the difficulties caused by the COVID-19 pandemic.

The 8D methodology is implemented as the primary problem-solving tool across the Group. It is a consistent approach designed to identify root causes and ensure appropriate corrective action is taken.

8D – The eight Disciplines of Practical Problem Solving



Recognition

An annual 8D Awards Competition is organised to recognise the best teams and projects. This competition is organised across all business units, in each region, with a jury composed of senior managers and sponsored by members of the Group Executive Committee. In 2021, more than 125 projects were presented in the Regional 8D Competitions. In addition to recognising the best problem-solving and projects, these events are an opportunity to recognise talent and disseminate knowledge.

Supporting our customers’ journey to net zero



Sustainable solutions

Vesuvius is committed to growing its contribution to a sustainable world, through products and services that improve safety, maximise environmental performance, reduce greenhouse gas emissions, and contribute to the circular economy.

Our products have the potential to help customers reduce and avoid greenhouse gas emissions when compared with their current practices by amounts that far exceed the emissions required to manufacture and distribute them.

**How our products help reduce and avoid greenhouse gas emissions, they:**

Increase metal yield in castings

Reduce downgrading, re-melting of scrap and repair of defects

Minimise casting temperature

Reduce heat losses

Maximise casting speed and throughput

Extend production sequence length, reduce downtime

Improve metal performance

Reduce and avoid greenhouse gas emissions

We actively cooperate with customers to help them evaluate the CO<sub>2</sub> emissions reduction our products bring to their complete value chain.

Our customers in the iron, steel and aluminium industries are embracing the challenge of dramatically reducing their CO<sub>2</sub> emissions. Many have pledged to reach net zero by 2050. They are investing significantly to transform their manufacturing technologies for the long

term, working on a range of initiatives including the direct reduction of iron with green hydrogen and the replacement of carbon anodes in aluminium smelting. We contribute to their efforts through technology partnerships and developing new products for the next generation zero emissions aluminium, iron and steel-making processes.

Assessing our product portfolio

We have created a comprehensive scorecard to evaluate our products over their full product life cycle. We rate our products in comparison with the standard offering in the market considering their performance in terms of health and safety, environmental impact, greenhouse gas emissions, and end-of-life processing. All criteria are assigned a weighting. In line with our objectives to reduce both our own CO<sub>2</sub> emissions and help our customers reduce their CO<sub>2</sub> emissions, we give these criteria a significantly higher weighting.

Performing this analysis supports our objective to develop and supply products that provide our customers with a superior overall sustainability performance against the market standard.

Market-leading sustainable products

Our Clean Steel submerged entry nozzle (SEN) – a product that acts as a conduit for molten metal from the tundish to the mould in the continuous casting process – minimises the formation of inclusion clusters on the SEN wall that can detach and cause defects in the final cast steel slab. The high-purity material of the SEN does not react with the inclusions in the steel to form these clusters. As a result, our customers’ yield of high-quality steel will increase.

In 2021, we commenced the roll-out of the scorecard across our product portfolio and assessed more than 90% of our revenue. Of our 2021 sales 16% were generated from market-leading sustainable products. Our objective is to continue growing their share of our product portfolio year after year.

Sustainability in new product development

Vesuvius invests significantly in new product development, working closely with our customers to offer optimised solutions for their specific needs. We have a unique combination of expertise covering a wide range of fields including metallurgy, refractory ceramics, robotics and mechatronics, and IT. This is combined with close contact with customers through our network of account managers and service teams, and through regular technical and R&D meetings with our key customers to drive innovation.



\* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

When designing new products, the Marketing and Technology teams in our six R&D centres of excellence listen to our customers, closely observing their processes to understand their current and future challenges, needs and expectations.

We combine this learning with the information we have collected from our analysis of past issues, and seek to achieve both incremental improvements and breakthrough innovations in safety, robustness, reliability and performance, to steer the development of next-generation products and services.

We have formally integrated sustainability considerations into product R&D. Using the same criteria and scorecard as we use in the assessment of the existing product portfolio, we have begun a complete assessment of the pipeline of R&D and new product development projects, to check that their contribution is aligned with our sustainability ambitions, adjust priorities and allocation of resources, and fine-tune the selection of new projects entering the pipeline.

R&D covers a wide range of activities ranging from fundamental research and front end innovation to the evaluation of alternative material sources and support to operations. In 2021, our R&D spend was £30.3m, of which c.£10.8m (36%) was dedicated to the development of products which outperformed existing marketed products in terms of sustainability outcomes. These constituted well over 80% of our New Product Development projects. Our objective is to reach 100% of such products in the development pipeline.

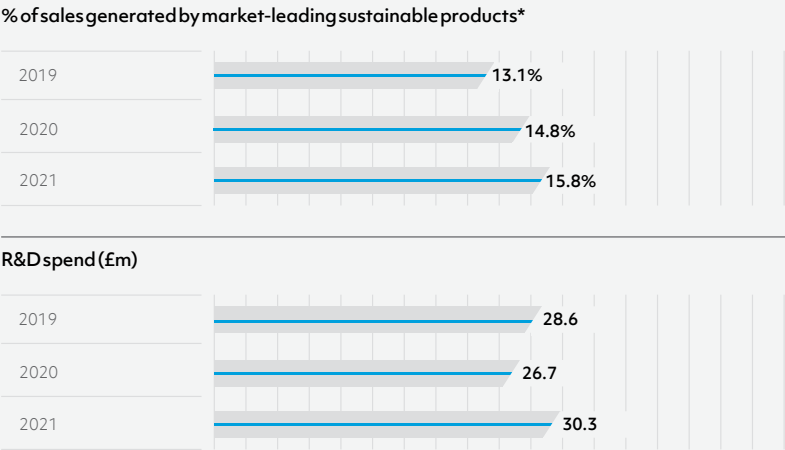
In 2022, we plan to launch 40 new products (2021: 27), of which 28 will allow customers to achieve superior sustainability performance (2021: 17).

The challenge of decarbonising iron making or aluminium smelting requires the development and industrialisation of radically new technologies. We complement our internal efforts with partnerships with over a dozen research institutions, universities and strategic customers, working to develop the refractory solutions that will support these novel processes.

Product sustainability benefits scorecard

Improves users’ comfort, health and safety	Safety in manufacturing and transportation
	Safety during usage
	Exposure to health hazards
Limits our impact on natural resources	Product weight
	Product lifetime
	Recycled materials
Minimises energy consumption and emissions	Cradle to grave greenhouse gas emissions
	Reduced and avoided CO <sub>2</sub> emissions for the customer
	Volatile compounds emissions
Reduces waste, avoids landfill and increases recycling	Waste generation during manufacturing and usage
	Recyclability after usage

Vesuvius’ investment in innovation and sustainability



\* Using Vesuvius’ internal scorecard.





Our people

The safety, diversity, personal growth and job satisfaction of our people are key to the success and growth of our business.

Health, safety and well-being at work



Our strategic ambition is to provide a safe working environment for all our people and to deliver value to them by providing development opportunities. This section details our performance and initiatives in both Health and Safety and Human Resources.

Safety is our top priority and our overriding commitment to health and safety is embedded throughout the organisation. Our approach is to identify, eliminate, reduce or control all workplace risks, and an ongoing system of training, assessment and improvement is in place to focus on achieving this. We remain fundamentally committed to protecting the health and safety of employees, contractors, visitors, customers and any other persons affected by our activities.

We want to become a zero-accident company and are striving to become a best-in-class organisation for safety performance and leadership.

Our principles

- 1 Good health and safety is good business
- 2 Safety is everybody's responsibility
- 3 Working safely is a condition of employment
- 4 All work-related injuries and work-related ill health are preventable

COVID-19

In 2021, the ongoing COVID-19 pandemic continued to affect Vesuvius in a wide variety of ways. In 2021 we lost 11 colleagues to this dreadful disease, and share the grief of the families and friends of those who passed away.

As many parts of the world were hit by third and fourth waves of infection, we continued to focus on protecting our employees whilst at the same time supporting our customers. Due to the outstanding efforts of our colleagues around the world we were able to maintain our operations and supplies during these difficult times.

With vaccines becoming widely available, we encouraged our colleagues to protect themselves and their families, whilst at the same time acknowledging that this is a matter of personal choice. In a number of countries, including India, Poland and South Africa, we were able to work with local health authorities to offer free vaccinations to our employees.

Safety leadership

Safety performance remains the priority item on the agenda at all our Group Executive Committee and management meetings, and safety performance is reported to the Board by the Chief Executive as a matter of priority at each Board meeting. In addition, as part of management reporting, the Board receives a detailed monthly update on all Lost Time Injuries (LTIs). The Group Executive Committee reviews all of the more serious incidents, including all LTIs, and the responses to these from local management. The Group remains fully committed to continuing safety improvement with a Group Health and Safety Policy stating a clear goal of:

- No Lost Time Injuries
- No repeat injuries
- No harm to our people or contractors

Health and safety governance

The Board has overall responsibility for health and safety-related matters and delegates authority for the management of the health and safety performance of the business to the Chief Executive. The Health and Safety Policy is signed by all members of the Group Executive Committee and the business unit Presidents are responsible for its deployment, with the support of the President of Operations.

The Board receives monthly information on every Lost Time Injury and key safety performance indicator. In addition, the Board carries out a biannual review of health and safety performance and overall Company safety strategy. Annual presentations of business unit strategy also include health and safety strategy. The results of our Group Safety Audits are presented to the Board twice per year.

Business accountability

The Group VP Sustainability, HSE & Quality is responsible for setting the Group's policies for health and safety and controlling their application.

The business units are responsible for the implementation of these policies and are directly accountable for the health and safety performance of their operations, with each business unit determining its own priorities and resource allocations, aligned with Group-wide targets on safety performance.

A majority of senior managers has a portion of their variable compensation tied to the achievement of safety performance targets.

Executive Safety Tours

This tone from the top is also demonstrated by the requirement for all senior managers, irrespective of discipline, to perform Executive Safety Tours, report on their findings to local operations management and follow up on improvement requirements. In this structure, all employees understand that they have a responsibility to take care of themselves and others whilst at work. Through this process, we expect everyone to participate positively in the task of preserving workplace health and safety. The tours encourage dialogue with staff, setting action points for discussion and implementation. In this way, these tours provide visible safety leadership on the shop floor in our sites and at our customer locations. Along with our daily safety audits, they are a central pillar of our Safety Breakthrough initiative.

In 2021, 80 Executive Safety Tours were carried out by members of the Group Executive Committee and their direct reports. This represented a decline from the 103 conducted in 2020, primarily because of continuing travel restrictions imposed by the COVID-19 pandemic.

Unfortunately, no Safety Tours were able to be conducted at customer locations in 2021. Whilst COVID-19 travel restrictions limited the number of Executive Safety Tours conducted in 2021, the number of Safety Tours conducted by middle management increased, assisted by the introduction of a mobile app to enhance the process.

Health and Safety governance



Review, assess and implement

Every business facility has an appointed health and safety manager, who works with management and all employees to review site health and safety, assess training needs and develop and implement site safety improvement plans. These local health and safety managers are assisted by central experts who not only identify adverse trends and respond to them, but also enable the sharing of best practice across Vesuvius.

We continue to work hard to reduce incident severity and generate actionable insights from the performance indicators we capture. The LTI frequency charts prepared monthly for each business unit and site, show where injuries have been reduced and where further effort is required, through a combination of a behaviour-based approach to safety and the implementation of physical safeguards. We focus on the safety of all personnel, whether they are employees, third-party contractors or visitors.

Based on the analysis of the kind of accident, type of injury and parts of the body affected, the businesses develop risk-based action plans that consider both the frequency and severity of incidents and track progress. Every site management team receives a monthly dashboard of health and safety-related performance indicators, covering both lagging and leading metrics.

Safety leadership

All site management teams must develop and implement site safety improvement plans, incorporating the identification and reduction of the site's main risks, compliance with the Group safety standards, deployment of shop floor safety leadership practices and resolution of issues highlighted during Group safety audits. Improvement plans are now in place for all production sites, with implementation being the direct responsibility of local managers.

Any site experiencing a severe incident, an LTI, a medically treated injury, or a serious dangerous occurrence is required to investigate the incident. Vesuvius' investigation procedures are based on the 8D practical problem-solving tool, which aims to identify the true root causes of incidents to prevent a repeat. Results are formally presented to management, with details of the 8D-based root causes. The site then incorporates the findings into their site safety improvement plans and shares their incident investigation so that improvement actions can be cascaded throughout the organisation.

Our employees are highly supportive of the Group's efforts to improve workplace safety and acknowledge how seriously we take this issue. In the 2021 I-Engage employee engagement survey, 83% agreed that the Company will address safety concerns if they are raised.

Health, safety and well-being at work

Health and Safety Policy and Standards

All employees are required to adhere to the Group’s Health and Safety Policy and Alcohol and Drug Policy. Copies of the policies are translated into local languages and displayed prominently in all locations. The Health and Safety Policy is supported with standards, procedures and ISO certifications, which are reviewed and updated on an ongoing basis. The findings and lessons learned from incident investigations are incorporated into updates to prevent any recurrence and new or improved standards are issued for implementation across the Group.

Group Safety Standards

Over the years, Vesuvius has developed a set of 28 Safety Policies and Standards. These are regularly reviewed and updated, based on the best practices implemented in sites and learnings from incidents in particular. The Group Safety Audit checklist is designed to cover the essential points of the Group Safety Policies and Standards.

Vesuvius also maintains a working hours policy and monthly reporting of headcount and hours worked. This allows us to identify if maximum working hours are being exceeded which can then be investigated by management.

Health and Safety Standards

Accident & Incident Reporting	Reviewed 2021
5S Colour Standard	Issued 2021
Business Continuity	
Control of Contractors	
Customer Location	Reviewed 2021
Crisis Management & Crisis Communication	
Drug and Alcohol	
Ergonomics	
Executive Safety Tour	
Gas Safety	
High-Risk Activities	
Inspection, Maintenance and Testing of Fixed Electrical Installations	
Isolated and Lone Working	
Isostatic Presses	
Legionella	Reviewed 2021
Lifting and Handling	
Lock, Tag and Try	
Machine Safety	
Overtime Policy	
Permit to Work	
Personal Protective Equipment	Reviewed 2021
Process Safety	
On Site Vehicle operations	
Road Safety	
Risk Assessment	
Safe Storage of Bulk Bags and Pallets of 25kg Bags	
Warehousing Racking	
Working Safely with Fibres	

Pillars of health and safety

Risk assessments

We routinely carry out risk assessments to identify and rate hazards and implement protective measures to minimise exposure.

These include:

- Engineering solutions to eliminate or minimise risks
- Procedural measures, such as training and auditing
- Work instructions, written with the involvement of the employees who carry out the tasks, with illustrations and in local languages
- Providing personal protective equipment to employees free of charge

Training employees to work safely

Our proprietary TurboS training pulls together all of our safety management practices. Using a train-the-trainer approach, TurboS training sessions are tailored to the audience and their activities. For example, there is a special training course developed for employees at customer locations that focuses on the specific risks faced by these individuals. We conduct Permit to Work training in all Group facilities, including customer locations, which ensures that all non-standard work conducted in our facilities, whether by our employees or contractors, is the subject of a pre-commencement risk assessment and a formal permission to commence the activity, with the safety requirements set out. We have developed machinery safety training with an outside industry leader, Pilz GmbH & Co, a company specialising in safe automation technology. Recognised best practices are extended throughout the Group through a series of machinery assessments and training programmes, with each site identifying and addressing the top five issues by severity as a matter of priority.

TurboS is a part of the Group’s Safety Breakthrough initiative, which was instigated in 2008. It includes a strong focus on the standardisation of all of our repetitive activities. TurboS also integrates good management practices in the workplace, with a strong emphasis on developing an organisation that enables everybody to work to the same high standards in safety performance.

As part of the continuing TurboS initiative:

- Senior executives regularly lead safety tours at all locations
- Severe accidents are formally reviewed by the Group Executive Committee
- Employees are routinely engaged in safety audits
- Employees receive regular communication (toolbox talks at the beginning of each shift, ‘town hall’ meetings, safety briefings after LTIs)
- We invest significantly in safety training for all employees, irrespective of their role and function within our business
- All employees are expected to routinely raise and implement safety improvement opportunities; we focus on the number of implemented ideas
- Safety standards are continually updated, translated and deployed throughout the Group
- All injuries and dangerous occurrences are analysed locally, with a formal presentation of findings, root causes and improvement actions cascaded through management

Working in tidy plants – 5S

The continuing use of 5S, the workplace organisation method, throughout the Group has driven significant improvements in our workplace environment. Employees are encouraged to develop ownership of their working areas and take pride in their cleanliness and organisation. The added support of our lean specialists has been key to improving plant safety by removing hazards for employees and offering a clean, bright and safe working environment. Regular 5S audits led by team leaders ensure continuous improvement of working conditions and promote a safer workplace.

Take 2

Our Take 2 initiative ensures that employees think again before performing any unusual or non-standard activity. Simply stated, the employees take two minutes to discuss the task, any hazards and how to prevent accidents before any work is started. This process allows the team to consider and reflect on hazards and the controls required before work commences.

Contractor management

Contractor management is a particularly important area of attention, as it involves employees of third-party companies working on our premises to perform various types of project work. Vesuvius has defined strict rules which are outlined in the Control of Contractors standard. These rules include a pre-screening for safety performance and risks before a contract is signed, a commitment to respecting the same safety standards as Vesuvius employees and a safety induction for all contractor employees on Vesuvius sites. All activities subject to a Permit to Work are audited on a daily basis.

Contractor safety management and performance is monitored. Safety performance targets for contractors are set at the same level as for Vesuvius employees.

Investing in technology for safety

Safety can be improved through the evolution of procedures and better behaviours, but technology offers new opportunities to continue to make our workplaces safer. Vesuvius is therefore investing in a range of technologies with the goal to automate strenuous or dangerous tasks and improve ergonomics. We are also exploring a range of new technologies including exoskeletons, wearable sensors and autonomous guided vehicles.

In 2021, we tested the Brightmile mobile phone driver safe behaviour app. We carried out pilot projects in four countries recognised for the high level of road traffic fatalities and with a large number of Vesuvius employees (Brazil, India, Mexico and South Africa).

Monitoring work conditions and employee health

Vesuvius has developed and implemented a variety of programmes to ensure that we provide our employees with work conditions that are not detrimental to their health. These include the routine monitoring of noise, dust levels, and volatile organic compounds emissions.

Routine health check-ups are also required for employees in positions that could present certain specific risks (e.g. forklift drivers).





Health, safety and well-being at work continued

8 Core Safety Rules



1. I always wear mandated personal protective equipment



2. I only operate equipment or vehicles if trained and authorised



3. I do not remove, bypass or tamper with machine guarding and safety devices



4. I lock, tag and try before any intervention on a machine



5. I make sure all high-risk activities are covered by a daily Permit to Work



6. I always ensure my fall protection is secure before working at height



7. Before entering a confined space, I check I will be able to breathe and escape



8. I only perform electrical work if certified and authorised

Core Safety Rules

In 2019, we launched the Vesuvius 8 Core Safety Rules that outline our colleagues’ basic safety responsibilities. These were rolled out across the organisation as the mandated practices for employee and manager conduct. In conjunction with this, the Group has implemented procedures to ensure the rules are followed. The rules were incorporated into the contractual terms of all employees, and all employees are expected to report breaches and violations of the rules, with appropriate sanctions imposed whenever required. Failure to do so is a disciplinary issue.

Customer Location Standard

In line with our safety priority, we have spent decades improving systems, processes and technology at our sites to protect our people at work. We also apply the same safety standards for our teams working at customer locations.

Our Customer Location Standard addresses the specific risks faced by our employees whilst operating in customer locations and applies to approximately 2,500 Vesuvius employees worldwide. The standard focuses on structuring cooperation between our customers’ management teams and our own to ensure health and safety issues are jointly identified and addressed.

For new contracts in customer locations, we use a formal risk assessment which aims to identify significant risks to our employees and contractors. This enables appropriate control measures to be agreed and implemented with the support of our customers in advance of work commencing. These are then formally included in the contractual conditions we impose when working at a customer site.

Process Safety initiative

In 2020, Vesuvius launched a new Process Safety initiative, starting with an analysis of the high-risk processes in the Company, the elaboration of a global process safety framework and a first technical standard covering high-pressure isostatic presses.

In 2021, we developed our second process safety standard, covering dust and explosive powders.

The deployment plans for these standards include training, the development of a centralised database and the implementation of a routine reporting process.

Safety training

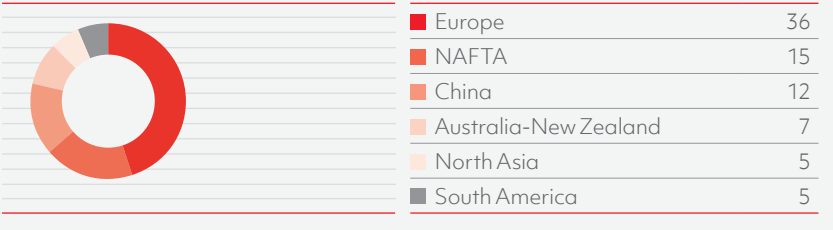
We regard the understanding and application of the Group Safety Standards by management and all employees as essential to ensure their proper implementation on the shop floor and ongoing adherence. We therefore expect our managers to carry out compliance self-assessments for their sites based on the Group Safety Audit checklist and invest in the training of employees on the HSE standards. In 2021, we delivered more than 169,000 hours of training on safety standards and safety leadership (TurboS), to our employees in Manufacturing, R&D, and Customer Locations representing on average, more than 15 hours per person.

In addition to the training on Group Safety Standards and TurboS, business units and sites develop and offer programmes addressing the specific processes and risks. Communication and training on hand safety and ergonomic practices have been major areas of recent focus.

Training activities routinely undertaken for our employees and contractors include:

Arc Flash Hazard
Bike Safety
Control of Contractors
Crane Operation
Defensive Driving
Electrical Testing
Environmental Waste Reporting
Ergonomics
Executive Safety Tour Leader
Exoskeleton
Fire Fighting
First Aid
Forklift Truck
Gas Safety
General Health & Safety and refresher training
Hand Hazard and Protection
Hazard Perception
Hazardous Goods
Health and Safety Representatives
ISO 45001:2018
Legionella
Lock, Tag and Try
Incident and Performance reporting
Machine Safety
Permit to Work
PPE Safety
Practical Safety in Steel Customers
Radiation
Road Safety
Safe Stacking
Safety and Environmental Auditing
Steel Mill Orientation
TurboS Safety and Safety Leadership
Warehouse Material Stacking and Handling
Welding Certification
Working at Height

Unique Executive Safety Tours 2021



Health and safety auditing

Groupsafety audits

The Group operates a central safety auditing team of three auditors, each with more than 10 years’ experience, who report to the VP Sustainability, HSE & Quality. The team’s main purpose is to verify the deployment and ongoing application of the Group’s standards and policies in our locations, including our manufacturing sites, R&D facilities and the customer locations in which a significant number of our employees operate daily. Each audit also includes an assessment of the site’s HSE leadership.

Following each audit, action plans are created by the site management teams to address any issues identified and work on completing these is assessed on a regular basis. The observations made during audits have been used to improve the Group’s training programmes and to enhance the Group’s health and safety standards. The results of the Group HSE audits, as well as the progress of action plans addressing the most critical issues, are reported to the Board twice a year.

During 2021, the team conducted 22 audits, visiting manufacturing locations, R&D centres of excellence and customer locations with 40 employees or more, as part of a programme of systematic audits of all Group locations worldwide.

Travel restrictions due to the COVID-19 crisis prevented the team from completing the full 2021 audit plan of inspection visits. Instead, the remote assessment programme developed in 2020 was used to reach sites that could not be physically audited. These assessments were carried out via videoconferences, during which the site management team presented the progress made in the implementation of Group safety standards, and improvement plans for the coming months. In 2021, we carried out 138 remote assessments.

Sites are encouraged to carry out self-assessments, based on the Group safety audit compliance checklist, to monitor their progress.

Safety audits and improvement opportunities

In our plants in 2021, more than 78% of our working population performed routine safety audits every month. This generated an average of more than seven implemented safety improvement opportunities per person from almost 10,000 employees, resulting in an improvement in worker safety. This audit programme involves employees at all levels – from the Group Executive Committee and safety specialists through to local site management, employees and directly supervised contractors.

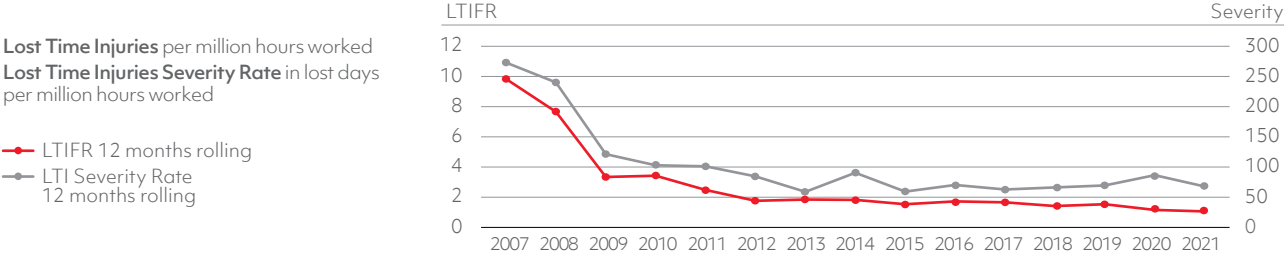
Health and safety certifications

We have five manufacturing sites (representing 9% of our manufacturing sites), one warehouse and three Vesuvius operations in customers certified to ISO 45001:2018. Vesuvius sites choose to certify based on local regulatory and customer requirements. A list of certified sites is available to view on our website: [www.vesuvius.com](http://www.vesuvius.com).



Health, safety and well-being at work continued

Safety performance in 2021



Safety performance 5-year table with main performance indicators

Performance indicators	All employees, contractors and visitors				
	2021	2020	2019	2018	2017
Work Related Death	0	0	0	1	0
Severe Injuries	3	4	0	2	1
Lost Time Injuries (LTI)	29	28	40	39	46
LTI Frequency Rate (LTIFR) per million hours	1.06	1.16	1.54	1.42	1.66
Recordable Injuries	123	126	144	125	147
RFR per million hours	4.51	5.20	5.53	4.54	5.31
Medically Treated Injuries (MTI)	201	164	198	202	214
MTIFR per million hours	7.38	6.77	7.60	7.34	7.73
Total Number of Injuries	627	419	520	492	563
Injury FR per million hours	23.01	17.31	19.96	17.87	20.33
LTI Lost Days	1,851	2,094	1,811	1,824	1,738
LTI Severity Frequency Rate (Lost Days) per million hours	68	86	70	66	63
Dangerous Occurrences (DO)	1,180	779	736	649	409
DOFR	43.30	32.18	28.25	23.57	14.77
Safety Audits Number	108,895	95,290	113,428	121,117	120,266
Safety Audits per 20 Employees per month	14	14	16	16	15
Employees Participating in monthly Safety Audits	9,994	8,559	8,804	9,973	10,086
Employees Participating in monthly Safety Audits %	78%	73%	75%	80%	77%
Safety Improvement Opportunities with a Permanent Action (SIOPA)	95,322	81,075	92,038	92,778	91,725
Other Improvement Opportunities with a Permanent Action (IOPA)	27,235	29,236	30,611	36,436	34,663
IOPA Total	122,557	110,311	122,649	129,214	126,388
SIOPA per Employee	7	7	8	7	7
Other IOPA per Employee	2	2	3	3	3
IOPA Total per Employee	10	9	10	10	10
Hours Worked (thousands)	27,254	24,211	26,053	27,533	27,688

All frequency rates (FR) are per million hours worked.  
Excludes Universal acquisition.  
There were two minor injuries involving third-party truck drivers on Vesuvius' operations in 2017, with none in 2018 to 2021.  
Average third-party contractors and visitors in 2021: 414.

Safety performance in 2021 is detailed below:

Performance indicators	Employees and directly supervised contractors 2021	Third-party contractors and visitors 2021	All employees, contractors and visitors 2021
Work Related Death	0	0	0
Severe Injuries	3	0	3
Lost Time Injuries (LTI)	26	3	29
LTI Frequency Rate (LTIFR) per million hours	0.99	2.94	1.06
Recordable Injuries	117	6	123
Recordable FR per million hours	4.46	5.89	4.51
Medically Treated Injuries (MTI)	195	6	201
MTIFR per million hours	7.43	5.89	7.38
Total Number of Injuries	618	9	627
Injury FR per million hours	23.56	8.83	23.01
LTI Lost Days	1,851	0	1,851
LTI Severity FR (Lost Days) per million hours	71	0	68
Dangerous Occurrences (DO)	1,177	3	1,180
DOFR	44.86	2.94	43.30
Safety Audits Number	108,895	n/a	108,895
Safety Audits per 20 Employees per month	14	n/a	14
Employees Participating in monthly Safety Audits	9,994	n/a	9,994
Employees Participating in monthly Safety Audits %	78%	n/a	78%
Safety Improvement Opportunities with Permanent Action (SIOPA)	95,322	n/a	95,322
Other Improvement Opportunities with Permanent Action (IOPA)	27,235	n/a	27,235
IOPA Total	122,557	n/a	122,557
SIOPA per Employee	7	n/a	7
Other IOPA per Employee	2	n/a	2
IOPA Total per Employee	10	n/a	10
Hours Worked (thousands)	26,235	1,019	27,254

2021 safety performance

With the aim of becoming 'best in class', the Group has re-energised its safety agenda to further enhance efforts to achieve its safety goals.

With a Lost Time Injury Frequency Rate (LTIFR) of 1.06 per million hours worked in 2021, we recorded our lowest frequency rate ever. Excluding third-party contractors the LTIFR was less than 1.0.

Fatalities and severe injuries

Sadly, in 2021, two of our colleagues were killed in road traffic accidents while commuting to work. Vesuvius is providing financial and social support to their families and has actively taken steps to reduce commuting related risks. Regrettably, two of our colleagues and a contractor also suffered severe injuries: deep hand lacerations requiring hospitalisation in Australia, an eye injury while changing a bit on a pneumatic tool

in China, and a foot amputation after being run over by a customer engine in a customer location in Vietnam. Following full root cause analyses, robust preventative measures were implemented across Vesuvius with changes made to our HSE standards to reduce the risk of recurrences.

Lost time and medically treated injuries

Vesuvius operates a robust and comprehensive process for the timely reporting of incidents. In our internal standards, third-party contractors are included, and we use more stringent definitions for Lost Time Injuries (LTIs) and 'severe accidents' than the definitions used by many regulatory bodies. All sites are required to report on all Medically Treated Injuries (MTIs), broader than recordables, to maintain the focus on safety. As an illustration of the precautionary preventative approach

taken by Vesuvius in accident investigation, all LTIs and MTIs required a full 8D report.

In 2021, 29 LTIs were reported which resulted in 1,851 lost days giving the LTI frequency rate for the year of 1.06 per million hours. This was a significant improvement versus the 1.16 recorded in 2020. 201 MTIs were reported in 2021 (versus 164 in 2020) out of a total of 627 injuries reported (versus 419 in 2020), resulting in an MTI frequency rate of 7.38, (versus 6.77 in 2020). Whilst both 2021 and 2020 were unusual years because of the COVID-19 pandemic and associated changes in working, we believe that the significant improvements in Lost Time Injury rates reflect a broader trend of underlying improvement for the Group and result from a strong management commitment to change.





Health, safety and well-being at work continued

Maintypesofwork-relatedinjury

In 2021, the main causes of work-related injuries were, in descending order of frequency: handling, lifting or carrying; being struck by moving objects; striking against something fixed or stationary; and slips, trips and falls. The main injuries suffered were contusions, lacerations, sprains and strains, fractures and abrasions to the eye. The main body parts affected were hands, wrists and fingers, backs, feet, knees and eyes. Based on this incident data, targeted campaigns are launched by the business units.

DangerousOccurrences

Vesuvius Dangerous Occurrences include all non-lost time and non-medically treated injury incidents and incidents with and without actual damage whether work related or not). There was renewed emphasis on the reporting of dangerous occurrences and injuries in 2021 so that root cause analysis could be undertaken, and preventative action plans implemented to prevent future occurrences. Consequently, there was an increase in the number of Dangerous Occurrences reported in 2021 to 1,180 (2020: 779). Out of the Dangerous Occurrences occurring in 2021, the more serious 27% that could have resulted in a severe accident also required a full 8D report, the remainder being dealt with via line PPS (Practical Problem Solving).

Safetyawardsandrecognition

In addition to our efforts to keep our employees and contractors safe, we take pride in sharing our safety management practices with our customers. We are very proud of the external recognition received by our teams for their safety leadership and achievements. Some of the awards received in 2021 included:

Awards

WRA Safety awards

The Pune plant and JSW Vijaynagar customer location, both located in India, received safety awards from the World Refractories Association and more than 50 Vesuvius locations (manufacturing sites and customer locations) received safety certificates.

ERPA Safety award

The Hengelo plant in the Netherlands received a safety award from the European Refractories Producers Association.

TATA 4-star ratings

Vesuvius teams in three TATA Steel locations in Thailand achieved a 4-star rating recognising their excellence in contractor safety.

Ternium Safe Supplier

Vesuvius was recognised as a ‘Safe Supplier’ by Ternium in Mexico and received a Safety Award in Brazil.

Usiminas Safety innovation award

We received the highest safety award granted by Usiminas in the innovation category for reducing the exposure of people to hot metal.

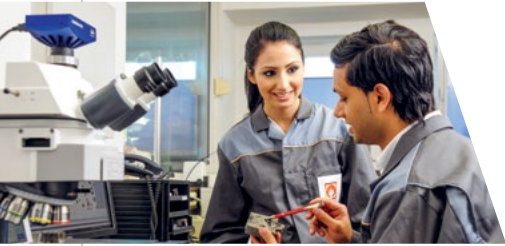
Shougang Jingtang Iron & Steel Outstanding Supplier

Shougang Jingtang Iron & Steel recognised Vesuvius as an outstanding supplier.

Vesuvius Safety Awards

Vesuvius has also created internal Safety Awards, to recognise its best performing locations. In 2021, we distributed Safety Awards to 11 regions, as recognition of their outstanding performance in the previous year. These regions each completed 2020 without recording a Lost Time Injury, recorded a participation of more than 80% of employees in monthly Safety Audits and implemented more than ten improvement opportunities per person per year.

People and Culture Strategy



In 2021, the implementation of our People and Culture Strategy which we launched in 2020 continued. This aims to build an outstanding business by ensuring we have the people, skills and capabilities critical to the delivery of our strategy.

We aim to grow outstanding people: we ensure our people managers have what they need to lead their diverse, engaged and high-performing teams for business and personal growth. These goals are strongly underpinned by a values-driven, winning culture that embraces diversity of thinking and continuous innovation to achieve high levels of performance and growth.

We create this culture by building broad organisational understanding of our strategy, goals and accountability, supported by our CORE Values and positive management behaviours. We seek to foster a working environment that is inclusive and diverse, where people can be themselves without fear of harassment, bullying or discrimination. True to our decentralised business model, each of our business units has their own strategic HR agenda supporting delivery of their business strategies.

As a result of ongoing COVID-19 challenges in 2021, we continued to adapt our working practices to ensure the safety and well-being of all our employees. In addition, our recruitment and talent sourcing strategy was adjusted to accommodate working remotely.

Currently 422 employees participate in the global Annual Incentive Plan (AIP). Eligibility for participation is based on job grade and is subject to approval by

the Chief HR Officer. The AIP structure is based 80% on Company performance and 20% on performance against employees’ personal objectives. In addition, 209 of these employees participate in various forms of share-based incentives.

Another 57% of our permanent employees worldwide, both salaried and hourly, participate in various local incentive schemes. The BU Presidents and Regional VPs are responsible for the target setting and the pay-out approval of these local plans.

Non-compensation benefits including pension and retirement benefits are managed locally in accordance with local laws.

Employeeengagement

Companies with highly engaged staff deliver better business outcomes. They have lower absenteeism, lower staff turnover, fewer safety incidents, better product quality, and higher productivity, sales and profitability.

At Vesuvius, we regard engagement as critical to our ongoing success and we work hard to listen to our people and act when issues impacting engagement are identified.

Engagement is a collective responsibility, particularly among our management community. We conduct an annual employee engagement survey to measure our employees’ attitudes to Vesuvius and their work. The survey generates reports of team responses to the survey. Managers then share the results openly with their teams and, working together, develop Action Plans to address issues.

The survey has been conducted since 2019 in partnership with Mercer. The results are clustered in eight strategic categories and benchmarked externally against global and manufacturing industry results.

Permanentemployee turnover per region				
Region	2021 turnover (%)	2021 voluntary turnover (%)	2020 turnover (%)	2020 voluntary turnover (%)
Americas	20%	10%	18%	6%
Asia-Pacific	16%	14%	12%	10%
EMEA	12%	9%	14%	6%
Total	16%	11%	14%	7%

Distribution of Vesuvius employees by category				
	2021	2021 (%)	2020	2020 (%)
Direct employees	10,657	96%	10,016	97%
Agency employees	419	4%	338	3%
Total	11,076	100%	10,354	100%

1. Employee numbers exclude employees joining Vesuvius as a result of the acquisition of the Universal Refractories business.
2. In addition to the headcount above, Vesuvius employed the services of 191 contractors and consultants in 2020 and 134 in 2021, to work on specific short-term projects.

Distribution of Vesuvius employees – full-time versus part-time								
	2021 Full-time employees	2021 Full-time employees (%)	2021 Part-time employees	2021 Part-time employees (%)	2020 Full-time employees	2020 Full-time employees (%)	2020 Part-time employees	2020 Part-time employees (%)
Permanent salaried	4,086	99.0%	43	1.0%	3,905	98.7%	53	1.3%
Permanent hourly	5,878	99.9%	6	0.1%	5,647	99.9%	7	0.1%
Temporary salaried	90	98.9%	1	1.1%	64	97.0%	2	3.0%
Temporary hourly	966	99.4%	6	0.6%	674	99.7%	2	0.3%
Total	11,020	99.5%	56	0.5%	10,290	99.4%	64	0.6%

Note: Employee numbers exclude employees joining Vesuvius as a result of the acquisition of the Universal Refractories business.



People and Culture Strategy continued

Employee engagement action plans

We focus action plans not on the pure statistics, but on seeking to bring about meaningful change in line with our CORE Values of Courage, Ownership, Respect and Energy. For example, much of the action taken to date has resulted in improved communications between managers and their teams and on greater cross-functional understanding and collaboration, all of which are key to the principles of our CORE Values.

In 2021, despite the ongoing challenges caused by the COVID-19 pandemic, and thanks to a tremendous effort by local management, supported by an effective communication campaign, we again achieved a very high participation level in our engagement survey with 92% of all employees completing it, the same level of participation as we achieved in 2020.

Following improvements across all survey categories in 2020, the overall engagement score remained stable, with further improvement across six of the eight categories of questions and no change in the remaining two categories.

For the third consecutive year, safety remained our top strength with employees confident in the Company's approach to safety. Other highlights included positive attitudes towards immediate managers and employees feeling that they are treated with respect.

While there was an increase in the belief that action plans from the 2020 survey had a positive impact, it continues to remain an area for improvement.

Living The Values Awards 2021

Our CORE Values are central to the culture we are building at Vesuvius. By living these values, we will create a truly entrepreneurial culture that focuses on the needs of our customers. One of the ways we encourage and recognise colleagues who display our values is our annual regional and global Living The Values Awards.

Winners of each of the categories of these Awards were nominated for the Global Awards, the results of which were announced at a special online ceremony in December 2021. Chief Executive Patrick André paid tribute to all finalists, noting that they each provide a remarkable example of what can be achieved by being true to the CORE Values.

People and strategy



Global Living The Values Awards winner:

Courage

**Audrey Pradhita**  
Commercial Sales Engineer, Advanced Refractories, Pelabuhan Klang, Indonesia



Audrey works in Advanced Refractories sales in South East Asia. Her hard work and commitment to finding better ways of working has enabled her to deliver huge increases in sales volumes and earned her the respect of everyone she works with.

Global Living The Values Awards winner:

Ownership

**Darla Coulter**  
Master Data Manager, Central Operations, Champaign



In the highly diversified Vesuvius environment, Darla demonstrated real ownership in successfully establishing the global Master Data Management practice. She showed unbelievable drive to deliver something she considers essential for Vesuvius' success.

Global Living The Values Awards winner:

Respect

**Jhuma Chowdhury**  
Assistant HR Manager, Flow Control, Kolkata



As part of her role, Jhuma manages the administration of Vesuvius India's travel requirements, both domestic and international. Jhuma treats everyone's needs with the utmost importance, acting with universal dedication and seriousness. Jhuma is a credit to our Company.

Global Living The Values Awards winner:

Energy

**Balla Murugesh**  
Assistant Manager – Mechatronics, Advanced Refractories, Kolkata



After supporting the first ever Tundish Spray Robot installation in the region, Balla was asked to support a second installation in Vietnam. Balla lived in one room of a closed hotel near the steel plant for five months relying on the help and cooperation of the local Vesuvius team for food and travel. The commissioning was successful and Balla finally returned home to India at the end of September 2021.

Internal communications

In 2021, we continued to develop our internal communications programme, to ensure we have a strong mix of channels to reach our diverse population. The Chief Executive regularly addresses the whole Group via Company-wide email and video and strategic messages, and Company news and announcements are regularly shared on the Group intranet and staff app. 2021 saw an active use of screen savers to communicate major news, and we continued to utilise posters and site 'town hall' meetings for on-site communications. Whenever possible, face-to-face communication is conducted at different levels of the organisation providing the necessary opportunities for interactive Q&A sessions with business leaders.

During 2021, the Group Executive Committee held 14 interactive virtual sessions with the Senior Leadership Group to share regular business updates and answer questions. We also held our annual leadership conference, SPARK. With COVID-19 travel restrictions still in place in some countries, the 2021 SPARK was a hybrid event, with close to 100 colleagues attending in person and 60 colleagues attending online.

Growth opportunities with training and career progression

Talent management

The Group Executive Committee holds direct responsibility for the roles and development of our senior leaders, jointly reviewing capability needs and deciding on succession and cross-organisational moves for the leadership group. This illustrates the strong commitment at the highest level of our organisation towards growing the Group using its Company-wide resources.

We employ individuals with an entrepreneurial mindset and an international outlook. Whether they are recent graduates or seasoned professionals, everybody who wants to leave their mark in a dynamic rapidly developing business environment has a chance to succeed. Special attention is paid to building strong, diverse teams that bring different backgrounds and experiences to our daily work.

Leadership pipeline

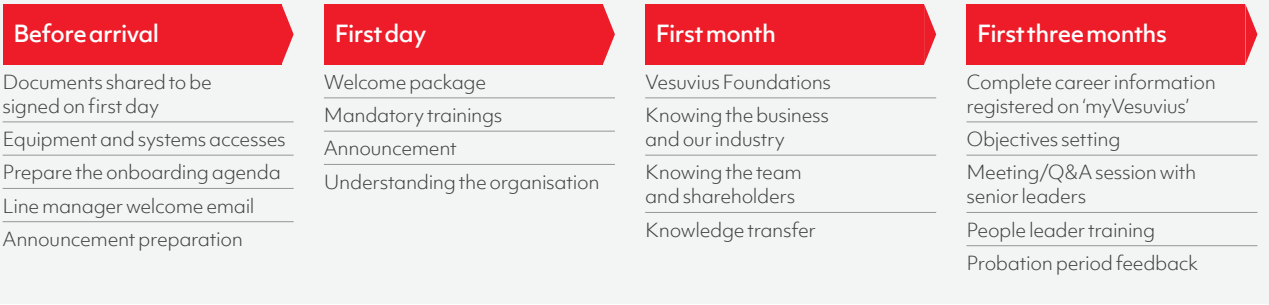
Strengthening the leadership pipeline and facilitating people development throughout the organisation remain key areas of focus for Vesuvius. We continue to work hard to ensure that we have the right capability in every part of the organisation to drive our strategy and realise market opportunities. As a result, we have built high-calibre leadership teams, many of whom are relatively new to their roles and to Vesuvius. We empower our people to drive the business with an entrepreneurial spirit, and to develop a performance-oriented culture.

In 2021, Vesuvius expanded its mentoring programme focused on leadership and talent development. There are currently 50 mentees taking part in the 12-month programme. Mentees learn from the experience and perspectives of a more senior person in Vesuvius, creating an individual personal development plan to enhance their careers and leadership capabilities. The programme ensures internal knowledge transfer and builds a broader, deeper and more ready talent pool.

We aim to adopt an ideal balance between external hires and internal promotion, fuelled by a strong process of backup and succession planning, especially for management positions. In 2021, for middle management and Top Management roles, 72% of open positions were filled by external candidates, reflecting a period of transformation and capability building from external hires. In 2021, the percentage of Senior Management (comprising the key leadership roles reporting directly to members of the Group Executive Committee) with more than three years of service was 42%.

In 2021, Vesuvius launched a new global onboarding framework, in order to provide maximum support to new joiners in their first three months with the Company. The new material includes a comprehensive presentation about our business, our history, CORE Values and main processes and procedures, together with technical training on Vesuvius' products for all roles. It is designed to be adapted to each employee, depending on the responsibilities of the role and level in the organisation. It supports the employee in four main steps of the onboarding phase: before arrival, first day, first month and first three months.

Vesuvius onboarding framework







People and Culture Strategy continued

Mandatory online training courses	Number of employees trained	% of targeted audience completing course	Total training hours
Anti-Bribery and Corruption	4,388	100%	2,194
Gifts, Hospitality and Entertainment	929	98%	465
Modern Slavery	61	100%	20
Anti-Tax Evasion	749	100%	375
Data Protection	4,466	99%	2,233
Cyber Security	5,109	74% <sup>1</sup>	5,962

1. Cyber security awareness training consists of five modules. 74% of employees have already successfully completed all five modules.

Training and development

Our leaders take responsibility for managing and developing their teams. They are provided with access to a central resource, offering expertise in Global Rewards and Mobility, Talent and Performance Management, Culture and Learning, and supported by Group-wide processes and information systems.

We encourage and reward high performance, foster talent and aim to create an environment where all can realise their individual potential. To meet the demands of the business and add rigour to our employee value proposition, we have launched training programmes to assist our employees to develop their skills and progress their careers.

In 2021, the main training focus areas included health and safety, compliance, technical skills, and commercial excellence. Some of the key initiatives are highlighted below.

In Q4 2021, we implemented a new Learning Management System (LMS) on 'myVesuvius', our online people management platform, in order to provide a global hub for Vesuvius online training courses. Mandatory training courses are automatically assigned to new joiners and completion statistics are easily reportable. Targeted training courses can also be allocated to employees in specific roles, e.g. Modern Slavery training for specific people in purchasing. Compliance, Data Protection and Cyber Security training are all accessible via the LMS.

During the course of our activities, we may collect, store and process personal data about our staff, customers, suppliers and other third parties and our Data Protection Policy recognises our commitment to treating this data in an appropriate and compliant manner. Specific data protection training through e-learning is a mandatory training course for all

employees with email access. At the end of 2021, the completion rate was 99%. It is regularly audited for non-completion.

In 2021, further training was undertaken relating to the Brazilian General Data Protection Law and the Data Security Law in China which came into force on 1 September 2021. Vesuvius continues to develop information technology and the use of apps, internet and other sites, in particular relating to marketing. Specific e-marketing training was prepared and delivered to business unit marketing teams in 2021.

Technical training

HeaTt training is aimed at the continuous technical development of Vesuvius employees. Courses range from entry to expert levels and are continuously updated to keep pace with developing technology and delivery methods, thereby guaranteeing that Vesuvius experts are at the forefront of technical innovation. They are a great way for our hugely experienced technical experts to pass on their knowledge to the next generation and ensure the sustainability of our know-how. The first introductory module is mandatory for all new employees and is available on the LMS, allowing participants to access learning at anytime, anywhere.

Expert levels of HeaTt training are still held face-to-face, as the course content is not suitable for web-based training. In 2021, 695 employees completed the first module online and 45 employees completed face-to-face HeaTt training sessions.

In addition, in 2021 Vesuvius launched a Commercial Excellence transformation programme, known as 'ComPro', for account managers in our steel business units, addressing specific skills gaps. 222 employees have completed the nine-month programme, which is a mix

of theory, e-learning, workshops, coaching and on-job application to ensure new habits are embedded and commercial capability strengthened.

During the year, we continued to develop our training programme on the principles contained in the Vesuvius Code of Conduct and associated anti-bribery, corruption and other compliance policies and procedures. Training gives our employees a clearer understanding of the scope of risks that exist as we conduct our business and gives context to how the Group expects each employee to respond to those risks.

Compliance training provided during 2021 included:

- An annual mandatory e-learning module for Anti-Bribery and Corruption, available in 22 of our functional languages.
- Webinar and videoconference training hosted by the Compliance team to staff at several sites covering Anti-Bribery and Corruption, Speak Up and trade sanctions.
- Updated face-to-face training for senior management on the overall compliance framework and process for policy and procedure implementation and monitoring.
- New Senior Manager compliance induction training – all new senior leaders receive dedicated training from the Compliance Director. This induction contains training and guidance on all relevant Compliance policies and procedures.

The Board has set a target of at least 90% of targeted staff completing the Anti-Bribery and Corruption training annually. 100% of the targeted staff (4,388 employees) completed the 2021 Anti-Bribery and Corruption training.

Workforce by gender<sup>1</sup>

As at 31 December 2021	Women	Men	Women	Men
Board	3	5	38%	62%
Group Executive Committee	2	6	25%	75%
Senior Management <sup>2</sup>	10	39	20%	80%
Middle Managers	63	427	13%	87%
All other employees	1,540	8,989	15%	85%
All employees	1,615	9,461	15%	85%

1. Employee numbers exclude employees joining Vesuvius as a result of the acquisition of the Universal Refractories business.  
2. Senior Management comprises key leadership roles reporting directly to members of the Group Executive Committee.

	Women	Men	Women	Men
Americas	517	2,721	16%	84%
Asia-Pacific	324	3,161	9%	91%
EMEA	774	3,579	18%	82%
Total	1,615	9,461	15%	85%

Diversity and inclusion

Vesuvius operates in 40 countries around the world, employing people with 69 nationalities, making us a truly diverse business. We regard this diversity as a critical aspect of our success and future growth as it allows us to access the widest range of skills and experience. At the end of 2021, the Senior Leadership team (comprising c.160 senior managers) consisted of 21 nationalities located in 22 countries. 15% of our overall workforce were women, which was an increase of 1% versus 2020. Over the past three years we have made visible progress in gender diversity. Females now represent 21% in our top management (members of the GEC and their Senior Management direct reports), a level that we consider is still too low, but which represents a significant improvement as compared with the level of 12.5% in 2019. Our ambition remains to reach 30% women in this tier by the end of 2025.

Copies of the Board Diversity Policy and Group Policy on Diversity and Equality are available to view on the Vesuvius website: [www.vesuvius.com](http://www.vesuvius.com).

Employee consultation and industrial relations

In all of the countries in which we operate, the Group informs and consults local works councils and trade unions in matters concerning the Vesuvius business as required. These processes and procedures are regulated by local law and generate constructive dialogue between employee representatives and management, which provides benefit to our business. In 2021, 72% of permanent employees were represented by local works councils, trade unions or other bodies.

In addition to local employee representation, the Group has operated a European Works Council (EWC) containing representatives from each of the EU countries in which Vesuvius has employees. The existing EWC Agreement terminated in 2020, following notice given by management and the departure of the UK from the European Union. The Group is in the process of negotiating the agreement for the formation of a new EWC with a Special Negotiating Body made up of representatives from the 13 European countries in which we operate. The new EWC Agreement will be registered in and operated under Polish law, as the representative country of Vesuvius plc, following the departure of the United Kingdom from the European Union.

When a new EWC Agreement is signed, and the Council constituted, European management will expect to meet the EWC formally at least once a year. At this meeting, management will provide an update on the performance of the business, with a focus on the developments likely to impact European employees.

Global reward

Reward and recognition are integral components of our employee value proposition, enabling us to attract, engage and retain key talent and highly qualified employees. Our reward systems are designed to create a market-competitive and fair pay environment for all our employees and to reinforce the vision, strategy and expectations set by the Board.

We seek to create a culture that champions performance, building a strong link between individual performance and pay. Supported by our online people management platform, 'myVesuvius', performance reviews and subsequent reward decisions are based not only on how employees have performed against their individual objectives but also on assessments of behaviour and commitment to our CORE Values.

Our global job grading framework, based on a structured assessment methodology, enables us to compare roles and ensure internal consistency throughout the organisation. We are committed to creating reward and performance management systems which are transparent and objective, where employees receive equal pay for work of equal value, regardless of their age, race, disability, sexual orientation, gender, marital, civil partnership or parental status, religion or beliefs. Our management Annual Incentive Plans are measured against both Vesuvius' financial targets and personal performance, an incentive structure consistent with that of our Executive Directors. The Vesuvius Share Plan for Executive Directors and Group Executive Committee members encourages decisions based on long-term goals rather than short-term gains and works to align the interests of participants and shareholders.

In 2021, 93% of our salaried permanent employees undertook a performance review with their line management. This compared with 95% in 2020 and 92% in 2019.

People and Culture Strategy continued

Global mobility

Vesuvius operates worldwide. We believe that our companies should be managed and staffed by local personnel. However, we also provide selected groups of employees with a range of international assignments. These assignments are usually for a limited period, most often three years.

Vesuvius expatriates do not come from one or two countries alone. We have a truly international mix of nationalities in our expatriate population. Individuals move not only within a region, but also between regions, with existing assignments including China to USA, France to Japan, UK to USA, Japan to Thailand, Germany to UK and Belgium to UK. Our mobility programme shows that our expatriate population is as diverse as our Group.

Vesuvius operates several international assignment policies to provide for the different circumstances of these assignments – whether they be short-term, longer-term or require extended commuting. These policies are supplemented with clearly identified benefits, delivering support appropriate to the nature of the assignment. By accessing this broad range of policies, we can manage our international assignments with greater flexibility, thus catering for changing expectations and demands from employees, whilst at the same time meeting the needs of the business.



Key rationale behind international assignments

Vesuvius considers individuals for international assignment for three primary reasons:

- Providing Vesuvius companies with skills that are not locally available and that are required at short notice. This typically occurs in countries where we are establishing or developing our presence. The number of expatriates working on this basis diminishes over time as the organisation matures and we recruit and train local talent to take over.
- Career development. We believe that the personal development plan of any employee being developed for a senior management or senior expert position should include a posting outside their home country. This encourages them to develop the skills necessary to function successfully in an international environment. These postings are tailored to the needs of the organisation and the needs of the individual.
- Enhancing diversity. Management teams benefit from having a mix of gender and cultures. In specific cases, we use international assignments to achieve this goal.



Our communities

We seek to establish strong relationships with all our key stakeholders, founded on mutual benefit and respect.

Our principles – a responsible company



**Vesuvius is committed to making a positive contribution to society. As part of this, we focus on operating an ethical business with appropriate policies in place to ensure compliance with the regulations and laws in all our markets.**

**We are particularly conscious of the need to support the communities in which we operate.**

Governance and policies

The Board is responsible for setting the culture and values of the organisation. The Group Executive Committee is responsible for implementing the culture and values, including ethics-related matters.

Vesuvius' operating policies underpin the principles set out in our Code of Conduct. They are the practical representation of our status as a good corporate citizen and they assist employees to understand and comply with our ethical standards and the legal requirements of the jurisdictions in which we conduct our business. They also give practical guidance on how this can be achieved.

**Human rights**

The Group Human Rights Policy reflects the principles contained within the UN Universal Declaration of Human Rights, the International Labour Organization's Fundamental Conventions on Labour Standards and the UN Global Compact, to which the Group is a signatory. The Policy applies to all Group employees. It sets out the principles for our actions and behaviour in conducting our business and provides guidance to those working for us on how we approach human rights issues. The Group commits not to discriminate in any of our employment practices and to offer equal opportunities to all. The Group respects the principles of freedom of association and the effective recognition of the right to collective bargaining, and opposes the use of, and will not use, forced, compulsory or child labour. These principles have been integrated into the work of our procurement teams as we assess our suppliers and their business practices.

Prevention of slavery and human trafficking

During 2021, we published our sixth transparency statement outlining the Group's approach to the prevention of slavery and human trafficking in our business and supply chain. A copy of our latest statement is available to view on our website: [www.vesuvius.com](http://www.vesuvius.com).

Since the publication of our first statement we have conducted a risk assessment of our purchasing activities, seeking to identify, by location and industry, where the potential risks of modern slavery are highest. Our assessment identified the following four industries that pose a higher risk of modern slavery for Vesuvius:

1. Mining and extractive industries (raw materials)
2. Textiles (personal protective equipment (PPE) and work clothing)
3. Transport and packaging
4. Maintenance, cleaning, agricultural work and food preparation (contracted workers)

Following our modern slavery risk assessment, we provided webinar training to our key purchasing staff and we continue to use an online e-learning module to upgrade the training given to all supplier-facing staff. This provides key guidance on the red flags associated with modern slavery to assist them in identifying these during supplier visits and accreditation. Since the launch of the Modern Slavery red flag training we have trained 100% of the targeted staff.



Supporting our communities continued

Conflict minerals

We actively and routinely review our purchasing portfolio to check for conflict minerals. In 2021 we did not purchase any conflict minerals.

Mica and child labour

Vesuvius is committed to working only with suppliers that respect the UN Global Compact’s 10 principles, and in particular do not employ child labour. As the mica industry has been widely recognised as a risk in this respect, we have engaged in a process of verifying our supplier base. In 2021, we contacted all our suppliers of mica, asking for written confirmation that they are not using child labour. Upon analysis of their replies, we asked suppliers to undergo sustainability assessments, including a strong focus on human rights. By year end, suppliers representing 96.6% of our mica spend had already confirmed not employing any child labour and had completed or were in the process of undergoing a Sustainability Assessment. We have since exited our relationships with those suppliers not willing to undergo a Sustainability Assessment.

Working with trade associations, lobbying and political expenses

Vesuvius and its employees on behalf of Vesuvius, do not make contributions to political candidates or political parties. Similarly, Vesuvius does not make any direct lobbying expenditure or spend any corporate funds on political advocacy.

Around the world, we participate in government and industry working groups, are members of industry associations, and engage in direct contact with independent bodies on key business issues. This ensures that we can help in shaping new policies, regulations and standards, and ensure compliance with existing requirements.

Vesuvius has established long-term relationships, either directly, or through some of its employees with several national and international trade associations directly related to our activities and to those of our customers. These trade associations advocate on major public policy issues of importance to Vesuvius, and are helpful for networking, building industry skills, civic participation and monitoring of industry policies and trends. They also provide information and perspectives on legislative matters

of significance to the Group and our lines of business. Vesuvius’ participation as a member of these associations comes with the understanding that we may not always agree with all the positions of an association or its other members.

Vesuvius is a member of the World Refractory Association, CerameUnie, the European Refractory Association, the Association for Iron & Steel Technology, the Confederation of Indian Industries, and the British Ceramics Association. These trade associations have all made climate change a clear focus area, with a variety of resulting actions such as engaging with regulators and policymakers, awareness and capability building within the industry, promotion of best available practices and technologies, and management of collaborative research projects.

Business ethics/anti-bribery and corruption and working with third parties

Vesuvius’ Code of Conduct affirms our commitment to competing vigorously, but honestly, and not seeking competitive advantage through unlawful means. We conduct ourselves ethically in all public affairs activities, in alignment with local laws and regulations. We do not engage in unfair competition, exchange commercially sensitive information with competitors, or acquire information regarding a competitor by inappropriate means. When received for business purposes, we safeguard third-party confidential information and use it only for the purpose for which it was provided.

We engage with various third-party representatives and intermediaries in our business. We recognise that they can present an increased anti-bribery and corruption risk. Our procedure on working with third parties clearly outlines our zero-tolerance approach to bribery and provides practical guidance for our employees in identifying concerns and how to report them.

Vesuvius engages with third-party sales agents, many of whom operate in countries where we do not have a physical presence. Our employees’ use of, and interaction with, sales agents is supported by an ongoing training programme for those who have specific responsibility for these relationships.

4,388 employees received Anti-Bribery and Corruption training in 2021

As part of communication around anti-bribery and ethics, employees are actively encouraged to consult on ethical issues. They have open access to the Compliance Director and Legal function who provide support on a regular basis.

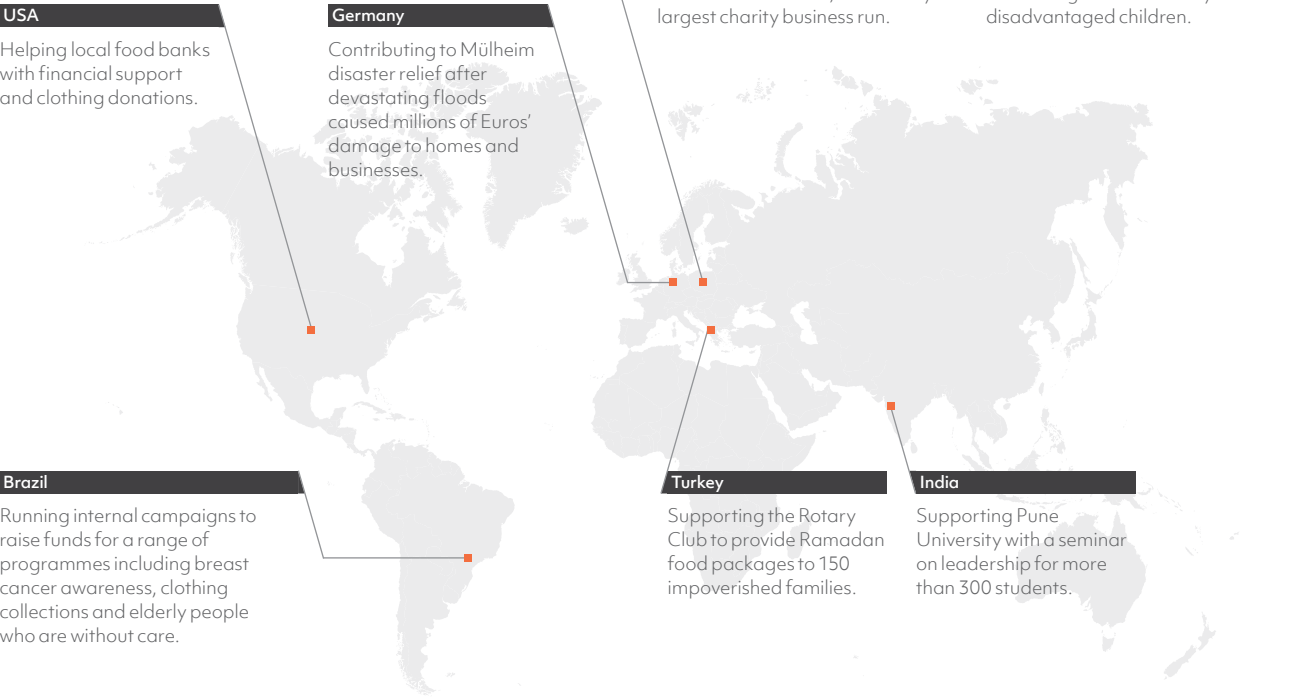
Working with third parties

During 2021, the Group continued the due diligence review of our third-party representatives and intermediaries. Following the previous years’ enhanced review of sales agents, custom clearance agents, distributors and logistics providers, we conducted repeat due diligence on specific third parties operating in higher risk jurisdictions or providing specific services. This included a detailed review of our due diligence activities on active distributors across the Group. This process covers public information searches, regulatory searches and activity reviews. During the year, we also continued our ongoing monitoring of the sales agents used across the Group. This included a review of the agent reporting, invoice data and commission calculation.

Our due diligence processes will continue to be extended using a risk-based approach during 2022 and beyond.

Community engagement

Vesuvius wants to make a positive contribution to the communities in which we work by supporting a wide variety of fundraising and community-based programmes around the world. Below are some examples of the many community programmes and activities our colleagues were involved in throughout 2021.



Opening up Vesuvius to colleagues of the future

Giving young and talented students opportunities to see, experience and become interested in manufacturing and engineering is important for the future of our business. At the Wurtland plant in Kentucky, USA, we welcome around 100 students from Marshall University and Ashland Community and Technical College every year. The visits last around two hours on-site, and the students have an opportunity to speak to staff from across the plant to learn more about the types of career path available to them.

This builds on a long-established partnership with Ashland Community and Technical College, which allows us to offer internships and hands-on experience working in manufacturing. Students at Ashland are studying Advanced Integration Technology, a two-year manufacturing-based programme and undergraduates at Marshall University are on a Supply Chain Logistics programme.

Our Wurtland team also attends job and career fairs at the university and the college, helping make our team and the manufacturing industry more widely accessible to students. By taking this open and accessible approach to welcoming students, the Wurtland plant has benefited from some amazing success stories. In 2021, nine students were hired from the programmes and are now working in production and maintenance roles.

Another benefit of hiring local university graduates is that talented young professionals can stay local to the area and build successful careers. This brings us closer to the wider community and helps the area to prosper.



Responsible sourcing



Vesuvius recognizes the crucial role that its Suppliers play in creating value in the products and services that Vesuvius ultimately provides to its customers. In addition to the consistent and timely supply of materials, products, and services which are of the highest quality, we expect our suppliers to operate in a manner that is appropriate, in terms of their ethical, legal, environmental, and social responsibilities.

Principles

The satisfaction of our customers, the safety and reliability of Vesuvius' products, and the efficiency of Vesuvius' internal processes are dependent on the reliability of its network of suppliers. Vesuvius is committed to ensuring that we utilise high-quality raw materials, secured through reliable and well-developed raw material suppliers. The principles of sustainable procurement are prescribed within the Vesuvius Sustainable Procurement Policy and supported by supplementary processes.

Long-term goals

Overall, our objective is to encourage suppliers to implement a meaningful sustainability programme, embrace the UN Global Compact principles, evaluate and reduce our upstream CO<sub>2</sub> emissions and identify potential risks (and if necessary, address them) in our supply chain.

Sustainable Procurement Policy

During 2021, a specific Sustainability Procurement Policy which outlines key criteria for suppliers was approved and deployed. The policy uses the Group Procurement's 'Request for Quotation' (RFQ) process to engage a significant number of Vesuvius suppliers, and is provided in conjunction with the Vesuvius Terms and Conditions of Purchase. For suppliers to participate in the RFQ, they are obliged to accept and agree to the terms of the Sustainability Procurement Policy, as it forms an addendum to Vesuvius' standard contract clauses. This policy is available on the Vesuvius website. 164 suppliers representing a spend of £71.5m have already formally agreed to comply with the policy.

The policy applies to all suppliers of goods and/or services either used in our manufacturing processes and/or sold directly by us to customers, including Tolling and Resale suppliers. It applies to suppliers, their agents and their sub-contractors. Once accepted, it is the responsibility of the supplier to verify and monitor compliance against this policy

– both for their operations and those of any sub-contractors. Compliance with the requirements in the policy is a key consideration in the selection of suppliers.

The major elements of the policy are:

- Employees and human rights
- Ethical and compliant business practices
- Environment
- Quality
- Business continuity
- Documentation and Verification encompassing Supplier due diligence and Supplier assessments

Supplier sustainability assessments

As part of our sustainability agenda, Vesuvius has implemented a Supplier Sustainability Assessment programme, setting targets for the proportion of the total raw material spend value covered by the assessment.

Vesuvius has partnered with an independent third-party service provider – EcoVadis – to rate our raw materials suppliers using a detailed set of criteria. These cover four themes and 21 criteria based on international standards: Labour & Human Rights; Ethics; Environment; and Sustainable Procurement.

Group procurement and regional procurement teams are heavily involved in the programme. 84 employees from these teams have already received specific training on supplier sustainability assessments (72% of the target group).

We aim to assess at least 50% of our raw material spend by the end of 2023 – a target approved by the Board – using criteria such as supplier size and risk metrics (including country, category of raw material, availability of alternative sources, delivery and quality performance) to identify participants.

Since its launch in January 2021, 131 suppliers have joined the programme, representing a spend value of £188 million, being approx. 52% of the Group's raw material spend. We have initiated a process of corrective and preventative actions to support our suppliers' Corporate Social Responsibility (CSR) capacity building and assessment scores. Of the rated suppliers, 16% did not meet the minimum score defined by Vesuvius, and were asked to implement improvement actions within a three-year timeline. Routine reviews and an annual reassessment will enable progress to be measured. The average overall score of Vesuvius suppliers was 46.8 against an industry benchmark of 43.8 across the critical themes.

Supplier sustainability programme monitoring

The Vesuvius supplier sustainability programme is coordinated and monitored via an independent third-party platform which consolidates information, manages and tracks actions, and provides feedback to our suppliers. We work closely with the independent third-party service provider through scheduled engagements fortnightly and monthly. The Group Executive Committee reviews updates on Procurement Sustainability at its regular meetings.

Supplier CO<sub>2</sub> emissions

It was estimated that the CO<sub>2</sub> emissions from purchased goods and services represented 1,160 thousand metric tonnes of CO<sub>2</sub> in 2021 (78.2% of Vesuvius Scope 3 emissions and 61.8% of Vesuvius' total CO<sub>2</sub>e emissions, see page 71). A more precise knowledge of these emissions, including data per raw material and supplier, will be required to properly establish and drive improvement plans. As noted above, we are using our RFQ process to gain a better understanding of these upstream CO<sub>2</sub> emissions and collect supporting data. This requires participating raw material suppliers to provide information on their energy sources, CO<sub>2</sub> emissions and improvement plans.

Of the 138 suppliers (representing a total spend of £71.5m) who responded to the request for information on their energy sources and CO<sub>2</sub> emissions, 50 (representing a total spend of £48m) reported that they had set emissions reductions targets and established action plans.

Supplier quality development

Vesuvius is very proud of the close relationships we have with our suppliers around the world. We work with them to ensure that the highest-quality materials and products enter our supply chain. The process entails an extremely comprehensive review including research and development to ascertain compatibility of supplier products.

Supplier audits

Vesuvius also conducts an annual Supplier Audit programme targeting product quality and security of supply. The programme is led by the Group's Purchasing and Quality teams, located across all regions. The goal of the audits is to reduce the number of quality issues that may affect our raw materials, and consequently our operations and those of our customers. As part of this, we carry out on-site inspections, share expectations with our suppliers, identify risks, and adapt our internal controls accordingly. We encourage our suppliers to improve their own processes and help them prioritise actions to achieve this.

Areas of focus include:

- a) Quality management rules: final inspection, controls at important process steps, management of incoming materials, data tracking, customer feedback and communication.
- b) Management of non-conformities: reaction to non-conformities, protection of customer, problem resolution and application of lessons learned.

c) Sustainability criteria: this has been newly introduced to align the supplier audits as a second platform to drive and visibly verify supplier sustainability efforts and programmes, complementing the assessments carried out by our third-party partner. The main areas of attention are environmental and social practices. A particular emphasis is being placed on child and forced labour. Any observation of such practice would be immediately escalated to the Group's senior management, and the supplier barred from doing business with Vesuvius.

In 2021, despite the impact of COVID-19 travel restrictions, 138 (2020: 98) audits were conducted at 138 supplier facilities. Seven suppliers (5% of suppliers audited) received grades below threshold. Actions were taken either to support them or to terminate our relationship with them.

Supplier corrective actions requests

To ensure the integrity of our products, we have a rigorous approach to issues relating to the quality of raw materials and other inputs to our processes.

When a supplier does not meet expectations, we issue a formal Supplier Corrective Action Request. Our proven 8D methodology is then used to investigate the root cause of the issues and define corrective actions. A web-based portal is available for suppliers to document the containment actions implemented and outcome of the investigation, to enable review by us.

In most cases, issues are identified and resolved quickly. Suppliers with repeat issues and poor problem-solving are required to undergo a Supplier Quality Audit. Whilst COVID-19 impacted on the ability to progress supplier audits during 2021, every effort has been made to sustain our critical internal control processes through virtual means.

Supplier sustainability assessment criteria

Environment	Labour & Human Rights	Ethics	Sustainable Procurement
Energy Consumption & GHGs	Employee Health & Safety	Corruption	Supplier Environmental Practices
Water	Working Conditions	Anticompetitive Practices	Supplier Social Practices
Biodiversity	Social Dialogue	Responsible Information Management	
Local & Accidental Pollution	Career Management & Training		
Materials, Chemicals & Waste	Child Labour, Forced Labour & Human Trafficking		
Product Use	Diversity, Discrimination & Harassment		
Product End-of-Life	External Stakeholder Human Rights		
Customer Health & Safety			
Environmental Services & Advocacy			



21 criteria based on international standards

The Strategic Report set out on pages 1–101 contains a fair review of our businesses, strategy and business model, and the associated principal risks and uncertainties. We also deliver a review of our 2021 performance and set out an overview of our markets and our stakeholders. Details of our principles, and our people and community engagement, together with our focus on safety, are also contained in the Strategic Report.

Approved by the Board on 3 March 2022 and signed on its behalf by

Patrick André  
Chief Executive

Guy Young  
Chief Financial Officer