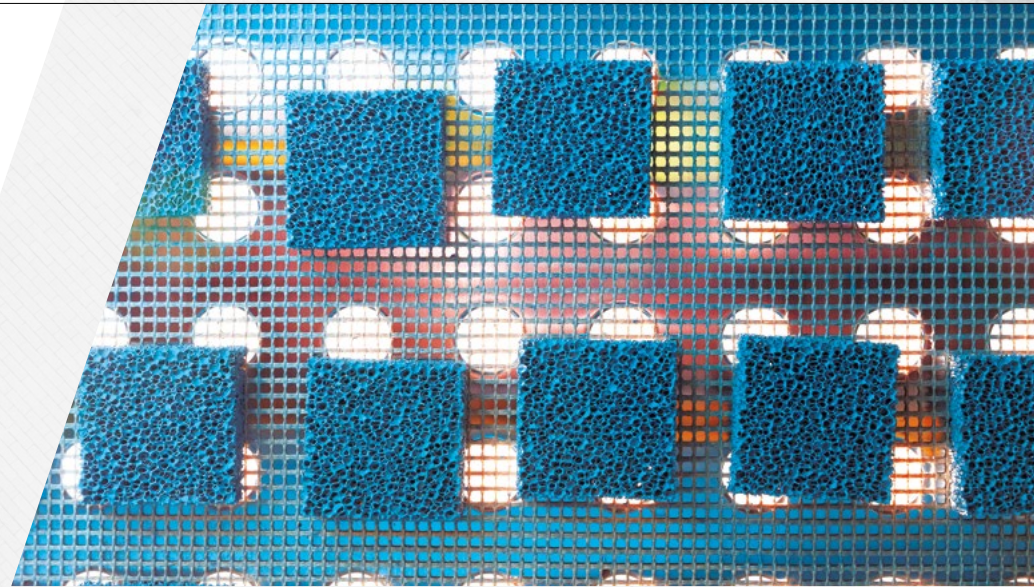






A Better Tomorrow



Vesuvius plc Sustainability Report 2021




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		Forward-looking statements			
		This Sustainability Report contains certain forward-looking statements with respect to the operations, strategy, performance, financial condition and growth opportunities of the Vesuvius Group. By their nature, these statements involve uncertainty and are based on assumptions and involve risks, uncertainties and other factors that could cause actual results and developments to differ materially from those anticipated.		The forward-looking statements reflect knowledge and information available at the date of preparation of this Sustainability Report and, other than in accordance with its legal and regulatory obligations, the Company undertakes no obligation to update these forward-looking statements. Nothing in this Sustainability Report should be construed as a profit forecast.	

Find out more in our annual report

Including more detailed information on what we do, our plans for the future, financial performance and how we run our business.

Download the full report 

What we do, plans and performance

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How we run our business

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Visit our website at www.vesuvius.com

Visit our online annual report at
report2021.vesuvius.com

This Sustainability Report, save for each of the Case Studies, and pages 1, 50, 74 and 103–113, is extracted without material amendment from the Vesuvius Annual Report 2021.

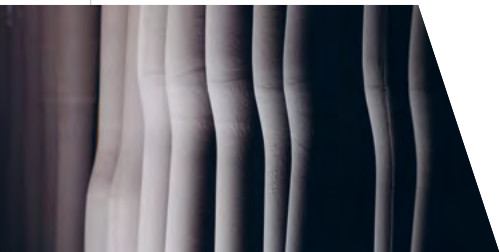
Our purpose

Think beyond. Shape the future.

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.



Introduction: Towards a better tomorrow

Progress on our sustainability roadmap



Welcome to our second Sustainability Report. I thank you very much for your interest in Vesuvius' journey.

At Vesuvius, we believe that we can build on our successes and so create even 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.

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 CO₂ 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.

Introduction: Towards a better tomorrow continued

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.

Alexander Laugier-Werth
VP Sustainability, HSE & Quality

Areas of focus

- Reducing Scope 1 and 2 emissions, measuring Scope 3 emissions and creating action plans to minimise these
- Determining CO₂ 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 CO₂ emissions reviewed every year
- Seeking ISO 14001 certification of manufacturing sites
- Undertaking sustainability assessments of suppliers



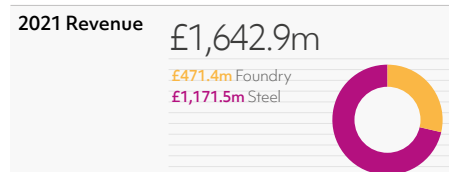
At a glance

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

Employees

Sales offices

R&D centres

Production sites

Americas

£505.9m

19.9% Foundry
80.1% Steel

3,367

21

1

18

EMEA

£644.8m

30.9% Foundry
69.1% Steel

4,352

28

3

19

Asia-Pacific

£492.2m

34.9% Foundry
65.1% Steel

3,485

26

2

17



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



Vesuvius at a glance: divisional overview

Steel division

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.

2021

£1,171.5m

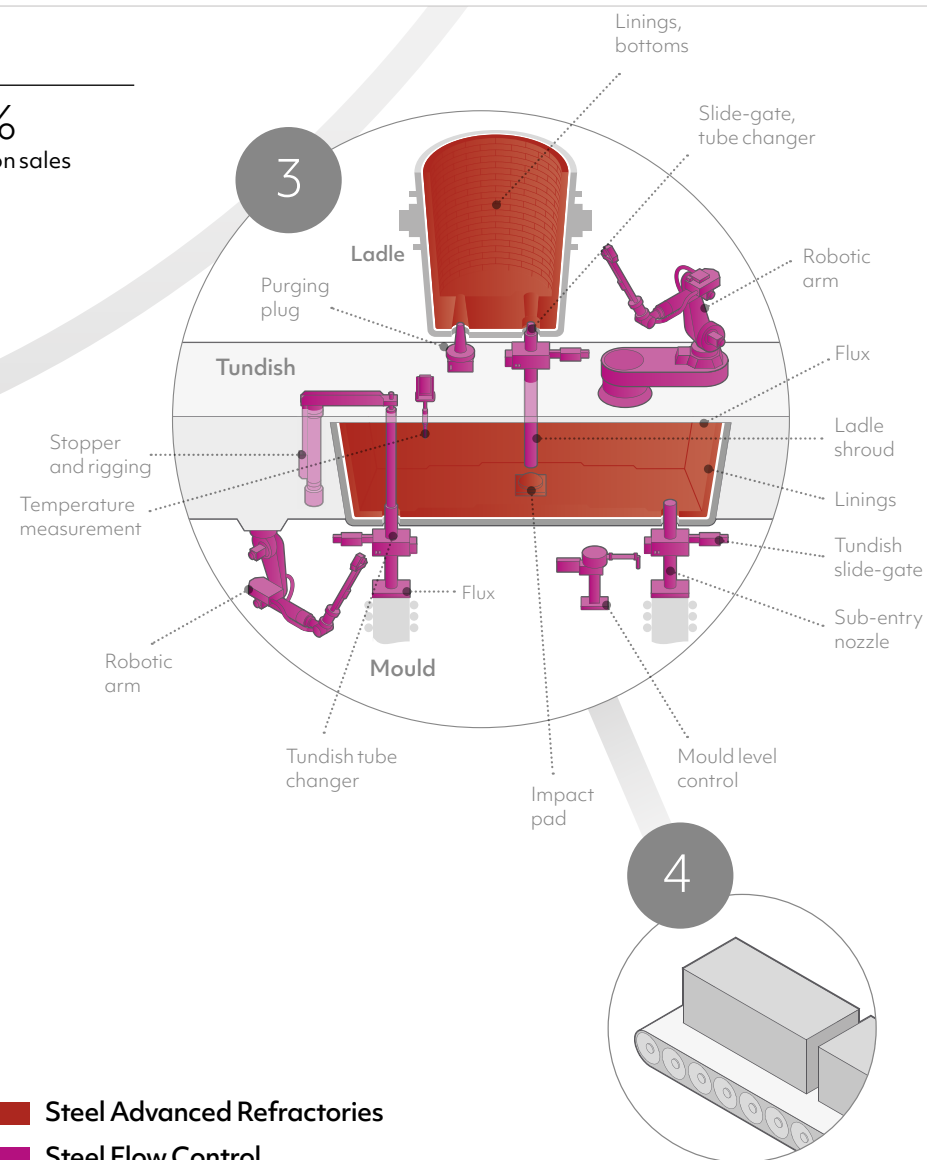
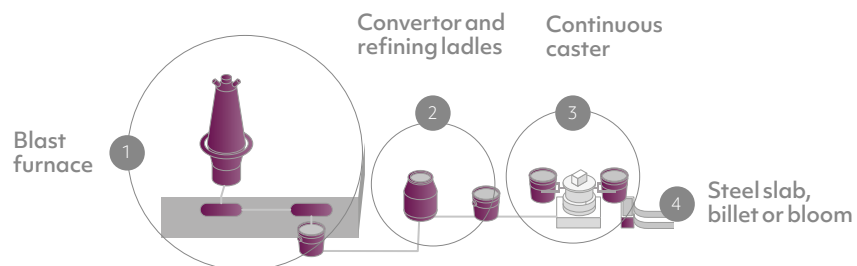
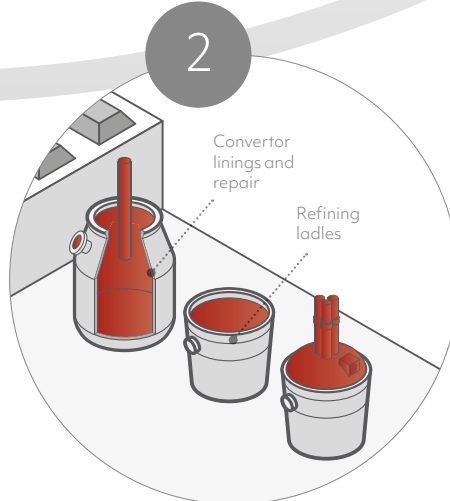
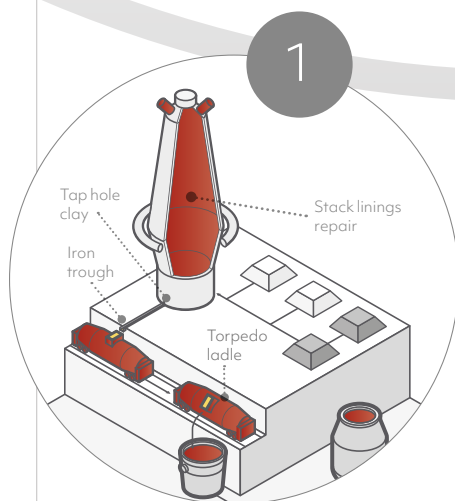
Revenue

8.7%

Return on sales

£102.0m

Trading profit



Vesuvius at a glance: divisional overview continued

Steel division

Steel Flow Control

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

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

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.

Vesuvius at a glance: divisional overview continued

Foundry division

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 Fosco brand.

2021

471.4m

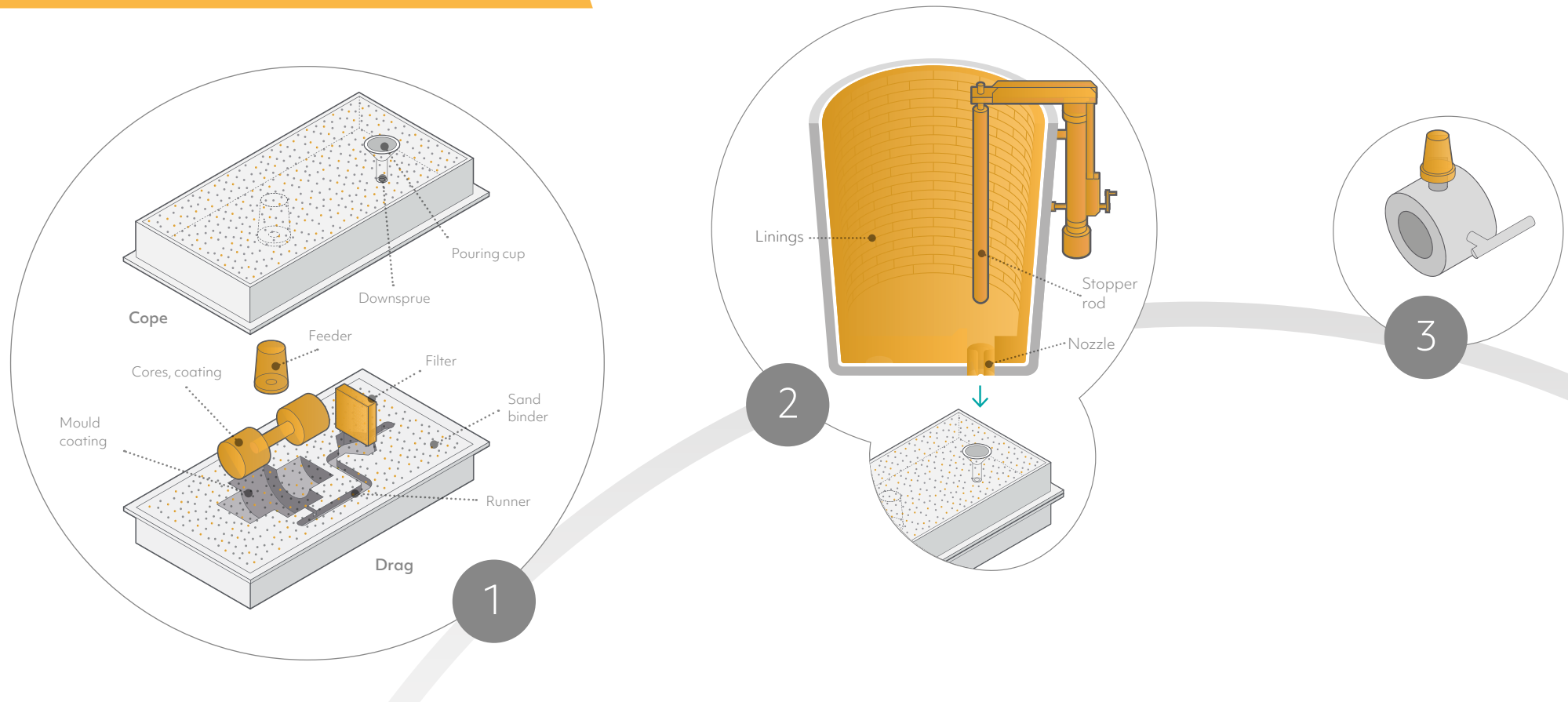
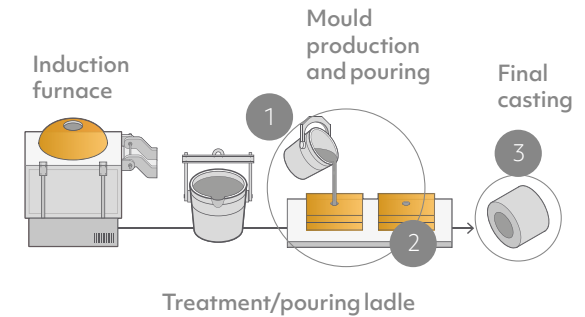
Revenue

£40.4m

Trading profit

8.6%

Return on sales



Vesuvius at a glance: divisional overview continued

Foundry division

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.



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 CO₂ emissions and helping 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.

P21 ➔



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 CO₂ emissions.

P55 ➔



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.

P69 ➔




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.

P93 ➔

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 CO₂e emissions	By 2025, reduce (Scope 1 and Scope 2) energy CO ₂ 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 ¹)	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.

Vesuvius and the United Nations Global Compact

Vesuvius supports the United Nations' Ten Principles on human rights, labour, environment and anti-corruption and is committed to advancing the development of the UN Sustainable Development Goals (SDG). Progress on our efforts to implement the UN Principles and initiatives to advance the SDGs are contained in our Annual and Sustainability Reports. This report constitutes Vesuvius' annual Communication Of Progress to the United Nations Global Compact.

Patrick André
Chief Executive



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

Anti-corruption

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



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

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



Goal 8

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



Goal 9

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



Goal 12

Ensure sustainable consumption and production patterns



Goal 13

Take urgent action to combat climate change and its impacts

Supporting SDGs



Goal 3

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



Goal 5

Achieve gender equality and empower all women and girls



Goal 6

Ensure availability and sustainable management of water and sanitation for all

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.

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

Sales offices	75
R&D centres	6
Production sites	54



Our principles, approach and governance continued

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.

CORE Values

C ourage

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

O wnership

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

R espect

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

E nergy

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

Our principles, approach and governance continued

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.

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 CO₂ emissions, all of which could profoundly affect our markets.

Our assessment is informed by the principles of reporting articulated within the Global Reporting Initiative (GRI) Standards 2021. The GRI content index can be found in page 103 of this report.

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 of our 2021 Annual Report. 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.

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

Our principles, approach and governance continued

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	<ul style="list-style-type: none"> – energy efficiency – CO₂e emissions – renewable energy – sustainable products
Circular economy	<ul style="list-style-type: none"> – solid waste – recovered and recycled materials
Protection of the environment	<ul style="list-style-type: none"> – wastewater – environmental management – responsible procurement
Human rights	<ul style="list-style-type: none"> – modern slavery – gender diversity – employee well-being – responsible procurement
Employee work relationships and conditions	<ul style="list-style-type: none"> – health and safety – employee representation – engagement and development – values
Communities	<ul style="list-style-type: none"> – education – business practices – supply chain
Governance	<ul style="list-style-type: none"> – Code of Conduct – anti-bribery and corruption – privacy and data security – responsible procurement

Materiality assessment process

Step 1	Step 2	Step 3	Step 4	Step 5
<ul style="list-style-type: none"> – 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 	<ul style="list-style-type: none"> – 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 	<ul style="list-style-type: none"> – Identification of metrics and setting of targets by Group Executive Committee – Approval by Board of directors 	<ul style="list-style-type: none"> – Strategy launch with Senior Leadership Group – Constitution of Sustainability Council – Deployment throughout the Group 	<ul style="list-style-type: none"> – 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 on page 19 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.

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 CO₂ 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 CO₂ emissions, a reduction in the Lost Time Incident Frequency Rate and an improvement in the gender representation in senior management.

Task Force on Climate-related Financial Disclosures continued

Topic		Disclosure summary	Vesuvius disclosure	Page reference ¹
Governance	Disclose the organisation's governance around climate-related risks and opportunities.	a Describe the board's oversight of climate-related risks and opportunities.	<i>Sustainability: TCFD</i>	p18 ➤
			<i>Risk, Viability and Going Concern</i>	AR p29–33 ➤
		b Describe management's role in assessing and managing climate-related risks and opportunities.	<i>Sustainability: TCFD</i>	p20 ➤
			<i>Risk, Viability and Going Concern</i>	AR 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.	<i>Sustainability: Our planet</i>	p22–28 ➤
		b Describe the impact of climate-related risks and opportunities on the organisation's businesses, strategy and financial planning.	<i>Sustainability: Our planet</i>	p22–54 ➤
			<i>Our external environment</i>	AR p16 and 17 ➤
			<i>Sustainability: Our customers</i>	p60–68 ➤
Risk management	Disclose how the organisation identifies, assesses and manages climate-related risks.	c Describe the resilience of the organisation's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.	<i>Sustainability: Our planet</i>	p29–32 ➤
		a Describe the organisation's processes for identifying and assessing climate-related risks.	<i>Sustainability: Our planet</i>	p22–28 ➤
			<i>Risk, Viability and Going Concern</i>	AR p29–33 ➤
		b Describe the organisation's processes for managing climate-related risks.	<i>Sustainability: Our planet</i>	p22–28 ➤
Metrics and targets	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.		<i>Risk, Viability and Going Concern</i>	AR p30 ➤
		c Describe how processes for identifying, assessing and managing climate-related risks are integrated into the organisation's overall risk management.	<i>Sustainability: Our planet</i>	p22–28 ➤
			<i>Risk, Viability and Going Concern</i>	AR p29–33 ➤
		a Disclose the metrics used by the organisation to assess climate-related risks and opportunities in line with its strategy and risk management process.	<i>Sustainability</i>	p11 ➤
		b Disclose Scope 1, Scope 2 and, if appropriate, Scope 3 GHG emissions, and the related risks.	<i>Sustainability: Our planet</i>	p34–40 ➤
		c Describe the targets used by the organisation to manage climate-related risks and opportunities and performance against targets.	<i>Sustainability: Our planet</i>	p34–49 ➤

1. Where indicated by 'AR' the disclosure is contained in the Company's 2021 Annual Report.

Task Force on Climate-related Financial Disclosures continued

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 CO₂ and CO₂e 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.

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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 CO₂ emissions and use of raw materials, and helping our customers reduce their own CO₂ 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 CO₂ 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 CO₂ 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.



Tackling climate change continued

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 of our Annual Report). 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 of our 2021 Annual Report ➔

We describe in more detail how practically we are maximising those opportunities to help our customers in the 'Our customers' section p55-68 of this report ➔

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 CO₂ 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.

Tackling climate change continued

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.



Tackling climate change continued

Sites with 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 continued

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)

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.

Medium term (2035)

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.

Long term (2050)

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.

Impact categories (trading profit)

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

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

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

Tackling climate change continued

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 ₂ 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

Tackling climate change continued

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 ₂ 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 case 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

Tackling climate change continued

	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	<ul style="list-style-type: none"> – 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) 	<ul style="list-style-type: none"> – 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 	<ul style="list-style-type: none"> – All major economies implement carbon pricing mechanisms. The cost of CO₂ 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"> – Fast growth of non-CO₂ emitting electricity sources (nuclear and renewable) in Europe – The cost of fossil fuels increases significantly in Europe – Coal reduces progressively, but does not disappear. Natural gas continues to grow outside Europe – Hydrogen does not become available on a wide scale and economically competitive until well after 2040 	<ul style="list-style-type: none"> – Fast growth of non-CO₂ emitting energy sources in Europe – The cost of fossil fuels increases significantly in Europe. Coal reduces progressively, but does not disappear, natural gas continues to grow outside Europe – Hydrogen becomes available on a wide scale in the USA and Europe and economically competitive between 2030 and 2040 	<ul style="list-style-type: none"> – Fast growth of non-CO₂ emitting energy sources (nuclear and renewable) in all regions – The cost of fossil fuels increases significantly (taxation), coal as a source of energy disappears, natural gas starts to reduce – Hydrogen becomes available on a wide scale and economically competitive between 2030 and 2040 – Fast electrification of the automotive industry
3 Technology transition – iron and steel making	<ul style="list-style-type: none"> – 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 – 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 	<ul style="list-style-type: none"> – European iron making transitions to clean processes (e.g. hydrogen, DRI, CCS, CCUS). The speed of the transition is dictated by the availability of carbon-free hydrogen in large quantities – Some US blast furnaces are converted to hydrogen, others to DRI+EAF – Chinese steel plants convert to clean iron and steel making processes, albeit at a slower pace – Little or no transition outside China, the EU and USA 	<ul style="list-style-type: none"> – Fast transition of iron making to clean processes in all regions; blast furnaces are revamped ahead of their normal schedule – European and Chinese integrated steel making will grow primarily in hydrogen-based iron production, implementing CCS and CCUS technologies as well – DRI + EAF will grow in the US (benefiting from the availability of low cost shale gas) and Europe – Customers also invest to increase the performance of furnaces, including downstream of casting
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 CO₂ 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-CO₂ emitting energy sources vs fossil fuels and respective infrastructures. These will greatly influence the pace of deployment of various technologies and industries

(electric vehicles, carbon-free 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 CO₂ 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.

Tackling climate change continued

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 CO₂ emitting (1% to 3% of a steel plant's CO₂ 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 CO₂e 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 (Scope 1 and Scope 2, market-based), comprising a 16.5% reduction in normalised Energy CO₂e usage and a 12.6% reduction in normalised Process CO₂. 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 CO₂e 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 CO₂e 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 CO₂ intensive energy sources
- When possible, replacing high CO₂e 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

16.5%

reduction in CO₂e emissions per metric tonne of product packed for shipment between 2019 and 2021

Tackling climate change continued

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 plants Kolkata and Vizag. 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 CO₂, 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ was initially set at €30 per tonne of CO₂. 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 CO₂ for 2022.

Key progress since 2019

Since 2019, four major projects have helped significantly reduce the Scope 1 CO₂ emissions of the Group by addressing some of its most CO₂e 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 CO₂ 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 CO₂ 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.

Tackling climate change continued

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 CO₂e 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 CO₂e emissions reduction in their prime objectives was approved in 2021.

In 2021, we analysed our CO₂ 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 CO₂ 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 carbon-free 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, carbon-free hydrogen, synthetic gas, biomass).

Energy consumption and Scope 1 and Scope 2 CO₂e 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 CO₂e emissions. (We report in metric tonnes of CO₂ equivalents CO₂e.)

A further five processes consume 34% of the Group's total energy consumption and represent 24% of our location based CO₂e 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 CO₂ and, building on the successes of previous years, continues to be a clear focus for our investment to reduce CO₂e 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 CO₂e 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.

Tackling climate change continued

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 CO₂e 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 CO₂e emissions reduced to the lowest level ever recorded:

- Location based: by 5.6% to 0.418 metric tonnes CO₂e per metric tonne product packed for shipment (2020: 0.443)
- Market based by 9.4% to 0.40 metric tonnes CO₂e 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 CO₂ 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).

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) CO₂e. We report in metric tonnes of CO₂e equivalent (CO₂e).

Our energy-related greenhouse gas(GHG) emissions, reported as carbon dioxide equivalents (CO₂e), include direct emissions of the three main GHGs (Carbon Dioxide (CO₂), Methane (CH₄) and nitrous oxide N₂O).

Process related emissions of the following in CO₂e equivalent and in metric tonnes are not significant:

- Direct methane CH₄ Emissions
- Direct nitrous oxide N₂O Emissions

Emissions of the following in CO₂ equivalent and in metric tonnes are not significant:

- Direct Sulphur Hexafluoride (SF₆) 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.

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

Tackling climate change continued

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 CO₂e) 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 ₂ e '000 metric tonnes 2021	CO ₂ e '000 metric tonnes 2020	% change	CO ₂ e metric tonnes per metric tonne of product 2021	CO ₂ 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 m³ 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 CO₂e) and energy consumption ('000 kWh).



Tackling climate change continued

Global GHG emissions (kg of CO₂e) and energy consumption ('000 kWh) (Location based statutory reporting)

Emissions and energy sources	UK and Offshore CO ₂ e '000 metric tonnes 2021	Global CO ₂ e '000 metric tonnes 2021	Proportion relating to the UK and Offshore Area	UK and Offshore CO ₂ e '000 metric tonnes 2020	Global CO ₂ 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 ₂ e per metric tonne of product packed for shipment		Metric tonnes CO ₂ 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
Emissions and energy reported above normalised to metric tonnes CO ₂ e per metric tonne of product packed for shipment	3,304	0,418	2,607	0,443	17,223	1,177
Change	26.7%	-5.6%			26.8%	-5.3%
Metric tonnes of CO ₂ e per £m revenue						
Total GHG emissions as metric tonnes CO ₂ 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

Global electricity usage

	2021	2020	2019
Total electricity consumption ('000 kWh)	207,238	194,441	214,336
Electricity from non-CO ₂ emitting sources ('000 kWh)	105,258	75,629	79,910
Electricity from non-CO ₂ 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 CO₂e emissions per region (market based)

	Category	CO ₂ 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 CO₂e emissions (market based)

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

CASE STUDY

Moving to carbon-free energy to cut CO₂

Vesuvius took some big steps toward carbon neutrality in 2021, including converting to carbon-free energy sources at a number of sites around the world.

In Germany, our sites at Borken, Mülheim and Großalmerode now purchase all their power from hydropower plants that meet the strict criteria of TÜV SÜD/EE00 certification.

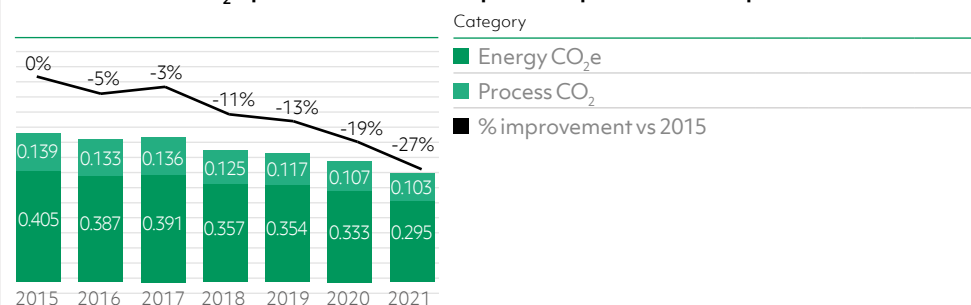
In India, our Foundry Technologies facilities in Pune, Puducherry and Mehsana partnered with energy provider Amplus Solar Group to obtain International Renewable Energy Certificates (iREC) for the facilities and cut CO₂ emissions.

And in Brazil, our Sao Paulo Foundry team successfully secured a contract for energy from renewable sources, while also cutting costs.

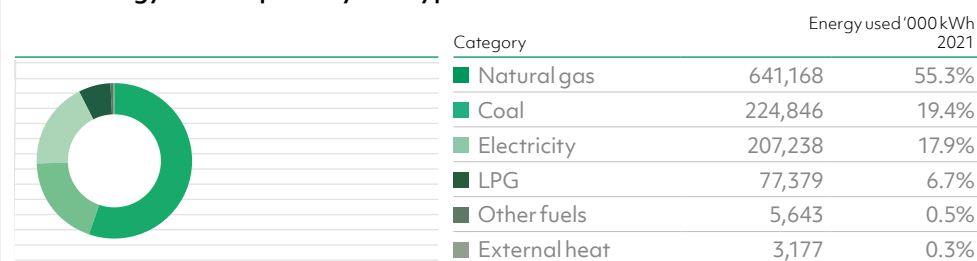


Tackling climate change continued

Metric tonnes CO₂e per metric tonne of product packed for shipment



2021 energy consumption by fuel type %



Scope 3 emissions

Vesuvius' Scope 3 CO₂e emissions, mainly upstream, contribute to a greater part of our total CO₂e 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 CO₂e 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 CO₂e emissions. In 2021, we also undertook a more focused evaluation of emissions associated with raw materials using publicly available average CO₂e emissions

factors. In addition, we started collecting information on energy source, CO₂e 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 CO₂e emissions. A few examples include:

- Returnable packaging solutions being implemented both with suppliers and customers
- Policies aimed at limiting the CO₂e 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

Tackling climate change continued

Scope 1, Scope 2 and Scope 3 emissions

Metric tonnes CO ₂ e	2021		2020		2019	
	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%
Scope 1 Process CO ₂ e emissions	101,121	5.4%	88,516	5.9%	106,737	6.0%
Scope 1 Energy CO ₂ e emissions*	209,592	11.2%	183,741	12.2%	215,836	12.0%
Scope 1 CO₂e emissions	310,713	16.6%	272,257	18.0%	322,573	18.0%
Scope 2 CO ₂ e emissions (market based)	82,519	4.4%	92,145	6.1%	106,681	5.9%
Scope 3 CO₂e 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 CO₂e emissions were 1,876,670 metric tonnes. This represented 1,140 metric tonnes per million £ revenue.

Scope 3 emissions

Metric tonnes CO ₂ 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 CO₂e emissions	1,483,438	100.0%	1,147,557	100.0%	1,363,709	100.0%

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.



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

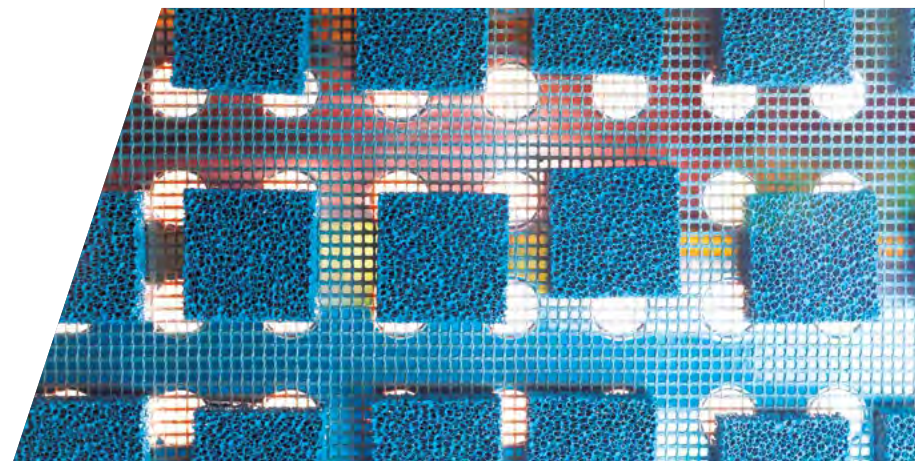
multiplied by as much. Approximately 10kg of refractory material are now consumed per tonne of steel cast, with some customers requiring as little as 7kg.

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.



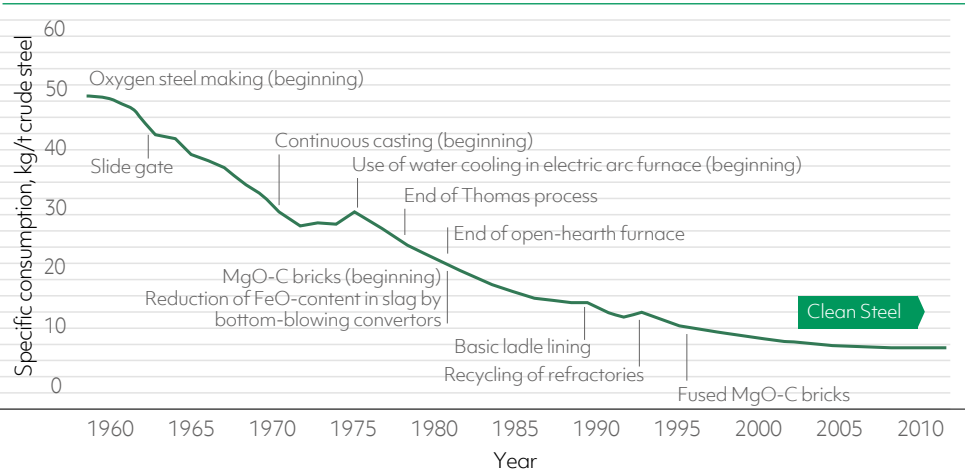
* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

Growing our engagement in the circular economy continued

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 CO₂ 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.

CASE STUDY

Switching to eco-cars cuts CO₂ and costs

A switch to electric company cars at our sites in Balborough and Tamworth in the UK, and Ghlin, Belgium, is set to reduce our CO₂ emissions and save money.

In 2021, the sites have approved new policies that will require all company cars to be either fully electric or plug-in hybrids that emit no more than 50g of CO₂ per kilometre driven.

There are currently 80 company cars based in Ghlin and 40 in Balborough. When the car leases come up for renewal, they will be

replaced with environmentally friendly alternatives. On average, this will save 80g/km of CO₂. With cars travelling an average of 20,000km per year, the CO₂ reduction will be approximately 200 metric tonnes annually. Further, while the initial outlay for eco-cars is higher, this is more than compensated for by the lower operational costs of these vehicles and tax savings for the company.

200 metric tonnes
CO₂e saving per year



Growing our engagement in the circular economy continued

CASE STUDY

Environmental concern brings change to the monolithic refractory market

The use of recycled raw materials is a paradigm change in how we operate as we seek to reduce our environmental footprint and reduce customers' costs and waste.

In South America, our Advanced Refractories regional team were challenged to find ways to increase the use of recycled materials while remaining faithful to our high production standards and ensuring the quality of the final product remained the same.

Critical to this is finding continuous supplies of recyclable materials that provide consistency. The innovative solution was to use the refractory scrap that is generated in the demolition of melting furnaces.

In 2020, an industrial test was carried out at one of our key customers, with 85 tons of scrap collecting a yield of 70 per cent and a saving of 50 per cent against raw cost materials. The success of this test has led to increased plans in 2021 to collect 550 tons of scrap, with the expectation for that to surpass 850 tons in the next few years.



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 CO₂e 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.

70%

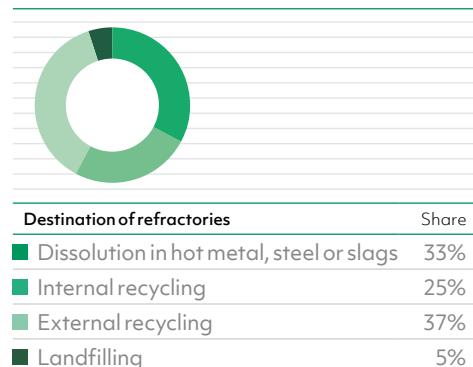
yield and 50% cost reduction

Growing our engagement in the circular economy continued

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.

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.

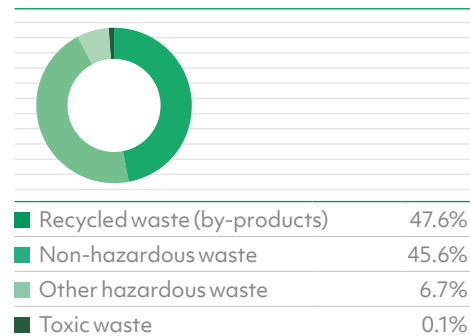
The Board has set a target of a 25% reduction of our solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment by 2025 (vs the 2019 baseline).

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

Breakdown of 2021 solid waste



	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.

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.

CASE STUDY

Little things can make big things happen

Cardboard raw material reuse by Digital Services in Mexico

Our Sensors & Probes technical sales team based with our customer AHMSA in Mexico has devised an innovative way to improve their operational efficiency by reducing their use of cardboard. The team have successfully trialed the reuse of Immersion Sampler Cardboard tubes by flipping them over and connecting them to a new Sampler Head. This is possible because samplers are only in the steel bath briefly and have no electronic connections.

According to “Recover USA” NGO studies, for every metric tonne of cardboard that is recycled, we save about 17 trees, plus 1,500 litres of oil and other fossil fuels, 5,000 kilowatt-hours of energy, 25,000 litres of water and 1 metric tonne of carbon dioxide (CO₂); which is the main cause for the global warming.

Now that the initial trials have been successful, we are currently testing with a larger number of tubes (up to 1000), to identify the right applicable dimensions for the reused tubes and to determine the product versions that could work with reused tubes.



1 metric tonne

of recycled cardboard saves 17 trees

Growing our engagement in the circular economy continued

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.

In 2021, our overall fresh water usage per tonne of product packed for shipment decreased by 16.4%. As with energy use, normalised consumption of water varies with product mix. This decrease was driven by an evolution in our product mix towards

products that require less water in their processing and was partly offset by the increase in wastewater per tonne of product packed for shipment (5.9%).

Vesuvius works to reduce the consumption of water in its manufacturing operations by recycling and improving water management processes. No salt water or cooling water is abstracted with no related outflow.

Water stress

An assessment of all Vesuvius manufacturing sites was carried out using the Aqueduct Water Risk Atlas. A small number of the areas in which Vesuvius operates are water stressed. In these areas, we make strenuous efforts to reclaim, recycle and minimise the overall use of water.



Reducing consumption, waste and emissions continued

CASE STUDY

Foundry Japan project team reduce filter waste

Zirconium dioxide slurry losses have been cut by almost 13% at our Foundry plant in Toyokawa, Japan.

A team at our filter plant in Toyokawa studied slurry losses in the production of ZR filters.

In the production process, foam is impregnated and sprayed with a ceramic slurry on an automatic production line prior to drying. After each cycle, the production lines are washed down to remove excess slurry from the belts.

When the team started work, 28% of the slurry being applied by the spraying line was being lost.

The team established that the major cause of the losses was from slurry sticking to the metal mesh conveyors which then needed regular washing down.

The team found that slurry was much less prone to sticking to a rubber rope conveyor system which, when implemented, cut losses to 15%.

But the team have not finished the optimisation process. The next step is to look at recycling scrap filters by adding them to the slurry mix.



13%

cut in slurry losses

CASE STUDY

Digital Services focus on packaging reduction

Our Digital Services business in South America has an ongoing project to cut its packaging use to save money for our business and customers and reduce our environmental footprint.

One initiative from the engineering and product development teams in the Piedade plant is substantially reducing the utilization of packaging paper in the packaging and wrapping of this division's products.

The initiative has the potential to reduce the packaging paper consumption by 7 tons per year once the project is fully implemented and operative.

In other initiatives, the use of polystyrene foam will be eliminated from the packaging of our Hydrogen Probes, and in another the team are replacing the plastics used to protect products from humidity during shipping with recycled plastics.



Reducing consumption, waste and emissions continued

Wastewater

Our sites with the highest level of water consumption are equipped with wastewater treatment plants. These represent 47% of all manufacturing sites and R&D centres of excellence. Additionally, many types of activity are routinely undertaken by our sites to control and reduce their water consumption, and we have action plans in place to reduce our wastewater generation globally. Some of the most significant examples include:

- Replacing wet scrubbing systems for particulate removal with dry filter systems
- Optimising container cleaning processes
- Installing high pressure stations to improve efficiency and speed of tool cleaning
- Optimising production schedules to reduce the need for cleaning between recipes
- The provision of environmental awareness training to employees

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 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.



Vesuvius employee photography competition – Michel Wissink – see inside back cover

Environmental policy

We will operate all work and business activities in a manner which ensures appropriate care and protection of the environment.

We will comply with all applicable legal and other local environmental obligations. We will be pro-active in preventing negative effects to the environment and will continuously improve our environmental management systems and performance.

Our beliefs

Preserving the environment is good business.

All employees must contribute to protect the environment.

All environmental incidents are preventable

Our commitments

- Minimise direct and indirect CO₂ and other greenhouse gas emissions, by reducing the energy intensity of our business and using cleaner energy sources.
- Minimise the consumption of water and other resources.
- Reduce waste at source and during production.
- Increase the usage of recycled materials and promote the development of the circular economy.
- Minimise any pollution or releases of substances which could adversely affect humans or the environment.
- Avoid negative impacts on biodiversity.

Our actions

- We will raise environmental issues at all levels, openly consult with stakeholders to address them, and report regularly on them.
- We will build environmental protection into our products and processes.
- Environmental risk assessments will be undertaken to identify hazards, prioritise any deficiencies and correct them in an appropriate way as well as to develop appropriate procedures.

This policy has been approved by the Group Executive Committee and is displayed and implemented at all facilities.

Protecting the environment continued

Our actions continued

- We will set targets and implement action plans to improve our environmental performance.
- All our investment decisions will include an analysis of their environmental impact. An internal price for CO₂ emissions will be included for the calculation of payback for all investments reaching the threshold for approval by the BU Presidents or Chief Executive.
- We will provide training to all employees and contractors to ensure that they understand their responsibilities and are able to act accordingly.
- Every business facility will have an appointed Environmental Manager.
- Every manufacturing site will implement an environmental management system that is aligned with ISO 14001.

Organisation and responsibilities

We regard all environmental matters – including climate change – as a mainstream management responsibility. Executives and line managers are directly responsible for environmental matters in operations under their control. Management is accountable for environmental performance against objectives.

Each and every employee is responsible and accountable for environmental matters in activities under their control.

We will encourage our Suppliers to adhere to the same Environmental standards as we do.

We expect everyone to participate positively in achieving our environmental aims.

CASE STUDY

Vesuvius Olifantsfontein regenerating industrial land to promote biodiversity

The team at Vesuvius Olifantsfontein in South Africa have been taking part in a long-term project to attract bird and insect life to the area by regenerating unused industrial land on site.

Since 2016, they have operated a greening project, planting native trees and shrubs. The area which used to contain a Rotaries Kiln structure has been converted into a huge garden and lawn, while elsewhere a fishpond attracts bird and insect life.

One of the highlights of the project involved installing an owl house in 2019 for a Spotted Eagle Owl breeding pair. For the past three years they have bred successfully.



Protecting the environment continued

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

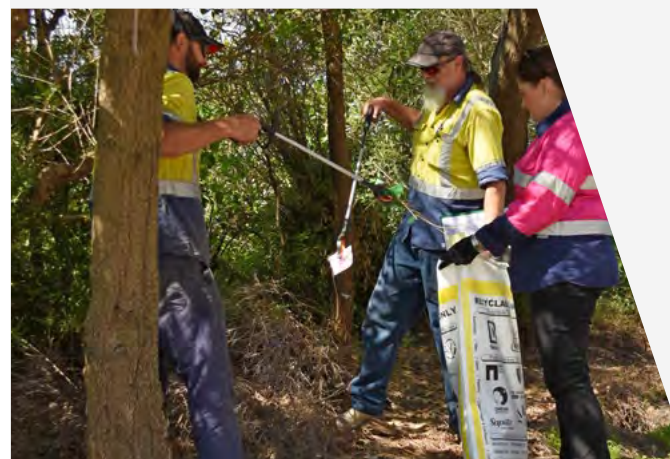
CASE STUDY

Port Kembla team do their bit to clean up Australia

A team of Vesuvian colleagues from our Port Kembla site in Australia in March 2021 pulled on high viz jackets and took part in the “Clean Up Australia – Step Up to Clean Up” initiative.

Every year, tens of thousands of people from across the country and all walks of life come together in their local communities to take part and make a positive difference to their local environment.

Vesuvius Australia invited our local Community Councillors to join them on the day. The collective cleared a large skip full of rubbish from the surrounding areas.



Protecting the environment continued

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.

ISO 14001:2015 certifications

Country	Company name	Site
Australia	Foseco Pty Ltd	Sydney
Belgium	Vesuvius Belgium N.V.	Ostend
Brazil	Foseco 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	Foseco India Limited	Puducherry
India	Foseco India Limited	Pune
Indonesia	P.T.Foseco Indonesia	Jakarta
Japan	Foseco Japan Limited	Toyokawa
Netherlands	Foseco Nederland BV	Hengelo
Poland	Vesuvius Poland Sp. z o.o.	Skawina
South Africa	Vesuvius South Africa (Pty) Limited	Olifantsfontein
South Korea	Foseco Korea Limited	Gyeonggi-do
Sweden	Vesuvius Scandinavia AB	Amal
Taiwan	Foseco Golden Gate Co. Limited	Ping Tung
United Kingdom	Vesuvius UK Limited	Tamworth

Protecting the environment continued

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.

CASE STUDY

Vesuvius colleagues planting trees around the world

Around the world, Vesuvius colleagues have taken part in a huge range of environmental initiatives, with tree planting programmes a very popular way to make a difference.

In 2021, colleagues at sites in the Netherlands, Poland and Brazil were involved in reafforestation and regeneration work that involved the planting of hundreds of trees and shrubs at public parks and our own sites.

Besides converting carbon dioxide (CO₂) into Oxygen (O₂), the trees protect the ground against erosion and landslides, they also absorb rainwater and convert it into groundwater making the soil rich and fertile.



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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, CO₂ 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.



Product safety and quality continued

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.



Product safety and quality continued

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.

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.

Product safety and quality continued

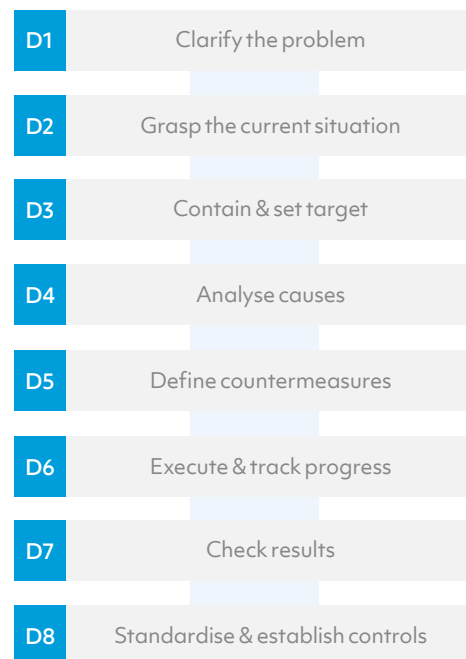
Problem-solving

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

CASE STUDY

DuraSleeve* offers range of customer benefits

In 2021, Vesuvius launched DuraSleeve*, a new generation of high-performance slag line sleeves designed to reduce the erosion of SEN/SES/MTSP slagline sleeve by 20%.

Our customers are more and more focused on higher productivity and reducing their carbon footprint. DuraSleeve*, through SEN/SES/MTSP slagline erosion resistance

improvement, will also help extend tundish lifetime and reduce the overall energy consumption and generated waste. Moreover, this new solution will enable Vesuvius to outperform its competitors.

This new product principally allows our customers to increase their productivity and provides more consistent and reliable performance. In addition to that, a more resistant slagline sleeve material will limit the ramping practice and hence bring a better quality of steel cast through our products.

Overall, by improving the sleeve material and its interaction with mold powder, DuraSleeve* offers:

- a productivity increase
- energy savings
- reduced labour and material cost
- a reduction of waste
- improved quality and reduced downgrades
- more reliable performance
- the possibility to increase mold clearance without negative impact on SEN/SES/MTSP performance.



20%

reduction in slagline sleeve erosion

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

Supporting our customers' journey to net zero continued

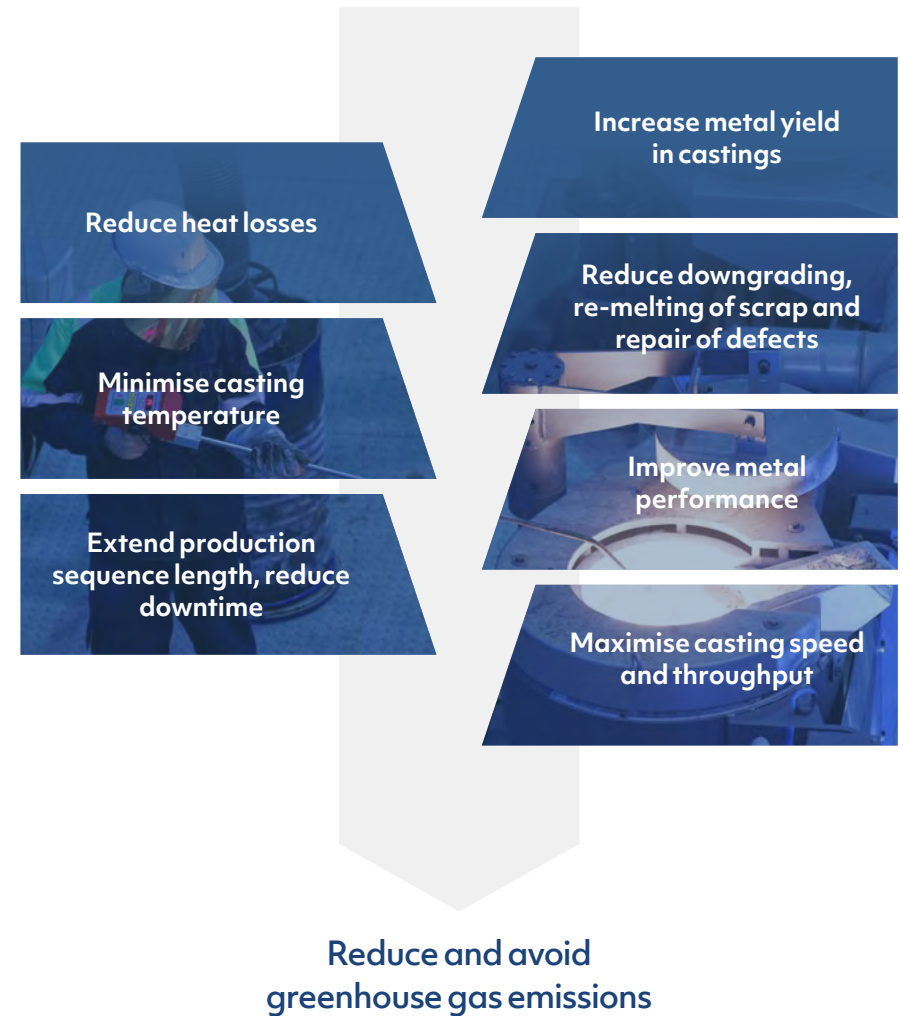
Sustainable solutions

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.

We actively cooperate with customers to help them evaluate the CO₂ 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 CO₂ 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 carbon-free 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.



Supporting our customers' journey to net zero continued

CASE STUDY

Prestigious innovation award for Vesuvius' DuraFlex* 5H



The Vesuvius DuraFlex* 5H ladle shroud won first place at the 2021 Usiminas Innovation Awards.

Usiminas is one of the largest producers of steel in the Americas, with major steel mills in Brazil with a total capacity of 9.5 million metric tons of steel per year. The company accounts for 28% of total steel output in Brazil and its awards, now in their 20th year, are highly prized in the industry.

The product awarded was the DuraFlex* 5H ladle shroud with extended can at the bottom. Usiminas converted to this ladle shroud in early 2020 and have manufactured more than 2000 pieces to date.

The high performance delivered by DuraFlex* 5H combined with an increase in steel quality were critical factors for Usiminas to choose Vesuvius as the 2021 winner. The award was made possible thanks to the work our Rio de Janeiro team who support the project and ensure high product consistency.



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

Supporting our customers' journey to net zero continued

CASE STUDY

Rapid Fire* Shotcrete: an innovative solution for a unique challenge

SIMEC Mining's iron ore pellet plant, based in Whyalla, South Australia, was experiencing hot face refractory failure at the kiln inlet and discharge end of their rotary kiln. This was because the incumbent material had less than a 12-month lifespan for the pellets across its lining.

The customer approached Vesuvius to propose a solution that would provide an improved lifespan, whilst also using rapid fire technology that could handle the aggressive start-up on their main Pillard burner.

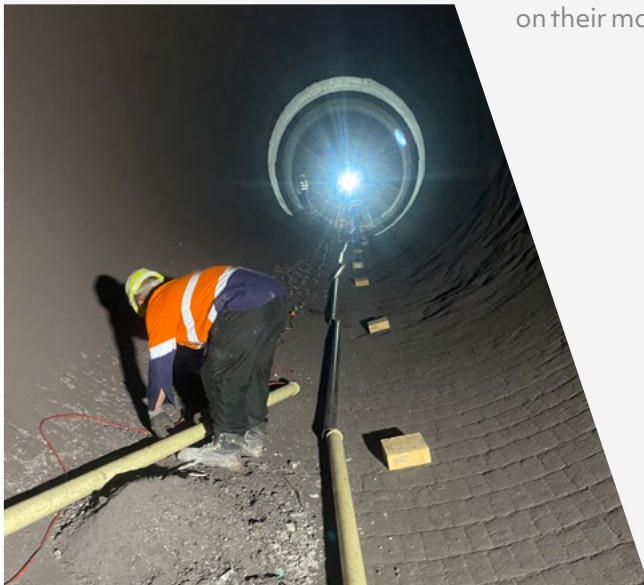
Vesuvius called on our global resources to provide the solution with Rapid Fire* Shotcrete, with input from the Vesuvius ANZ Technical and Laboratory support team who analysed our Shotcrete ranges from India and NAFTA before adapting the formula for Australian raw materials.

In addition, they ensured that the product could be pumped from 20 metres high and from 50 metres on the horizontal – a unique challenge in itself.

Rapid Fire* Shotcrete has many benefits including:

- A minimal curing period of just four hours. Accelerated dry-out rates going from an ambient temperature to 1200°C in 20 hours.
- No hold periods are required. Whilst conventional material requires a more conservative heat up Rapid Fire* Shotcrete gets the furnace back online and producing up to 56 hours quicker.
- Explosive steam spall resistance.

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



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 CO₂ emissions and help our customers reduce their CO₂ 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.

Supporting our customers' journey to net zero continued

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.

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.

CASE STUDY

Foundry China help customer to enter wind energy casting market

A customer in China was keen to enter the fast growing wind energy casting market but had no experience of making such demanding castings.

By working together with our colleagues in Foundry China, they managed to produce samples that exceeded the technical requirements demanded by the end-user and secured a contract to manufacture the hubs.

In short, Foundry China worked together with the customer to:

- minimise casting surface defects through the correct selection and application of refractory coatings;
- avoid turbulence and metal velocity related defects with the deployment of STELEX® PrO filters;
- ensure that the casting layout and design would produce a “right first time” casting by simulating the process in advance using MAGMA software; and
- achieve the necessary mechanical and metallurgical properties by developing a carefully designed two step metal treatment process.



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

Supporting our customers' journey to net zero continued

CASE STUDY

Foundry launch FEEDEX® FEF Feeder Sleeves

Our Foundry Technologies team in Borken Germany has developed a new feeder sleeve solution to support greensand foundries to reduce environmental impact and costs as their need for high performance spot feeders increases.

FEEDEX® FEF is a fluoride emission free, highly exothermic and high pressure-resistant feeder sleeve material for high pressure iron castings.

Available for the complete range of ram-up feeder sleeves, the solution sets a new standard in sustainability and best-in-class feed performance for high-pressure automatic moulding lines to deliver on the increasing demands of casting today's iron applications. Ongoing weight reduction, alloy developments and the demand for improved mechanical applications are driving constant change.

FEEDEX® FEF supports the industry's strong focus on reducing and eliminating harmful emissions and hazardous waste, being both fluoride emission free and lower in VOC than market alternatives.

At the same time, it is proven to deliver the highest thermal and feed performance. It offers the identical industry-valued easy application, consistency and high strength of conventional low fluoride FEEDEX® HD products, which makes the new feeder sleeves particularly suitable for the challenges of high-pressure automatic moulding lines.



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Supporting our customers' journey to net zero continued

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 ₂ emissions for the customer
	Volatile compounds emissions
Reduces waste, avoids landfill and increases recycling	Waste generation during manufacturing and usage
	Recyclability after usage

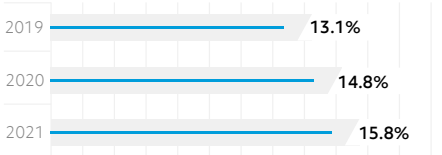
R&D covers a wide range of activities ranging from fundamental research and front end innovation to the evaluation of alternative material sources and support to operations. In 2021, our R&D spend was £30.3m, of which c.£10.8m (36%) was dedicated to the development of products which outperformed existing 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).

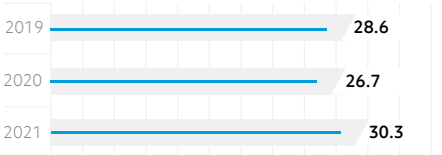
The challenge of decarbonising iron making or aluminium smelting requires the development and industrialisation of radically new technologies. We complement our internal efforts with partnerships with over a dozen research institutions, universities and strategic customers, working to develop the refractory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

Vesuvius' investment in innovation and sustainability

% of sales generated by market-leading sustainable products*



R&D spend (£m)



* Using Vesuvius' internal scorecard.

15.8%

of sales generated by market-leading sustainable products

Supporting our customers' journey to net zero continued

CASE STUDY

New tech cuts water and gas use in tundish lining

Vesuvius has developed a new technology that dramatically reduces water and gas consumption in the spray application of tundish lining.

Because tundish linings are sprayed on, water can make up to 25-30% of the materials applied. This means it is necessary to carry out a drying process to remove water and ensure the operational safety of the casting process. In addition to gas consumption, the drying process adds around three hours of processing time, which reduces equipment availability.

Vesuvius' new composition, Baselite* Quick Start, contains different additives and dispersing elements, and innovative packaging that uses about 30% less water than regular materials.

In addition, its physical characteristics reduce drying time, with only a quick heating being carried out 65 minutes before casting.

As well as the gains in preparation time and tundish availability, this technology brings an important gain in terms of gas savings and CO₂ generation.

30%

less water used in tundish linings



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Supporting our customers' journey to net zero continued

CASE STUDY

Sustainability icons highlight product benefits for customers

With sustainability becoming a strategic concern for many of our customers, Vesuvius is focusing on developing products and services that help them improve their environmental performance and create a safer workplace.

A set of icons highlighting the sustainability benefits of our products and their use was defined by a joint team of Marketing & Technology specialists from all three Business Units.

Four distinctly coloured icons are available: two to highlight product features and two to highlight benefits of application.

The use of the icons will be carefully managed and subject to strict approval rules to ensure consistency and that all claims are backed by robust evidence.

Product icons are used to highlight that there is an inherent feature that complies with the sustainability definition and that the benefits of that feature will be realised by any customer using that product.



Application icons are used to highlight that there is a feature that complies with the sustainability definition and that the benefits of that feature will be realised by the recommended application of the product.



In this section

Health, safety and well-being at work 70 >

People and Culture Strategy 84 >

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

CASE STUDY

Masterchef comes to Monterrey to promote healthy eating

Vesuvius is keen to promote healthy lifestyles to our people and supports a range of activities to raise awareness of the importance of healthy eating and exercise. Vesuvius colleagues in Monterrey have taken part in a terrific healthy eating promotion – the first annual Vesuvius Masterchef BBQ.

Five teams of five people were challenged to prepare a complete healthy meal including starter, main course and dessert, all prepared on a barbecue grill.

The teams had two hours to complete their meals and their efforts were impressive with the presentation of dishes worthy of a professional. Once complete the dishes were evaluated by a panel of five judges and a guest chef.

Finally, the teams with the most healthy and delicious meals were awarded prizes, with the winning team receiving the barbecue.



Health, safety and well-being at work continued

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

CASE STUDY

Care for people and meeting customer needs

When a COVID-19 spike hit parts of China, our colleagues in Bayuquan went above and beyond to serve our customers.

The top priority was to protect our people, and the site responded by providing a dormitory where colleagues could stay safely and comfortably.

Bayuquan is the only manufacturing base for Magnesite-Carbon bricks and Alumina-Magnesite-Carbon bricks. When a record order was received, the team worked tirelessly to bring everyone at the plant together and meet the order. The result was an historical production record, making a significant contribution to the global Advanced Refractories business.

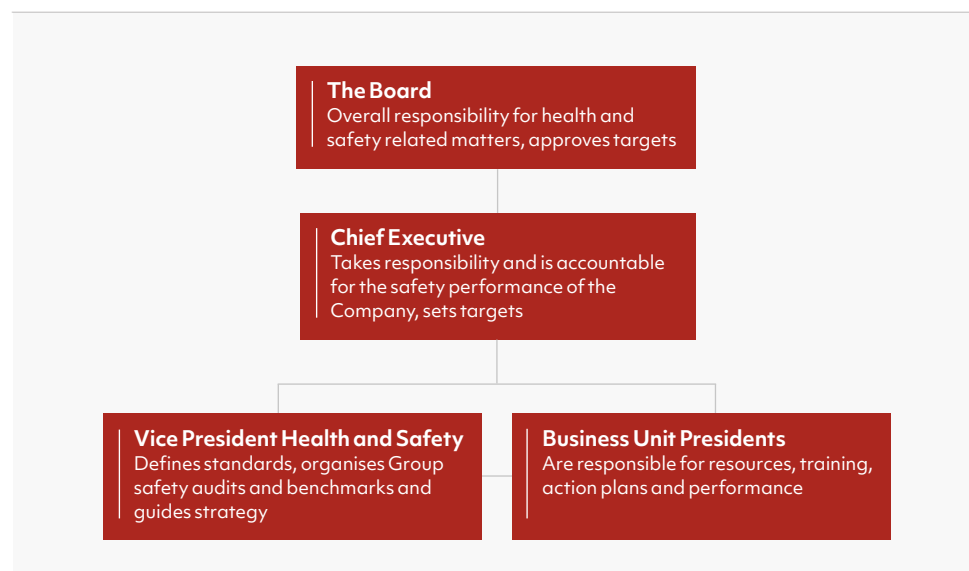


Health, safety and well-being at work continued

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, safety and well-being at work continued

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 continued

Health and Safety Policy

We will operate all work and business activities in a manner which ensures the physical and mental health and safety of employees, contractors, visitors, customers and any other persons affected by these activities.

We will comply with the legal health and safety obligations.

We will be pro-active in preventing injuries and ill-health, and continuously improve our Health and Safety systems and performance.

Our beliefs

Good Health and Safety is Good Business.

Safety is everybody's responsibility.

Working safely is a condition of employment.

All work-related injuries and work-related ill-health are preventable.

Our aims

No Accidents.

No Repeat Injuries.

No Harm to People.

Our commitments

- We will abide with simple and non-negotiable standards.
- We will report transparently and thoroughly investigate any incident to learn, share, and avoid repeats.
- Risk assessments will be undertaken to identify hazards, prioritise any deficiencies and correct them in an appropriate way as well as to develop appropriate safe work procedures.
- Every business facility will follow the agreed Health and Safety plans, committing to reduce the frequency and severity of injuries, improve workstation ergonomics, prevent exposure to hazardous substances, and minimize the risk of occupational diseases.
- We will ensure awareness about Health and Safety issues and provide training for all new employees and contractors, and then at least annually, to ensure that they understand their responsibilities and are able to act accordingly.
- Every business facility will have an appointed Health and Safety Manager.

Organisation and responsibilities

We regard health and safety matters as a mainstream management responsibility. Executives and line managers are directly responsible for health and safety matters in operations under their control. Management is accountable for Health and Safety performance against objectives.

All employees have a responsibility to take care of themselves and others whilst at work. We expect everyone to participate positively in the task of preserving workplace health and safety.

We will encourage our Suppliers to adhere to the same Health & Safety standards as we do.



Health, safety and well-being at work continued

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.

Health, safety and well-being at work continued

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).

Health, safety and well-being at work continued

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).

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.

8 Core Safety Rules



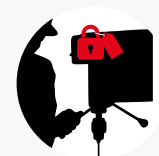
1. I always wear mandated personal protective equipment



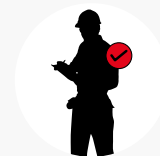
2. I only operate equipment or vehicles if trained and authorised



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

Health, safety and well-being at work continued

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.

Training activities routinely undertaken for our employees and contractors include:

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

Health, safety and well-being at work continued

Health and safety auditing

Group safety 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.

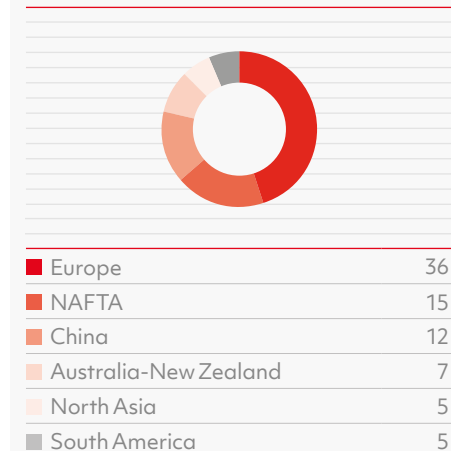
Safety audits and improvement opportunities

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.

Unique Executive Safety Tours 2021



Health, safety and well-being at work continued

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.

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.

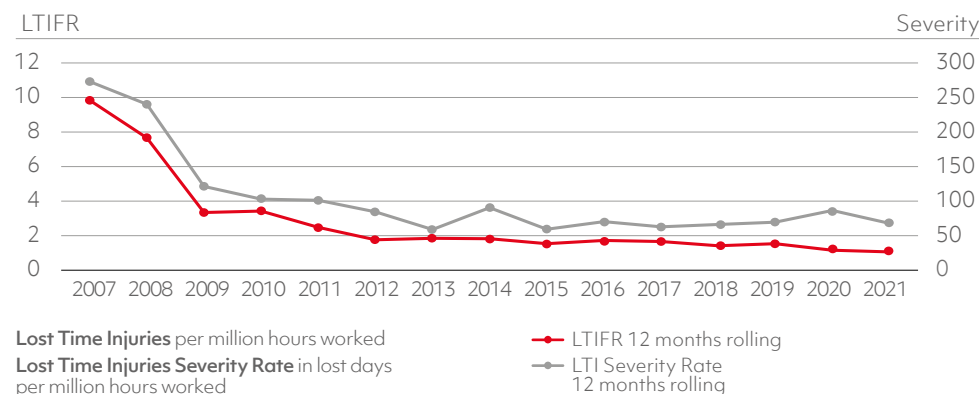
Health, safety and well-being at work continued

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.

Safety performance in 2021



CASE STUDY

Hand safety initiative part of global programme

The safety of our colleagues is our number one priority and around the world a range of activities are undertaken to raise awareness at many levels.

Colleagues in the San Rafael plant in Guadalupe, Nuevo León have taken part in an innovative and very colourful programme of activity to promote hand safety at work.

The first phase of the programme was a competition where colleagues were asked to come up with a "hand safe phrase", a catchy slogan that would stick in people's minds.

Secondly, the site held a special event with four activities including a display of security gloves and a risk identification activity.

And finally, site staff created a giant mural featuring multi-coloured cut outs of hands which were then signed by more than 150 administration and production workers. The hands were then put together in the mural in the dining room entrance, where it will be a constant reminder of the need for safety at work.



Health, safety and well-being at work continued

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

CASE STUDY

Vesuvius supports safety at customer site

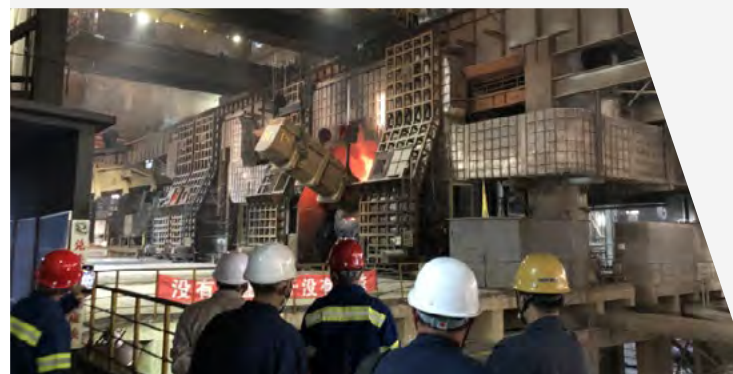
Vesuvius' commitment to health and safety goes beyond our own staff to our customers as well, many of whom will seek our support to improve safety at their sites.

Chaoyang Steel plant in China is part of Anshan Steel Group and a loyal long-term Vesuvius customer. In 2021, Chaoyang contacted Vesuvius to conduct some consultations on safety management and onsite training for the steel plant management. Chaoyang wanted to achieve better safety performance and ensure

that safety was embedded in daily routine and behaviour.

Vesuvius called on the skills and experience of our management team and HSE professionals to organise the training and share our insights into best practice in site safety.

A seminar was organised to discuss production safety, maintenance, and non-standard work safety challenges. Practical safety topics were shared, the customer presented their daily difficulties and questions, which were answered by our team with practical solutions. Our team covered the establishment of a safety culture and the setup of effective processes and HSE framework.



Health, safety and well-being at work continued

Main types of work-related injury

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.

Dangerous Occurrences

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).

Safety awards and recognition

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.



People and Culture Strategy continued

Employee engagement

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.

Permanent employee 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%

- Employee numbers exclude employees joining Vesuvius as a result of the acquisition of the Universal Refractories business.
- 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.

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.

People and Culture Strategy continued

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

Outstanding business

Critical skills and capabilities to win

Outstanding people

Capable managers leading diverse, engaged and high-performing teams

Outstanding function

Teaming up with the business to solve their biggest people issues

Winning culture

Embracing diversity of thinking and continuous innovation to achieve high levels of performance and growth

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.

People and Culture Strategy continued

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%.

People and Culture Strategy continued

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

Before arrival

Documents shared to be signed on first day
Equipment and systems accesses
Prepare the onboarding agenda
Line manager welcome email
Announcement preparation

First day

Welcome package
Mandatory trainings
Announcement
Understanding the organisation

First month

Vesuvius Foundations
Knowing the business and our industry
Knowing the team and shareholders
Knowledge transfer

First three months

Complete career information registered on 'myVesuvius'
Objectives setting
Meeting/Q&A session with senior leaders
People leader training
Probation period feedback

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% ¹	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.

People and Culture Strategy continued

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.

People and Culture Strategy continued

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.

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.

Workforce by gender¹

As at 31 December 2021

	Women	Men	Women	Men
Board	3	5	38%	62%
Group Executive Committee	2	6	25%	75%
Senior Management ²	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%



People and Culture Strategy continued

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.



In this section

Our principles – a responsible company 94 ➤

Responsible sourcing 99 ➤

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.



Our principles – a responsible company continued

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.

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.

Conflict minerals

We actively and routinely review our purchasing portfolio to check for conflict minerals. In 2021 we did not purchase any conflict minerals.

CASE STUDY

Vesuvius India helping the disadvantaged

Vesuvius colleagues around the world get involved in their local communities, with our colleagues in India very focussed on helping the most disadvantaged in society

Foseco India have been helping the local Rotary Club to support disadvantaged families in the local area, making a donation towards the distribution of "Happy Family Kits" of useful household items.

Rotary Clubs around India have distributed over 1000 of the kits which contain a biomass cooking stove, solar lamp, first aid kit, rubbish bins, napkins, soap, sanitary pads, face masks and a tarpaulin, and come in a large robust travel bag.

In another programme, Vesuvius teams collected clothing to support the work of the Society for Protection of Children in India, which has worked with deprived children, mostly girls, for the last 120 years.



Our principles – a responsible company continued

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.

Our principles – a responsible company continued

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.

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.

USA

Helping local food banks with financial support and clothing donations.

Germany

Contributing to Mülheim disaster relief after devastating floods caused millions of Euros' damage to homes and businesses.

Poland

Raising funds for people with disabilities by entering a team in the Poland Business Run, the country's largest charity business run.

Distributing 'back to school' kits containing uniforms, shoes, school bags and stationery to disadvantaged children.

India

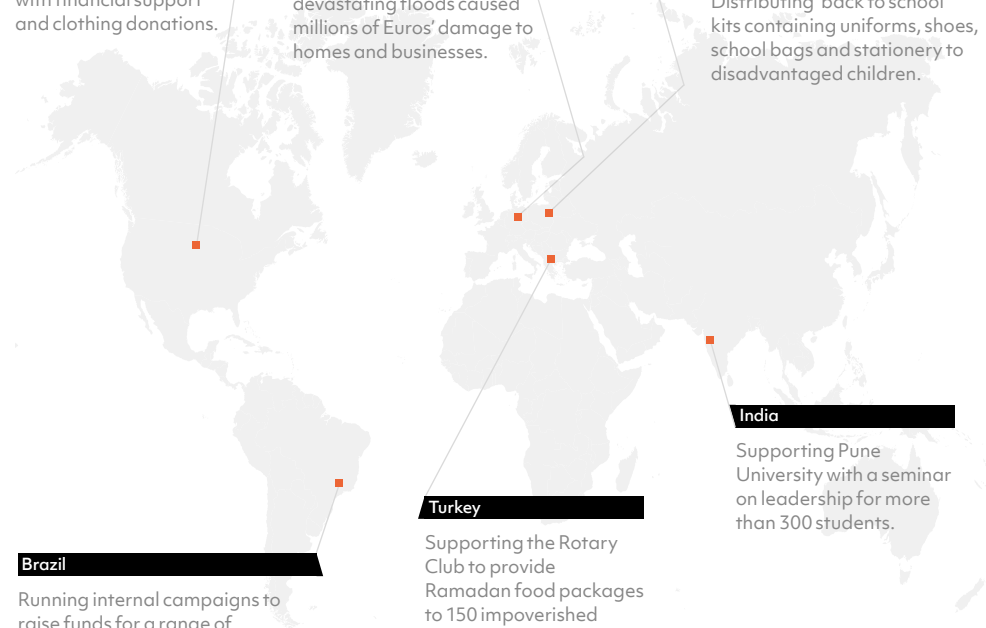
Supporting Pune University with a seminar on leadership for more than 300 students.

Turkey

Supporting the Rotary Club to provide Ramadan food packages to 150 impoverished families.

Brazil

Running internal campaigns to raise funds for a range of programmes including breast cancer awareness, clothing collections and elderly people who are without care.



Our principles – a responsible company continued

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.

CASE STUDY

Vesuvius supports the next generation of industry leaders

As part of our commitment to supporting our industry into the future, Vesuvius looks for opportunities to develop the next generations of leaders in our sector and support training and education programmes.

In Belgium, Vesuvius is an industrial partner of the Polytechnic Faculty of Mons and supported the Mechatronic Award 2020/21.

During the graduation ceremony at Mons University, students received

the Mechatronics Polytechnic Award, with a bursary funded by Vesuvius for the best Master's degree final project.

In South America, we operate a range of programmes, including our Young Apprentice programme in Piedade which provides professional training in specific occupations in the industry, aimed at young people aged between 14 and 24 years old with minimum education.

In 2021, we also supported a career workshop project in public high schools, helping young people to understand more about our industry and the career opportunities it offers.

4,388

employees received Anti-Bribery and Corruption training in 2021



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 CO₂ 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.

Responsible sourcing continued

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 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



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.

Responsible sourcing continued

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 CO₂ emissions

It was estimated that the CO₂ emissions from purchased goods and services represented 1,160 thousand metric tonnes of CO₂ in 2021 (78.2% of Vesuvius Scope 3 emissions and 61.8% of Vesuvius' total CO₂e emissions, see page 71 of our 2021 Annual Report). 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 CO₂ emissions and collect supporting data. This requires participating raw material suppliers to provide information on their energy sources, CO₂ 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 CO₂ 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.

Responsible sourcing continued

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.

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.

Areas of focus include:

Quality management rules: final inspection, controls at important process steps, management of incoming materials, data tracking, customer feedback and communication.

Management of non-conformities: reaction to non-conformities, protection of customer, problem resolution and application of lessons learned.

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.

GRI Index

GRI Standard	Disclosure Number/ Description	Page Number/Index comment	
General Disclosures			
Organisation Profile			
GRI 102: General Disclosures 2020	102-1 Name of the organization	Back cover AR 2021 page 238	Vesuvius plc
	102-2 Activities, brands, products, and services	Pages 5-9 https://www.vesuvius.com/en/our-solutions/en-uk.html	No products or brands are banned in any markets. Vesuvius sells its products around the world in compliance with applicable export control and sanctions regimes.
	102-3 Location of headquarters	AR 2021 page 238	165 Fleet Street, London EC4A 2AE, United Kingdom
	102-4 Location of operations	Page 14 https://www.vesuvius.com/en/about-us/where-we-operate.html https://www.vesuvius.com/en/about-us/overview/key-metrics.html	
	102-5 Ownership and legal form	AR 2021 page 231	Vesuvius plc is a public company limited by shares. It is incorporated and domiciled in England and Wales, United Kingdom, and listed on the London Stock Exchange. The nature of the company is a holding company.
	102-6 Markets served	Page 14 https://www.vesuvius.com/en/about-us/where-we-operate.html	
	102-7 Scale of the organization	Pages 5, 14, 88 AR 2021 pages 20, 38	
	102-8 Information on employees and other workers	Pages 85, 90	The following are not available: headcount broken down by (i) employment contract by gender and (ii) full-time vs. part-time by gender. The reason for the omission: data system does not capture information in this way, we are working to improve the effectiveness of the data system internationally. Temporary workers represent less than 10% of the workforce. Additionally, seasonal variations in headcount do not occur.
	102-9 Supply chain	Pages 95, 96, 98 https://www.vesuvius.com/en/supplier-portal/organisation-principles.html https://www.vesuvius.com/en/sustainability/our-policies.html https://www.vesuvius.com/content/dam/vesuvius/corporate/Sustainability/policies/Sustainable%20Procurement%20Policy.pdf	Raw materials are our dominant category and comprise unprocessed and processed mined materials, and chemicals. We source materials globally, with important sources in China, North America, Europe and India. Our supply chain also includes capital equipment and specialist services.
	102-10 Significant changes to the organization and its supply chain	Page 3	
	102-11 Precautionary Principle or approach	Pages 12, 81	
	102-12 External initiatives	Pages 2, 12, 22, 47, 52, 59, 94, 96, 100	
	102-13 Membership of associations	Pages 94, 96, 100	

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment	
General Disclosures			
Strategy			
GRI 102: General Disclosures 2020	102-14 Statement from senior decision-maker	Page 3 AR 2021 pages 10, 12-13	
Ethics and Integrity			
GRI 102: General Disclosures 2020	102-16 Values, principles, standards, and norms of behavior	Pages 15-16	
Governance			
GRI 102 General Disclosures 2020	102-18 Governance structure	Page 14, 18 AR 2021 pages 22-35, 52, 56, 107	
Stakeholder Engagement			
GRI 102: General Disclosures 2020	102-40 List of stakeholder groups	AR 2021 pages 22-28	
	102-41 Collective bargaining agreements	Page 91	
	102-42 Identifying and selecting stakeholders	Pages 1, 10 Code of Conduct pages 3, 6, 8-10 AR 2021 page 22	
	102-43 Approach to stakeholder engagement	Pages 10, 12, 14-17, 22, 44, 56, 58, 61, 64, 72, 84, 90, 95-97, 99-100 AR 2021 pages 23, 25-28, 57	
	102-44 Key topics and concerns raised	Pages 4, 10-11 AR 2021 pages 26-28, 57	
Reporting Practice			
GRI 102: General Disclosures 2020	102-45 Entities included in the consolidated financial statements	Page 3 AR 2021 pages 222-226	No entities listed in the financial statements fall out of the scope of the sustainability reporting, except for Vesuvius Penn Corporation which contains the business and assets of Universal Refractories, Inc. acquired in late 2021.
	102-46 Defining report content and topic Boundaries	Pages 16-17 AR 2021 page 57	
	102-47 List of material topics	AR 2021 page 57	
	102-48 Restatements of information		Minor restatements of safety statistics and environmental metrics have been made, with no significant effect on reported outcomes. These are due to error corrections and final updates of estimated data, for example.
	102-49 Changes in reporting	AR 2021 page 57	
	102-50 Reporting period	Calendar year 2021	

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment
General Disclosures		
Reporting Practice		
GRI 102: General Disclosures 2020	102-51 Date of most recent report	2020 https://www.vesuvius.com/en/sustainability/sustainability-reports.html
	102-52 Reporting cycle	Annual
	102-53 Contact point for questions regarding the report	Page 4 sustainability@vesuvius.com
	102-54 Claims of reporting in accordance with the GRI Standards	This report has been prepared in accordance with the GRI Standards: Core option.
	102-55 GRI content index	This Content Index
	102-56 External assurance	Page 40 AR 2021 page 118 https://www.vesuvius.com/en/sustainability/statutory-documents.html 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 have been externally verified by Carbon Footprint Ltd. The report has not been externally assured in its entirety. Senior management are involved in the ongoing review of management, collection, internal control, verification, and assurance of reporting information and data.
Topic Specific Disclosures		
Anti-Corruption		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 17, 96 Code of Conduct page 6
	103-2 The management approach and its components	Pages 17, 96, 99 AR 2021 p52 https://www.vesuvius.com/en/sustainability/our-policies.html
	103-3 Evaluation of the management approach	Pages 10-11 AR 2021 pages 34-35, 52-53, 120-121
GRI 205: Anti-Corruption 2016	205-2 Communication and training about anti-corruption policies and procedures	Pages 11, 89, 98-100 AR 2021 pages 13, 39, 121 All employees and contractors receive communication on the related policies. All governance body members receive training in these matters. Vesuvius does not collect training data entirely in the breakdown required by this disclosure. Reason for omission: the Board set a target applicable to a specific group of 4,388 permanent employees for the training, all of whom completed it. A regional breakdown is not available for this group. They comprised those with specific roles and interactions with third parties.

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment
Topic Specific Disclosures		
Materials		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 41-43, 99 Code of Conduct page 5
	103-2 The management approach and its components	Pages 10-11, 14, 43-44 https://www.vesuvius.com/en/sustainability/our-policies.html
	103-3 Evaluation of the management approach	Page 11 AR 2021 pages 34-35, 52-53, 58-59, 120-121
GRI 301: Materials 2016	301-2 Recycled input materials used	Pages 43-44, 46
Energy		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 22, 24, 29, 99
	103-2 The management approach and its components	Pages 10-11, 22-24, 32-33 https://www.vesuvius.com/en/sustainability
	103-3 Evaluation of the management approach	Pages 11, 32-33 AR 2021 pages 34-35, 52-53, 58-59, 120-121
GRI 302: Energy 2016	302-1 Energy consumption within the organization	Pages 34-39 No cooling or steam is purchased. No electricity, heat, cooling or steam is sold commercially. Electricity generated from our solar panels is exported to the network and reimported where it is accounted for as electricity purchased; the amounts are insignificant, and not material.
GRI 302: Energy 2016	302-2 Energy consumption outside of the organization	Pages 34-39
GRI 30 : Energy 2016	302-3 Energy intensity	Pages 36-37

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment
Topic Specific Disclosures		
Water and effluents		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 12-13, 23, 25 Code of Conduct page 5
	103-2 The management approach and its components	Pages 47, 50 https://www.vesuvius.com/en/sustainability/our-policies.html
	103-3 Evaluation of the management approach	Pages 11, 51-52 AR 2021 pages 34-35, 52-53, 58-59, 120-121
GRI 303-1 Management Approach 2018	303-1 Interactions with water as a shared resource	Pages 23-24, 47, 50
GRI 303-2 Management Approach 2018	303-2 Management of water discharge-related impacts	Pages 51-52 https://www.vesuvius.com/en/sustainability/our-policies.html
GRI 303: Water 2018	303-3 Water withdrawal	Not applicable (in line with GRI Standards 2020 clause 3.2)
GRI 303: Water 2018	303-4 Water discharge	Pages 46-47 All wastewater is within regulatory permit limits. No substances of concern are recorded. Discharges in areas with water stress are not significant. All wastewater is discharged to municipal sewer systems.
GRI 30 : Water 2018	303-5 Water consumption	Pages 47, 49 Total water consumption was 745,369 cubic metres or 745 megalitres. Water storage does not have a significant impact. We provide data in cubic meters (1 cubic metre = 1000 litres). Data is collected quarterly in submissions from all operations globally under the operational control of Vesuvius.

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment	
Topic Specific Disclosures			
Emissions			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 22-24 AR 2021 page 16 Code of Conduct page 5	
	103-2 The management approach and its components	Pages 10-11, 22-23, 26, 29, 32 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Pages 3, 11, 40 Carbon Footprint Statement of Verification (https://www.vesuvius.com/en/sustainability/statutory-documents.html) AR 2021 pages 34-35, 52-53, 58-59, 120-121	
GRI 305: Emissions 2016	305-1 Direct (Scope 1) GHG emissions	Pages 35-40	
GRI 305: Emissions 2016	305-2 Energy indirect (Scope 2) GHG emissions	Pages 35-40	
GRI 305: Emissions 2016	305-3 Other indirect (Scope 3) GHG emissions	Pages 35-40	
GRI 305: Emissions 2016	305-4 GHG emissions intensity	Pages 35-40	
GRI 305: Emissions 2016	305-5 Reduction of GHG emissions	Pages 35-38	
Waste			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 40, 43-45, 100 Code of Conduct page 5	
GRI 103: Management Approach 2016	103-2 The management approach and its components	Pages 10-11, 35, 44 https://www.vesuvius.com/en/sustainability/our-policies.html	
GRI 103: Management Approach 2016	103-3 Evaluation of the management approach	Pages 3, 11, 51 AR 2021 pages 34-35, 52-53, 58-59, 120-121	
306-1 Management Approach 2020	306-1 Waste generation and significant waste-related impacts	Pages 44-45, 57-58	Refractory production and steel and foundry operations have a significant history of environmental control owing to the potential impacts of process wastes on the environment. We have become a recognised enabler of positive environmental impacts through our high quality products.
306-2 Management Approach 2020	306-2 Management of significant waste-related impacts	Pages 41-44 https://www.vesuvius.com/en/sustainability/our-policies.html	
306 Waste 2020	306-3 Waste generated	Page 45	

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment	
Topic Specific Disclosures			
Environmental Compliance			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 51, 100 Code of Conduct page 5	
	103-2 The management approach and its components	Pages 51-52 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Pages 3, 52 AR 2021 pages 34-35, 52-53, 58-59, 120-121	
GRI 307: Environmental Compliance 2016	307-1 Non-compliance with environmental laws and regulations	Page 51	
Supplier Environmental Assessment			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 4, 10-11, 52, 100 Code of Conduct page 5	The topic boundary extends 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.
	103-2 The management approach and its components	Pages 10-11, 98-102 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Page 100 AR 2021 pages 34-35, 52-53, 58-59, 120-121	
GRI 308: Supplier Environmental Assessment 2016	308-1 New suppliers that were screened using environmental criteria	Page 100 AR 2021 pages 34-35, 52-53, 58-59, 120-121	Reason for omission: the assessment programme began in January 2021 and by 2022 it has been expanded to include new suppliers. Final data are not available yet.
Employment			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 11-12, 83-84 Code of Conduct page 8	The topic boundary is limited to employees and workers of Vesuvius plc.
	103-2 The management approach and its components	Pages 83-84 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Page 84 AR 2021 pages 34-35, 52-53, 58-59, 120-121	
GRI 40: Employment 2016	401-1 New employee hires and employee turnover	Page 85	We do not provide new hires data. We do not breakdown turnover by age, gender and region. Reason for omission: national data confidentiality rules relating to age are not uniform across the regions where we operate.

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment	
Topic Specific Disclosures			
Labour-Management Relations – Occupational Health and Safety			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 70-72 Code of Conduct page 5	The topic boundary is limited to employees and workers, and contractors of Vesuvius plc.
	103-2 The management approach and its components	Pages 70-76 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Page 79 AR 2021 pages 34-35, 52-53, 58-59, 120-121	
GRI 403: Management Approach 2018	403-1 Occupational health and safety management system	Pages 75, 77, 79	
GRI 403: Management Approach 2018	403-2 Hazard identification, risk assessment, and incident investigation	Pages 70, 78-79 Code of Conduct page 14 https://www.vesuvius.com/en/sustainability/our-policies/code-of-conduct.html	
GRI 403: Management Approach 2018	404-3 Occupational health services	Page 78	As part of the delivery of our safety management system, we provide occupational health services that are relevant to hazards and risks to which employees and others are exposed at our operations. Directly supervised contractors are treated the same as employees. Occupational health impacts are covered in the safety management risk identification. Occupational health and personal safety management is blended at all of our sites.
GRI 403: Management Approach 2018	403-4 Worker participation, consultation, and communication on occupational health and safety	Pages 71-73, 79	
GRI 403: Management Approach 2018	403-5 Worker training on occupational health and safety	Pages 75-77, 80	
GRI 403: Management Approach 2018	403-6 Promotion of worker health		In line with our values, and our commitment to employee engagement, benefits including access to healthcare and medical support are managed locally in accordance with local laws. Directly supervised contractors are treated the same as employees. Also, site management are attuned to local impacts, and local approaches to worker health operate in accordance with the risk at a local level.
GRI 403: Management Approach 2018	403-7 Prevention and mitigation of occupational health and safety impacts directly linked by business relationships	Pages 55-58, 66	
GRI 403: Occupational Health and Safety 2018	403-9 Work-related injuries	Pages 79-82	

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment	
Topic Specific Disclosures			
Training and Education			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 85-87	The topic boundary is limited to employees and workers of Vesuvius plc.
	103-2 The management approach and its components	Pages 83, 86-88 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Pages 84, 88 AR 2021 pages 34-35, 52-53, 58-59, 120-121	
GRI 404: Training and Education 2016	404-1 Average hours of training per year per employee	Pages 87-90	
GRI 404: Training and Education 2016	404-3 Percentage of employees receiving regular performance and career development reviews	Page 89	
Diversity and Equal Opportunity			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 14-15, 90 Code of Conduct page 8	The topic boundary is limited to employees and workers of Vesuvius plc.
	103-2 The management approach and its components	Pages 83, 85, 89, 100 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Pages 11, 90 AR 2021 pages 34-35, 52-53, 120-121	
GRI 405: Diversity and Equal Opportunity 2016	405-1 Diversity of governance bodies and employees	Page 90 AR 2021 pages 127-128	Vesuvius does not collect data entirely in the breakdown required by this disclosure. Reason for omission: national data confidentiality rules relating to age are not uniform across the regions where we operate.
Non-discrimination			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 12, 84, 94 Code of Conduct page 8 Gender Pay Gap reports (available at vesuvius.com)	The topic boundary is limited to employees and workers of Vesuvius plc.
	103-2 The management approach and its components	Pages 94, 100 AR 2021 pages 109, 127 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	AR 2021 pages 34-35, 52-53, 109, 120-121	
GRI 406: Non-discrimination 2016	406-1 Incidents of discrimination and corrective actions taken		Most Speak Up whistleblower reports received in 2021 related to HR issues (AR 2021 page 109), however we recorded no compliance concerns nor serious breaches of the Code of Conduct amongst them.

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment	
Topic Specific Disclosures			
Child Labour			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 94-96, 100 Code of Conduct page 8	In terms of topic boundary, the impact described is limited to our mica supply chain.
	103-2 The management approach and its components	Pages 94-96, 100 AR 2021 pages 109, 127 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Pages 95-96 AR 2021 pages 34-35, 52-53, 109, 120-121	
GRI 408: Child Labour 2016	408-1 Operations and suppliers at significant risk for incidents of child labour	Pages 95-96	Our internal operations control processes did not detect any child labour within our operations. All significant suppliers are subject to our supplier audit system; in 2021, the assessment of child labour was added to the scope of the supplier audit.
Local Communities			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 10, 15-16, 93, 96 Code of Conduct page 10	
	103-2 The management approach and its components	Pages 15-16, 50 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	AR 2021 pages 34-35, 52-53, 109, 120-121	
GRI 413: Local Communities 2016	413-1 Operations with local community engagement, impact assessments, and development programs	Page 91	
Supplier Social Assessment			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 4, 10-11, 99 Code of Conduct pages 5-7, 13	The topic boundary extends 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.
	103-2 The management approach and its components	Page 98 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Pages 98-99 AR 2021 pages 34-35, 52-53, 120-121	
GRI 414: Supplier Social Assessment 2016	414-1 New suppliers that were screened using social criteria	Pages 100-101	Reason for omission: the assessment programme began in January 2021 and by 2021 it has been expanded to include new suppliers. Final data are not available yet.

GRI Index continued

GRI Standard	Disclosure Number/Description	Page Number/Index comment	
Topic Specific Disclosures			
Customer Health and Safety			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Page 56	The topic boundary relates to Business-to-Business (B2B) customer operations.
	103-2 The management approach and its components	Pages 56-58, 100 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Pages 59, 63-64	
GRI 416: Customer Health and Safety 2016	416-1 Assessment of the health and safety impacts of product and service categories	Pages 56, 66	
GRI 416: Customer Health and Safety 2016	416-2 Incidents of non-compliance concerning the health and safety impacts of products and services	Page 58	Vesuvius plc were not notified of any non-compliance with regulations and/or voluntary codes concerning the health and safety impacts of products and services in 2021.
Socioeconomic Compliance			
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its Boundary	Pages 93, 100 Code of Conduct pages 5-8, 10, 13	
	103-2 The management approach and its components	Pages 94-95 https://www.vesuvius.com/en/sustainability/our-policies.html	
	103-3 Evaluation of the management approach	Pages 3, 52, 95 AR 2021 pages 34-35, 52-53, 120-121	
GRI 419: Socioeconomic Compliance 2016	419-1 Non-compliance with laws and regulations in the social and economic area	Pages 95-96	We have not identified any non-compliance in 2021.

VESUVIUS PLC

Vesuvius plc

165 Fleet Street

London

EC4A 2AE

T +44 (0)20 7822 0000

www.vesuvius.com

These images were taken by Vesuvius colleagues who were asked to submit photographs of different aspects of their work in a staff competition.

Page 50 Photography by Michel Wissink, Development & Service Technician. Vesuvius Hengelo