Risk Factors Comparison 2024-02-27 to 2023-03-14 Form: 10-K

Legend: **New Text** ~~Removed Text~~ Unchanged Text Moved Text Section

The Atotech Acquisition involves numerous risks, and we may not be able to effectively integrate Atotech' s business and operations or realize the expected benefits from the acquisition, which could materially harm our operating results. • As part of our business strategy, we have entered into and may continue to pursue business combinations and acquisitions that may be difficult to identify and complete, challenging and costly to integrate, disruptive to our business and our management, and / or dilutive to stockholder value. Financial Risks • Our consolidated indebtedness has increased substantially as a result of the Atotech Acquisition. This increased level of indebtedness could adversely affect us, including by increasing our interest expense and decreasing our business flexibility. • The terms of our ~~New~~ Term Loan Facility and ~~New~~ Revolving Facility (each as defined below) impose significant financial obligations and risks upon us, limit our ability to take certain actions, and could discourage a change in control. • A material amount of our assets represents goodwill and intangible assets ~~,~~ **. We incurred a net loss as a result of impairments of these assets in 2023** and our net income ~~would~~ **may** be **significantly** reduced ~~if our goodwill or intangible~~ **in subsequent periods by future impairments of these** assets ~~become impaired~~ . Risks Related to Cybersecurity, Data Privacy and Intellectual Property Protection • We are exposed to risks related to cybersecurity and data privacy threats and incidents, ~~including~~ **such as** the ransomware event we identified ~~on~~ **in** February ~~3,~~ 2023, and we are subject to restrictions and changes in laws and regulations governing data privacy and data protection, any of which could have a material adverse effect on our business. • Our proprietary technology is important to the continued success of our business. Our failure to protect this proprietary technology may significantly impair our competitive position. Risks Related to Our Operations • Supply chain disruptions and other manufacturing interruptions or delays have affected our ability to meet customer demand and have led to higher costs, while the failure to estimate customer demand accurately has resulted in excess or obsolete inventory, all of which has negatively impacted, and we expect will continue to impact, our business. • Our dependence on sole and limited source suppliers and international suppliers has negatively impacted, and could continue to impact our ability to manufacture products and systems. • Our failure to successfully manage the transition of certain of our products to other manufacturing locations ~~and /~~ **, the transition of certain of** ~~or~~ **our products** to **or from** contract manufacturers and the transition of certain other functions to centralized locations would likely harm our business, financial condition and operating results. • Our products could contain defects, which would increase our costs and seriously harm our business, financial condition, operating results and customer relationships. • Chemical manufacturing is inherently hazardous and could result in accidents that disrupt our operations or expose us to significant losses or liabilities. • We outsource a number of services to third- party service providers, which decreases our control over the performance of these functions. Disruptions or delays at our third- party service providers could adversely impact our operations. • The loss of net revenues from any one of our major customers would likely have a material adverse effect on us. • Key personnel have been, and may continue to be, difficult to attract and retain. Risks Related to Our Industries and Markets • The semiconductor, electronics manufacturing and automotive industries we serve are characterized by periodic fluctuations in business activity that may cause a reduction in demand for our products. • Many of the markets and industries we serve are highly competitive, are subject to rapid technological advancement, and have narrow design windows, and if we fail to introduce new and innovative products or improve our existing products, or if our products or the applications we invest in do not achieve widespread adoption, our business, financial condition and operating results will be harmed. • We offer products for multiple markets and must face the challenges of supporting the distinct needs of each of the markets we serve. Risks Related to Operating a Global Business • We face significant risks associated with doing business internationally. • We face significant risks associated with doing increased business in China in particular. • Unfavorable currency exchange rate fluctuations may lead to lower operating results or may cause us to change customer pricing, which could result in reduced sales and losses. Legal, Tax, Regulatory and Compliance Risks • We ~~have~~ **previously** identified a material weakness in our internal control over financial reporting and ~~that~~ **may discover additional material** ~~weakness~~ **weaknesses** ~~has led~~ **in the future. Our inability** to ~~a conclusion that~~ **remediate material weaknesses in the future, and** our **inability to achieve and maintain effective disclosure controls and procedures and** internal control over financial reporting ~~and disclosure controls and procedures were not effective as of December 31~~ , ~~2022. Our inability to remediate the material weakness, our discovery of additional weaknesses, and our inability to achieve and maintain effective disclosure controls and procedures and internal control over financial reporting~~ could adversely affect our results of operations, our stock price and investor confidence in our Company. • If significant trade restrictions or tariffs on our products or components that are imported from or exported to China continue or are increased, our business, financial condition and operating results may be materially harmed. • We are subject to international trade compliance regulations, and violations of those regulations could result in fines or trade restrictions, which could have a material adverse effect on us. • Changes in tax rates or tax regulation or the termination of tax incentives could affect our operating results. • Many of our products and customers are subject to numerous laws regulating the production and use of chemical substances, and some of our products may need to be reformulated or discontinued to comply with these laws and regulations. • We are subject to environmental regulations. If we fail to comply with these regulations, our business could be harmed. • We are exposed to various risks related to legal proceedings, including **,** for example, product liability claims, intellectual property infringement claims, **regulatory claims,** contractual claims and ~~securities~~ class action litigation, which if successful, could have a material adverse effect on our commercial relationships, business, financial condition and operating results. Risks Related to ~~the COVID- 19 Pandemic~~ **Pandemics** and other Widespread Health Crises • The ~~continued~~ effects of the COVID- 19 pandemic ~~or~~ **had, and** the emergence of other widespread health crises may have **,** an adverse effect on our business, financial condition and operating results. Risks Related to Owning Our Common Stock • Our quarterly operating results have fluctuated, and are likely to continue to vary significantly, which may result in volatility in the market price of our common stock. • The ~~future exercise of registration rights may adversely affect the market price of our common stock. • The~~ market price of our common stock has fluctuated and may continue to fluctuate for reasons over which we have no control. PART I Item 1. Business MKS Instruments, Inc. (" MKS " ~~or~~ **,** the " Company **", " our ", or " we** ") was founded in 1961 as a Massachusetts corporation. We enable technologies that transform our world. We deliver foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging, and specialty industrial applications. We apply our broad science and engineering capabilities to create instruments, subsystems, systems, process control solutions and specialty chemicals technology that improve process performance, optimize productivity and enable unique innovations for many of the world' s leading technology and industrial companies. Our solutions are critical to addressing the challenges of miniaturization and complexity in advanced device manufacturing by enabling increased power, speed, feature enhancement, and optimized connectivity. Our solutions are also critical to addressing ever- increasing performance requirements across a wide array of specialty industrial applications. Where You Can Find More Information We file reports, proxy statements and other documents with the Securities and Exchange Commission (" SEC "). Our SEC filings are available to you on the SEC' s website at http: / / www. sec. gov. Our website is http: / / www. mks. com. We are not including the information contained in our website as part of, or incorporating it by reference into, this Annual Report on Form 10- K. We make available free of charge through our website our Annual Reports on Form 10- K, Quarterly Reports on Form 10- Q, Current Reports on Form 8- K and amendments to these reports filed or furnished pursuant to Section 13 (a) or 15 (d) of the Securities Exchange Act of 1934, as amended (the " Exchange Act "), as soon as reasonably practicable after we electronically file such materials with, or furnish them to, the SEC. On August 17, 2022 (the " Effective Date "), we completed the acquisition of Atotech Limited (" Atotech "), through the acquisition of the entire issued share capital of Atotech by Atotech Manufacturing, Inc. ~~(" Bidco ")~~ , a Delaware corporation and indirect wholly owned subsidiary of the Company (the " Atotech Acquisition ~~"). The Atotech Acquisition was implemented by means of a scheme of arrangement under the laws of Jersey (the " Scheme ") pursuant to the definitive agreement entered into by the Company and Atotech on July 1, 2021, as amended by the Letter Agreement dated October 29, 2021 by and among the Company, Atotech and Bidco, and as further amended by the Amendment to the Implementation Agreement dated April 1, 2022 by and among the Company, Atotech and Bidco (together, the " Implementation Agreement~~ "). Atotech, which we operate as our Materials Solutions Division, develops leading process and manufacturing technologies for advanced surface modification, electroless and electrolytic plating, and surface finishing. Applying a comprehensive systems- and- solutions approach, Atotech ~~'~~ **'** s portfolio includes chemistry, equipment, software, and services for innovative and high- technology applications in a wide variety of end markets. Atotech further broadens the Company ~~'~~ **'** s capabilities by bringing leadership in critical chemistry solutions for electronics and packaging and specialty industrial applications ~~. On the Effective Date, pursuant to the Scheme and in accordance with the terms and conditions of the Implementation Agreement, Bidco acquired each issued and outstanding ordinary share of Atotech in exchange for per share consideration of $ 16. 20 in cash and 0. 0552 of a share of Company common stock. The total net purchase price, including cash consideration, net of cash acquired, value of MKS shares issued, repayment of Atotech debt and settlement of certain Atotech share- based awards totaled $ 5. 7 billion. The Company funded the payment of the aggregate cash consideration with a combination of cash on hand and the proceeds from the New Term Loan Facility, as defined below. As a result of the Atotech Acquisition, the Company issued an aggregate of 10. 7 million shares of Company common stock to the former Atotech shareholders. In connection with the completion of the Atotech Acquisition, the Company entered into a credit agreement with JPMorgan Chase Bank, N. A., as administrative agent and collateral agent, Barclays Bank PLC, and the lenders from time to time party thereto (the " New Credit Agreement "). The New Credit Agreement provides for (i) a senior secured term loan facility (the " New Term Loan Facility ") comprised of three tranches: a $ 1. 0 billion loan (the " USD Tranche A "), a $ 3. 6 billion loan (the " USD Tranche B ") and a EUR 600 million loan (the " Euro Tranche B "), each of which were borrowed in full on the Effective Date, and (ii) a senior secured revolving credit facility of $ 500 million (the " New Revolving Facility " and, together with the New Term Loan Facility, the " New Credit Facilities "), with the commitments under each of the foregoing facilities subject to increase from time to time subject to certain conditions~~ . Markets and Applications Since our inception, we have focused on satisfying the needs of our customers by establishing long- term collaborative relationships. We have a diverse base of customers across our ~~primary served~~ **three end-** markets, ~~which include~~ semiconductor, electronics and packaging, and specialty industrial. We have developed the following two product strategies that have been instrumental in delivering value to our customers and helping them solve their most complex problems: • Our Surround the ~~WaferSM~~ -- **Wafer ®** offering includes a wide range of products, design and development services, system **-** level integration, training programs, calibration, service, and repair for our semiconductor customers. This unique combination of products and services enables our customers to solve the challenges of ultra- thin layers, new materials and complex 3D structures while maintaining quality and productivity levels. We have cultivated this strategy over the past two decades by adding critical enabling technologies to our portfolio. The Surround the Wafer offering is an update from what we previously referred to as Surround the Chamber ®, given our broadened exposure in photonics solutions for lithography, metrology and inspection, which extends beyond just the vacuum chamber. • Our Surround the Workpiece ® offering includes product design and development, system **-** level integration, research and development, system, subsystem and component selection, and maintenance, repair and calibration services in the field of laser- based guidance and control for manufacturing processes. **In connection** ~~With~~ **with** the ~~recent acquisition of~~ Atotech **Acquisition** , we ~~have~~ introduced an extension of the Surround the Workpiece offering called Optimize the ~~InterconnectSM~~ -- **Interconnect ®** , which refers to MKS' combined laser drilling and chemistry solutions geared towards accelerating innovation and customers' time- to- market in printed circuit board (" PCB ") and package substrate manufacturing. At ~~our~~ **its** core, MKS is a foundational enabler of miniaturization and complexity. We believe there are three secular trends ~~benefitting~~ - **benefiting** MKS. First is the impact of a world that continues to be increasingly interconnected, driving the need for smaller, more powerful and feature- rich advanced electronic devices, which is enabled by semiconductor manufacturing, laser processing and chemistry solutions. Second is the increasing complexity of technology transitions in semiconductor, PCB and package substrate manufacturing, which leads to inflections, such as extreme vertical structures and process engineering at the atomic level, as well as increased interconnect density and smaller features. These inflections provide additional growth opportunities for MKS, as we believe we are uniquely positioned to deliver the broadest and deepest portfolio of solutions. Third is the accelerating need for laser- based precision manufacturing techniques, which are enabled by lasers, photonics, optics, precision motion control, vibration control and systems solutions. We believe our long history and deep expertise in solving critical problems position us well to address these challenges for our customers. Semiconductor Market MKS is a critical solutions provider for semiconductor manufacturing. Our products are used in major semiconductor processing steps, such as ~~depositing~~ - **deposition** ~~thin films of material onto silicon wafer substrates~~ , etching, cleaning, lithography, metrology, and inspection. The semiconductor industry continually faces new challenges, as products become smaller, more powerful and highly mobile. Ultra- thin layers, smaller critical dimensions, new materials, 3D structures, and the ongoing need for higher yield and productivity drive the need for tighter process measurement and control, all of which MKS supports. We believe we are the broadest critical subsystem provider in the wafer fabrication equipment ecosystem and address over 85 % of the market. We have characterized our broad and unique offering as Surround the Wafer to reflect the technology enablement we provide across almost every major process in semiconductor manufacturing today. The semiconductor market is subject to rapid demand shifts, which are difficult to predict. We cannot be certain as to the timing or extent of future demand or any future ~~weakness~~ **softness** in the semiconductor capital equipment industry. For example, **due in part to these demand shifts,** our semiconductor market revenue sequentially **decreased 28 % in 2023, but it sequentially** increased 12 % in 2022 ~~,~~ **and** 32 % in 2021 ~~, and 49~~ **. Approximately 41** % ~~in 2020. We anticipate that our semiconductor revenue could decrease in 2023~~ , ~~as a result of expected softening in the semiconductor market following three years of significant growth, due, in part, to new U. S. government regulations, as further described under Part II, Item 7, " Management' s Discussion and Analysis of Financial Condition and Results of Operations — Segments and Markets — Semiconductor Market. " Approximately~~ 58 %, **and** 62 ~~%, and 59~~ % of our net revenues for **2023,** 2022, **and** 2021 ~~, and 2020~~ , respectively, were from sales to our semiconductor market. ~~Following~~ **This decrease from 2022 to 2023 was primarily a result of the full-year impact of** the Atotech Acquisition, ~~MKS' end-~~ **as MSD only sells into our electronics and packaging and specialty industrial** ~~market~~ **markets** ~~exposure has become more diversified and in the fourth quarter of 2022, revenue from the semiconductor market was 46 % of total net revenues~~ . Electronics and Packaging Market MKS is a foundational solutions provider for the electronics and packaging market. Our portfolio includes photonics components, laser drilling systems, electronics chemistries and plating equipment ~~,~~ that are critical for the manufacturing of PCBs and package substrates, **and critical to** ~~as well as in~~ wafer level packaging (" WLP ") applications. Similar to the semiconductor industry, the PCB, package substrate and WLP industries **increasingly** demand smaller features, greater density, and better performance. In addition, the electronics and packaging market also includes sales of our vacuum and photonics solutions for display manufacturing applications. We characterize our complementary offering of laser systems and chemistry solutions as Optimize the ~~InterconnectSM~~ -- **Interconnect** , to reflect the unique technology enablement we provide at the interconnect level within PCBs, package substrates and WLPs. Approximately **25 %,** 15 %, **and** 12 ~~%, and 11~~ % of our net revenues for **2023,** 2022, **and** 2021 ~~, and 2020~~ , respectively, were from sales to our electronics and packaging market. Specialty Industrial Market MKS' strategy in specialty industrial is to leverage our domain expertise and proprietary technologies across a broad array of applications in industrial technologies, life and health sciences, and research and defense markets. Industrial Technologies Industrial technologies encompasses a wide range of diverse applications, including chemistries for functional coatings, surface finishing and wear resistance in the automobile industry, vacuum solutions for synthetic diamond manufacturing and photonics for solar manufacturing. Other applications include vacuum and photonics solutions for light emitting diode and laser diode manufacturing. Life and Health Sciences Our products for life and health sciences are used in a diverse array of applications, including bioimaging, medical instrument sterilization, medical device manufacturing, analytical, diagnostic and surgical instrumentation, consumable medical supply manufacturing and pharmaceutical production. Research and Defense Our products for research and defense are sold to government, university and industrial laboratories for applications involving research and development in materials science, physical chemistry, photonics, optics and electronics materials. Our products are also sold for monitoring and defense applications including surveillance, imaging and infrastructure protection. Approximately **34 %,** 27 %, **and** 26 ~~%, and 29~~ % of our net revenues for **2023,** 2022, **and** 2021 ~~, and 2020~~ , respectively, were from sales to our specialty industrial market. International Markets A significant portion of our net revenues is from sales to customers in international markets. For **2023,** 2022, **and** 2021 ~~, and 2020~~ , international net revenues accounted for approximately **66 %,** 58 %, **and** 57 ~~% and 55~~ %, respectively, of our total net revenues. A significant portion of our international net revenues were from sales to customers in China, Germany **, Japan** and South Korea. We expect that international revenues will continue to account for a significant percentage of total net revenues for the foreseeable future. Long- lived assets located outside of the United States accounted for approximately **58 % and** 57 ~~% and 28~~ % of our total long- lived assets in **2023 and** 2022 ~~and 2021~~ , respectively ~~. The increase in long- lived assets outside of the United States primarily related to the Atotech Acquisition~~ . Long- lived assets include property, plant and equipment, net, right- of- use assets, and certain other assets ~~and exclude goodwill, intangible assets and long- term tax- related accounts~~ . Reportable Segments, and Product and Service Offerings **We are divided into** ~~In the first quarter of 2022, we updated the names of our then-~~ three divisions **:** ~~in order to simplify our naming convention. These three divisions, formerly known as the Vacuum & Analysis Division, the Light & Motion Division and the Equipment & Solutions Division, were renamed~~ the Vacuum Solutions Division (" VSD "), the Photonics Solutions Division (" PSD ") and the ~~Equipment Solutions Division (" ESD "), respectively. Following the Atotech Acquisition, we refer to the Atotech business as the~~ Materials Solutions Division (" MSD "). ~~During~~ **MSD represents** the **Atotech** ~~third quarter of 2022, we consolidated our~~

~~equipment solutions~~ business **and was established following the Atotech Acquisition** ~~(“ ESB ”), previously ESD, into a component of PSD~~ . We group our product offerings by our reportable segments: VSD, PSD and MSD. Global Service represents our service offerings and consists of total services for all three of our reportable segments. VSD delivers foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging and specialty industrial applications. VSD products are derived from our core competencies in pressure measurement and control, flow measurement and control, gas and vapor delivery, gas composition analysis, electronic control technology, reactive gas generation and delivery, power generation and delivery and vacuum technology. Its products include: • Pressure and Vacuum Control Solutions Products, which consist of direct and indirect pressure measurement. • Materials Delivery Solutions Products, which include flow and valve technologies as well as integrated pressure measurement and control subsystems, which provide customers with precise control capabilities. • Power Solutions Products, which consist of microwave and radio frequency power delivery systems, radio frequency matching networks and metrology products. Our power delivery solutions are used to provide energy to various etching, stripping and deposition processes. • Plasma and Reactive Gas Products, which consist of remote plasma and ozone generators that create reactive species. A reactive gas is used to facilitate various chemical reactions in the processing of thin films, including the deposition of films, etching and cleaning of films and surface modifications. PSD provides a broad range of instruments, components and subsystems to leading edge semiconductor manufacturing, electronics and packaging and specialty industrial applications. PSD products are derived from our core competencies in lasers, photonics, optics, temperature sensing, precision motion control and vibration control. Its products include: • Laser Products, which consist of continuous wave and pulsed nanosecond and ultrafast lasers based on diode, diode- pumped solid- state and fiber laser technologies. • Photonics Products, which include precision motion control, optical tables and vibration isolation systems, photonic instruments, high- performance optics and optical assemblies, opto- mechanical components, temperature- sensing products for wafer fabrication systems, laser and LED measurement products, including laser power and energy meters and laser beam profilers and complex optical and photonic subsystems. • Laser- based systems for PCB manufacturing, which include flexible interconnect PCB processing systems and high- density interconnect **(“ HDI ”)** solutions for **the creation of blind micro- vias necessary for the manufacturing of PCBs (flexible,** rigid ~~PCB manufacturing and substrate processing. • Multi~~ - **flexible, multilayer, HDI** ~~layer ceramic capacitor (“ MLCC ”~~) ~~test systems, which include testing of ultra- small form factor MLCCs, used mainly in smartphones~~ and **package substrates** ~~other electronics manufacturing and large chip MLCCs, used mainly in automotive and communications infrastructure applications~~ . MSD develops leading process and manufacturing technologies for advanced surface modification, electroless and electrolytic plating, and surface finishing. ~~Atotech is a brand within MSD.~~ Applying a comprehensive systems- and- solutions approach, MSD' s portfolio includes chemistry, equipment, software, and services for innovative and high- technology applications in our electronics and packaging and specialty industrial markets. Its products include: • **Advanced** ~~Chemical~~ **chemical** processes ~~and~~ **,** production equipment **and software solutions,** for ~~PCB~~ **the** manufacturing **of** ~~, which include flexible, rigid- flexible, multilayer, high- density interconnect PCB~~ **PCBs** ~~processing~~ , package ~~substrate~~ **substrates** and ~~wafer~~ **wafers** ~~level packaging~~ used in **smartphones, computers, other** ~~a wide spectrum of industries such as~~ consumer electronics, ~~communications infrastructure~~ **server and data centers** , automotive electronics, **and the** medical and industrial **industries** . • **Advanced** ~~Chemical~~ **chemical** processes and production equipment for decorative and functional surface finishing, which include decorative, corrosion- protective, and wear- resistant coatings for various end markets **,** such as ~~the~~ automotive, construction, energy, **household appliance** and heavy machinery ~~industries~~ . • **Advanced** ~~Chemical~~ **chemical** processes for paint **support** applications **,** including pretreatment, stripping and overspray treatment for ~~the~~ **various end markets such as** automotive **, construction, aviation, heavy machinery** and household appliance ~~industries~~ . For further information on our segments, see Note ~~20~~ **22** to the Notes to Consolidated Financial Statements contained in Part II, Item 8 of this Annual Report on Form 10- K. Global Service includes: • Installation services and training for many of our products. • **On- site services for maintenance and repair of equipment and critical subsystems. •** Technical support offices and technology centers located near many of our customers’ facilities. • Repair and calibration services at internal service depots and authorized service providers located worldwide. • Warranties on our products that typically range from one to three years, with the majority of the warranties on our products ranging from one to two years. We typically provide warranties on our repair services for periods ranging from 90 days to up to one year, depending upon the type of repair. We also offer extended warranties **on our products** ranging from one to five years. Customers We sell our products and services to thousands of customers worldwide, in a wide range of end markets. **Net** ~~Revenues~~ **revenues** from our top ten customers accounted for **30 %,** 42 % ~~,~~ **and** 46 ~~% and 44~~ % of net revenues for **2023,** 2022 ~~,~~ **and** 2021 ~~and 2020~~ , respectively. **None of** ~~Lam Research Corporation and Applied Materials, Inc. were~~ our ~~top two~~ customers in ~~2022~~ **2023** ~~and together~~ accounted for ~~approximately 24~~ **greater than 10** % of ~~our~~ net revenues ~~. Both of these customers are in the semiconductor market~~ . Sales and Marketing Our worldwide sales and marketing organizations are also critical to our strategy of maintaining close relationships with a wide array of customers across a diverse set of advanced applications, including semiconductor capital equipment manufacturers, semiconductor device manufacturers, PCB and package substrate manufacturers, and customers across a range of specialty industrial applications. We market and sell our products and services through our global direct sales organization, an international network of independent distributors and sales representatives, our websites and product catalogs. We maintain a marketing staff that identifies customer requirements, assists in product planning and specifications, and focuses on future trends in the markets we serve. Research and Development Our products incorporate sophisticated technologies to measure, monitor, deliver, analyze, power, control and improve complex semiconductor and advanced manufacturing processes, thereby enhancing uptime, yield and throughput for our customers. With the Atotech Acquisition, we also offer a broad portfolio of specialty chemistry solutions for advanced surface modification, electroless and electrolytic plating, surface finishing, functional coating and corrosion resistance applications. MSD is supported by 15 state- of- the- art global technology centers, which are used to conduct extensive research and development in order to anticipate future industry requirements. We continue to develop our products as we strive to meet our customers’ evolving needs. We have developed, and continue to develop, new products to address industry trends, such as the shrinking of integrated circuit critical dimensions and technology inflections, and, in the flat panel display and solar markets, the transition to larger substrate sizes, which require more advanced processing and process control technology, the continuing drive toward more complex and accurate components and devices within the handset, tablet and high performance computing markets, the transition to 5G for both communications devices and infrastructure, the growth in units and via counts in the **HDI** ~~high density interconnect~~ PCB and package substrate markets, and the industry transition to battery- powered vehicles in the automotive market. In addition, we have developed, and continue to develop, products that support the migration to new classes of materials, ultra- thin layers, and 3D structures that are used in small geometry manufacturing. In our chemistry and equipment plating businesses, a majority of our research and development investment supports existing customers' product improvement needs and their short- term research and development goals, which enables us to pioneer new high- value solutions while limiting commercial risk. We involve our marketing, engineering, manufacturing and sales personnel in the development of new products in order to reduce the time to market for new products. Our employees also work closely with our customers’ development personnel, helping us to identify and define future technical needs on which to focus research and development efforts. We support research at academic institutions targeted at advances in materials science, semiconductor process development and photonics. Our research and development expenses were $ **288 million, $** 241 million ~~,~~ **and** $ 200 million ~~and $ 173 million~~ for **2023,** 2022 ~~,~~ **and** 2021 ~~and 2020~~ , respectively. Our research and development efforts include numerous projects, none of which are individually material, and generally have a duration of 3 to 36 months, depending upon whether the product is an enhancement of existing technology or a new product. Our current initiatives include projects to enhance the performance characteristics of older products, to develop new products and to integrate various technologies into subsystems. Manufacturing activities include the assembly and testing of components and subassemblies, which are integrated into our products. Our manufacturing facilities are located in Austria, Brazil, Canada, China, Czech Republic, France, Germany, India, Israel, Italy, Malaysia, Mexico, Romania, Singapore, South Korea and the United States. In addition, we rely on significant subcontracted operations in Mexico and selected contract manufacturers in Asia. Our business depends on the timely supply of products and services that meet the rapidly changing technical and volume requirements of our customers, which depends in part on the timely delivery of parts, components and subassemblies from suppliers, including contract manufacturers. We purchase a wide range of electronic, optical, mechanical and electrical components, some of which are designed to our specifications. We consider our lean manufacturing techniques and responsiveness to customers’ significantly fluctuating product demands to be a competitive advantage. Backlog We generally schedule production of our products based upon our customers’ delivery requirements. Lead times for many of our products are very short, as a large portion of our orders are received and shipped within 90 days. Some of the plating equipment manufactured by MSD has longer lead times of up to 12 months. In many cases, orders may be subject to cancellation or rescheduling by the customer with limited or no penalty. Our backlog at any particular date, therefore, is not necessarily indicative of actual sales which may be generated for any succeeding period. Historically, our backlog levels have fluctuated based upon the ordering patterns of our customers and changes in our manufacturing capacity ~~. Order patterns exiting 2022 reflected a softening demand for semiconductor capital equipment anticipated for 2023~~ . Competition The market for our products is cyclical and highly competitive. Principal competitive factors include product quality, performance and price, historical customer relationships, breadth of product line, ease of use, manufacturing capabilities and responsiveness, and customer service and support. Although we believe that we compete favorably with respect to these factors, we can make no assurances that we will continue to do so. We encounter substantial competition in most of our product lines, although no single competitor competes with us across all product lines. Certain of our competitors have greater financial and other resources than we do. In some cases, competitors are smaller than we are, but are well established in specific product niches. For example, in VSD, Advanced Energy Industries, Inc. offers products that compete with our power solutions, plasma and reactive gas and photonics products. Inficon, Inc. offers products that compete with our pressure and vacuum control solutions products. Hitachi Ltd., Horiba Ltd., Brooks Instrument and VAT, Inc. offer products that compete with our materials delivery solutions products. In PSD, Trumpf Group, Lumentum Holdings Inc., IPG Photonics Corporation, EdgeWave GmbH and Amplitude Systemes SA offer products that compete with our laser products. Coherent Corp., ~~Qioptiq Ltd~~ **Excelitas Technologies Corp** ., Jenoptik AG and Thorlabs, Inc. offer products that compete with our laser and photonics products. Sigma Koki Co., Ltd. and PI miCos GmbH offer products that compete with our photonics products. Our laser- based systems for PCB manufacturing primarily compete with laser- based systems provided by Via Mechanics, Ltd., EO Technics Co., Ltd. and Mitsubishi Electric Corporation. ~~Our MLCC test systems primarily compete with Humo Laboratory Ltd., as well as component manufacturers that develop systems for internal use.~~ In MSD, Element Solutions Inc., DuPont de Nemours, Inc., Uyemura, Dipsol Chemicals Co., Ltd., JCU International, Inc. and Okuno Chemical Industries Co., Ltd. offer products that compete with our chemistry products. Schmid Group, Process Automation International Limited and Manz AG offer products that compete with our plating equipment products **. Sources and Availability of Materials, Parts and Components We use various suppliers and contract manufacturers to supply materials, parts and components for manufacturing and support of our product lines. Although our intention is to establish multiple sources of supply whenever practicable, we have sole or limited source supply arrangements for certain materials, parts and components, such as certain metals and electronic components. Certain of our sole or limited source supply arrangements are the result of “ copy exact ” requirements of our customers. We may not be able to procure these materials, parts and components from alternate sources at acceptable prices and quality within a reasonable time, or at all. The risk of loss or interruption of this supply could impact our ability to deliver certain products on a timely basis. For additional information about risks related to our supply chain, please refer to our Risk Factors in Part I, Item 1A of this Annual Report** . Patents and Other Intellectual Property Rights We rely on a combination of patent, copyright, trademark and trade secret laws and license agreements to establish and protect our proprietary rights. As of December 31, ~~2022~~ **2023** , we owned ~~764~~ **690** U. S. patents and 3, ~~430~~ **121** foreign patents that expire at various dates through ~~2044~~ **2042** . As of December 31, ~~2022~~ **2023** , we had ~~144~~ **169** pending U. S. patent applications. Foreign counterparts of certain U. S. applications have been filed or may be filed at the appropriate time. We require each of our employees, including our executive officers, to enter into standard agreements pursuant to which the employee agrees to keep confidential all of our proprietary information and to assign to us all inventions while they are employed by us. Government Regulations We are subject to various federal, state, local and international laws and regulations relating to the development, manufacture, sale and distribution of our products and services, and it is our policy to comply with the laws in every jurisdiction in which we conduct business. Regulations include, but are not limited to, those related to the environment, corruption, bribery, import and export controls, competition, product safety, workplace health and safety, employment, labor and data privacy. The following describes certain significant regulations that may have a material effect on our capital expenditures, earnings and competitive position. For additional information about risks related to government regulations, please refer to “ Risk Factors – Legal, Tax, Regulatory and Compliance Risks ” in Part I, Item 1A of this Annual Report on Form 10- K. Trade Compliance We are subject to trade compliance laws in both the United States and other jurisdictions where we operate, including export regulations such as the U. S. Export Administration Regulations, administered by the U. S. Department of Commerce’ s Bureau of Industry and Security, and the International Traffic in Arms Regulation, administered by the Department of State’ s Directorate of Defense Trade Controls. Environmental Regulations We are subject to various, federal, state, local and international laws and regulations relating to environmental protection, including those governing discharges of pollutants into the air, water and land, the reporting, generation, use, handling, storage, transportation, treatment and disposal of hazardous substances, waste and other materials and the cleanup of contaminated sites. These environmental regulations include the European Union Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals ~~(“ EU REACH ”)~~ and the Toxic Substances Control Act ~~(the “ TSCA ”)~~ in the United States. Human Capital In order to compete and succeed in highly competitive markets and industries that are subject to rapid technological change, we believe it is critical to attract, motivate and retain a dedicated, talented and innovative team of employees. As part of these efforts, we strive to foster a diverse, equitable and inclusive community, invest in continuous learning and development, engage meaningfully with employees, offer a competitive compensation and benefits program and provide a safe and healthy workplace. ~~Our total workforce and geographic presence significantly increased as a result of the Atotech Acquisition.~~ As of December 31, ~~2022~~ **2023** , we had a total workforce of approximately 10, ~~900~~ **200** individuals, excluding contracted employees, across ~~39~~ **37** countries, with ~~31~~ **33** % located in the Asia- Pacific region, ~~31~~ **33** % located in Europe, the Middle East and India, and ~~38~~ **34** % located in the Americas. Of our total workforce, approximately 10, ~~450~~ **000** were employees and approximately ~~450~~ **200** were temporary workers. Of our total workforce, ~~14~~ **18** % work in research and development, ~~50~~ **56** % work in operations, manufacturing, service and quality assurance, and ~~36~~ **26** % work in sales, order administration, marketing, finance **, human resources** , legal, information technology, general management and other administrative functions. Diversity, Equity and Inclusion At MKS, **we embrace the strength found in** our **diversity – a diversity of perspectives, experiences, and thoughts. Our** commitment **is** to **cultivate an inclusive environment where all team members feel valued and empowered to bring their authentic selves to their work. This dedication stems from our belief that diverse viewpoints not only spur innovation but also fuel exceptional performance and sustainable progress.** ~~diversity~~ **Diversity** , equity **,** and inclusion (“ DE & I ”) is ~~core to~~ **deeply ingrained in** our ~~culture~~ **cultural fabric** . **The composition** ~~We believe that diversity~~ of ~~gender, race, ethnicity, sexual orientation, culture, education, background and experience fuels innovation and results, as well as enables~~ our ~~employees to succeed. Our~~ executive team ~~is comprised of 22~~ **reflects this commitment, with women representing 30** % ~~female members~~ and ~~22~~ **people of color representing 30** % ~~racially diverse members~~ . ~~Our~~ **Similarly, our** Board of Directors is comprised of ~~33~~ **38** % **women** ~~female members~~ , ~~22~~ **25** % ~~racially diverse members~~ **people of color** and ~~11~~ **13** % LGBTQ members, and our Lead Director is a woman. We have ~~been recognized~~ **garnered recognition** for our ~~commitment~~ **efforts** to ~~advancing~~ **advance gender diversity** ~~women’ s representation~~ on ~~the~~ **public company** boards ~~of directors of public companies~~ . **To further** ~~We have taken a number of steps to~~ foster DE & I at MKS **, we have implemented several initiatives** : • **Since 2020,** ~~Over~~ **over** ~~the last three years, approximately~~ 320 of our **global** leaders **have** ~~around the world~~ completed a six- week DE & I program ~~hosted~~ **led** by a **renowned** consulting firm ~~recognized as best-~~ in ~~- class in~~ the **field** ~~area of DE & I capability building~~ . • ~~In 2022~~ **Throughout the year** , we **provide** ~~continued to offer~~ DE & I training for all employees and bias awareness ~~training~~ **sessions** for our global talent acquisition and management teams. • We ~~proactively provide~~ **have bolstered** our **recruitment and selection procedures by introducing our MKS** ~~hiring~~ **Hiring Guide & Toolkit** ~~managers with diverse candidate slates in our employee recruiting process and~~ , ~~in accordance~~ **which is designed to attract top talent while mitigating bias. • Consistent** with our Corporate Governance Guidelines, **we actively** seek diverse candidates for ~~the pool from which~~ our Board of Director nominees ~~are chosen~~ . • We ~~regularly~~ **routinely** conduct ~~robust~~ **comprehensive** analyses of pay practices across gender ~~globally~~ and other diversity ~~factors within the United States~~ **dimensions in our major regions of operations** to ~~detect~~ **identify and rectify** any ~~existing~~ disparities **promptly** ~~within base~~ and ~~total~~ **effectively. Our recent global** compensation ~~, taking prompt and effective action to correct any identified disparities. Our most recent~~ analysis ~~of our global employees' compensation~~ , **spanning** ~~which was conducted over the past~~ several years, has ~~, with minimal required adjustments,~~ resulted in equitable pay for our ~~employees~~ **workforce with minimal adjustments** . • We offer regional and global initiatives **, such as** ~~that afford employees opportunities to engage in~~ mentoring programs, **DE & I- focused** book **clubs** ~~reading groups and facilitated discussion groups~~ , webinars **,** and workshops ~~that celebrate~~ **to provide opportunities for our diverse workforce to engage** and **thrive** ~~recognize awareness months and days~~ . Learning and Development MKS **remains steadfast in** ~~is~~ **its** ~~committed~~ **dedication** to **fostering** ~~investing in~~ learning and professional ~~development~~ **growth** . ~~Our~~ **We offer our** employees ~~have access to~~ a ~~wide range~~ **diverse array** of programs, ~~classes~~ **courses,** and resources **aimed at enhancing** ~~to help them excel in~~ their ~~careers~~ - **career trajectories** and **fostering knowledge- sharing among peers** ~~share what they learn with their colleagues~~ . Our performance management ~~process includes performance~~ **framework is designed to provide ongoing,**

actionable feedback and **facilitate dynamic** career development **conversations** ~~discussions that are dynamic and actionable~~ throughout the year. In ~~2022~~ **2023** , we **expanded our** ~~continued to broadly roll out courses~~ - **course offerings** to ~~develop our focus on~~ **encompass areas such as** employee engagement, change management **,** and leadership excellence ~~. Over the past three years~~ , **underscoring our commitment to continuous improvement. Furthermore, many of** our leaders ~~also~~ **successfully** completed the DE & I course ~~described~~ **as part of this initiative as mentioned** above. **We extend** ~~In addition, we provide~~ financial **assistance for higher education to eligible employees, including** support for college and graduate **studies** ~~education for U~~ . ~~S. employees and access~~ **Additionally, we ensure accessibility** to online learning **resources in local languages** for all **staff, thus bolstering** ~~employees in local languages to help further~~ the ~~careers of~~ **professional growth opportunities for** our entire workforce. Employee Engagement MKS ~~is committed~~ **remains dedicated** to **fostering** meaningful ~~engagement~~ **connections** with its employees. In ~~2022~~ **2023** ~~, we engaged a firm that specializes in corporate culture to conduct a global survey on company culture, in order to understand the values, beliefs and behaviors that shape our organization. The results of the survey are expected to inform how we manage our business and build relationships. In addition, in 2022~~ , MKS conducted its ~~second~~ **third** annual global employee engagement survey, **marking a significant milestone as it** ~~which, due to the timing of the closing of the Atotech Acquisition, did not include~~ **included** Atotech employees **for the first time post- acquisition** . The ~~results of the~~ survey **findings** were **analyzed** ~~thoroughly assessed~~ and shared with our **President and** Chief Executive Officer ~~and~~ **, the** executive leadership team **, and** ~~as well as~~ our Board of Directors. ~~In 2023, we plan~~ **Comprehensive communication of the results was extended** to ~~include~~ all employees **, supplemented with executive videos and both** in **- person and virtual focus groups to pinpoint prevailing themes. Leveraging** ~~the~~ **these** ~~global~~ **themes and data points, tailored action items were created to encourage meaningful change. Additionally, our executive leadership team routinely engages in direct communication with** ~~employee~~ **employees worldwide, ensuring alignment with the Company' s strategic goals. Our executive leadership team is committed to continuously enhancing MKS' workplace environment and steering organizational growth, with the annual** engagement survey **serving as a pivotal component for gathering** ~~, using the feedback we receive to examine current practices and drive new initiatives. Our executive management team also conducts regular calls with employees~~ - **employee insights** ~~around the world to ensure they are connected to the progress of the Company~~ . Compensation and Benefits MKS is committed to providing total compensation packages that attract, motivate and retain our employees. Additionally, MKS is committed to recognizing and rewarding ~~each employee~~ **employees** ' ~~s~~ sustained performance and results. We run a recognition program for all U. S. employees, which allows peer- to- peer recognition and recognition by managers. We continue to assess the potential expansion of this recognition program globally. We also maintain a global flexible work policy. We are committed to ensuring that our total compensation packages are externally competitive and internally equitable, while supporting our business plans and strategies. As employee turnover is an indicator of employee satisfaction, we monitor turnover globally. MKS has a very stable and committed workforce, as evidenced by low voluntary turnover. Our ~~12- month rolling average for~~ voluntary turnover **in** ~~at the end of 2022~~ **2023** was below ~~6~~ **8** %. Our employee average tenure is more than ~~9~~ **nine** years. Health and Safety MKS is committed to providing a safe and healthy workplace for all employees. We accomplish this through strict compliance with applicable laws and regulations regarding workplace safety, including recognition and control of workplace hazards, tracking injury and illness rates, utilizing a global travel health program and maintaining detailed emergency and business continuity plans. We also **provide mandatory environmental, health, and safety training to ensure all employees are provided with the education to perform their jobs safely and to protect the environment. In 2022, we instituted MEHS, a formal Global MKS Management System for Environmental, Health, and Safety, to protect our employees, other stakeholders, and the environment. We continue to implement this strong foundation across our organization in a stepwise process. In addition, we** offer employees and eligible family members a full range of health and wellness programs, as well as many clinical and administrative services. Additional information regarding MKS' activities related to its people and sustainability can be found in our Environmental, Social, Governance Report, which is accessible through the Environmental, Social and Governance section of our website. Our Environmental, Social, Governance Report is updated periodically ~~. This website address is intended to be an inactive textual reference only~~ . None of the information on, or accessible through, MKS' website is part of this Annual Report on Form 10- K or is incorporated by reference herein. Item 1A. Risk Factors This section describes certain risks we face in our business. Additional risks that we do not yet know of or that we currently believe are immaterial may also impair our business. If any of the events or circumstances described in this section actually occurs, our business, financial condition or operating results could suffer, and the market price of our common stock could decline. In assessing these risks, investors should also refer to the other information contained in or incorporated by reference into this report and our other filings with the Securities and Exchange Commission (" SEC "). Acquisition Risks The Atotech Acquisition involves numerous risks, and we may not be able to effectively integrate Atotech' s business and operations or realize the expected benefits from the acquisition, which could materially harm our operating results. The acquisition of Atotech Limited (" Atotech ") in August 2022 (the " Atotech Acquisition ") significantly increased our size, including with respect to revenue, product offerings, number of employees and facilities, and geographic exposure. Atotech' s products and technology, and certain of its markets and customer base, are significantly different from our historical experience. In particular, we ~~do~~ **did** not have previous experience in the specialty chemistry industry, which Atotech serves. Atotech' s chemistry business is also subject to highly complex environmental regulations, across multiple jurisdictions around the globe, and may expose us to significant additional liabilities for past or future activities. Integrating Atotech' s business and operations with ours has been and will continue to be complex, challenging and time- consuming and has required and continues to require significant efforts and expenditures, and we may not be able to achieve the integration in an effective, complete, timely or cost- efficient manner. Other potential risks related to the Atotech Acquisition include our ability to: • ~~expand~~ **Expand** our financial and management controls and reporting systems and procedures to integrate and manage Atotech; • ~~integrate~~ **Integrate** our information technology **(" IT ")** systems to enable the management and operation of the combined business; • ~~realize~~ **Realize**

expected synergies resulting from the Atotech Acquisition during our expected timeframe; • ~~maintain~~ **Maintain** and improve Atotech' s operations; • ~~retain~~ **Retain** and expand Atotech' s customer base while aligning our sales efforts; • ~~avoid~~ **Avoid** lost revenue resulting from the distraction of our personnel as a consequence of the Atotech Acquisition and ongoing integration efforts; • ~~retain~~ **Retain** key Atotech personnel; • ~~recognize~~ **Recognize** and capitalize on technology enhancement opportunities presented by our combined businesses; • ~~adequately familiarize ourselves with~~ **Develop sufficient knowledge of** Atotech' s products and technology and certain of its markets and customer base such that we can manage Atotech' s business effectively; and • ~~successfully~~ **Successfully** integrate our respective corporate cultures such that we achieve the benefits of acting as a unified company. Other potential risks related to the Atotech Acquisition include: • ~~operating~~ **Operating** in geographies that are new to us, and increasing our exposure to high- risk geographies; • ~~the~~ **The** assumption of unknown or contingent liabilities, or other unanticipated events or circumstances; and • ~~the~~ **The** potential to incur or record significant cash charges, such as integration and restructuring, or non- cash charges, such as the write down of the carrying value of fixed assets, intangible assets and goodwill obtained in the Atotech Acquisition, which could adversely impact our cash flow or lower our earnings in the period or periods for which we incur such charges or write down such assets **. For example, as described in Note 13 to the Notes to Consolidated Financial Statements, following triggering events at each of our electronics (" EL ") and general metal finishing (" GMF ") reporting units, which together represent the Atotech business and constitute our Materials Solutions Division (" MSD "), we recorded goodwill and intangible asset impairments at MSD of $ 1. 3 billion during the quarter ended June 30, 2023 and, following an annual impairment analysis of all our reporting units, we recorded goodwill and intangible asset impairments at MSD of $ 62 million during the quarter ended December 31, 2023. These impairments were in part due to softer industry demand, particularly in the personal computer and smartphone markets, that negatively affected MSD' s revenues and operating results** . If we are unable to successfully or timely integrate the operations of Atotech' s business into our business, we may be unable to realize the revenue growth, synergies and other anticipated benefits resulting from the Atotech Acquisition and our business could be adversely affected. Additionally, we have incurred and will continue to incur transaction ~~- related costs, including legal, regulatory and other costs associated with implementing integration plans, including facilities and systems consolidation costs and employment~~ - related costs. Although we expect that the elimination of duplicative costs, as well as the realization of other efficiencies related to the integration of the businesses, should allow us to offset certain transaction and integration- related costs over time, this net benefit may not be achieved in the near term, or at all. Further, we may not realize the expected benefits from the Atotech Acquisition **, including** ~~. Atotech' s business and operations may not achieve~~ the ~~anticipated~~ revenues and operating results **we anticipate** . Any of the foregoing risks could materially harm our combined business, financial condition and results of operations. As a part of our business strategy, we have entered into and continue to pursue business combinations and acquisitions. Our ability to successfully identify suitable acquisition targets, complete acquisitions on acceptable terms, and efficiently, effectively and profitably integrate and operate our acquired businesses is critical to our growth. We may not be able to identify target companies that meet our strategic objectives or successfully negotiate and complete acquisitions with companies we have identified on acceptable terms. Further, we may incur significant expense in pursuing acquisitions that cannot be completed, or are significantly delayed, due to regulatory or other restrictions. Additionally, our credit facilities only permit us to make acquisitions under certain circumstances, and also restrict our ability to incur additional indebtedness in certain circumstances. As a result, our ability to pursue our acquisition strategy may be hindered by our indebtedness. Moreover, we may not realize the benefits we anticipate from these acquisitions, because of significant challenges, such as: • The difficulty, distraction, resource requirements, cost and disruption of integrating the operations, technology and personnel of the acquired companies; • The potential disruption of our ongoing business and distraction of management; • Possible internal control or other compliance weaknesses of the acquired companies; • Significant expenses related to the acquisitions, including any resulting shareholder litigation; • The assumption of unknown or contingent liabilities associated with acquired businesses; • The potential to incur or record significant cash or non- cash charges or write down the carrying value of intangible assets and goodwill obtained in the acquisitions, which could adversely impact our cash flow or lower our earnings in the period or periods for which we incur such charges or write down such assets; • Potentially incompatible cultural differences between us and the companies we acquire; • Incorporating the acquired companies' technology and products into our current and future product lines, and successfully generating market demand for these expanded product lines; • Potential additional geographic dispersion of operations; • The difficulty in achieving anticipated synergies and efficiencies; • The difficulty in leveraging the acquired companies' and our combined technologies and capabilities across our product lines and customer base; • Burdensome requirements or conditions imposed by government regulators in connection with their review of acquisitions, including divestitures and restrictions on the conduct of our business or the business of the acquired companies; and • Our ability to retain key customers, suppliers and employees of the acquired companies. We may also face competitive disadvantages by selling products that are new to us and / or selling products in markets and geographies that are new to us. In addition, if we are not successful in completing acquisitions or integrating acquired businesses, we may **need** ~~be required~~ to re- evaluate our growth strategy. We may incur substantial expenses and devote significant management time and resources to complete acquisitions that may not generate the financial results we planned to achieve. We may also choose to close or divest certain sectors or divisions of acquired companies, which **would reduce our overall revenue and** could require us to record losses and / or spend cash relating to such closures or divestitures. We continue to experience significant risks associated with the acquisition of Electro Scientific Industries, Inc. (**" ESI " and such transaction,** the " ESI Merger "), which we completed in 2019. These risks include our ability to retain key personnel and to realize the anticipated growth in net revenues from the acquired business, as well as the potential to incur or record significant cash or non- cash charges or write down the carrying value of intangible assets and goodwill obtained in the ESI Merger, which could adversely impact our cash flow or lower our earnings in the period or periods for which we incur such charges or write down such assets **. For example, as described in Note 13 to the Notes to Consolidated Financial**

Statements, following a triggering event at the Equipment Solutions Business (" ESB ") reporting unit, which represents the ESI business and is a part of our Photonics Solutions Division (" PSD "), we recorded goodwill and intangible asset impairments at our ESB reporting unit of $ 524 million during the quarter ended June 30, 2023, and following an annual impairment analysis at all our reporting units, we recorded goodwill impairment of $ 13 million at our ESB reporting unit during the quarter ended December 31, 2023 . In addition, we could use substantial portions of our available cash for all or a portion of the purchase price of future acquisitions. We could also issue additional securities as consideration for or to finance these acquisitions, which could cause significant stockholder dilution, or obtain additional debt financing, which would increase our costs, reduce our future cash flow and subject us to covenants and other restrictions that may impede our ability to manage our operations, without achieving the desired accretion to our business. As a result of our previous acquisitions, we presently have several different decentralized operating and accounting systems. We will need to continue to modify our accounting policies, internal controls, procedures and compliance programs to provide consistency across all of our operations. In order to increase efficiency and operating effectiveness and improve corporate visibility into our decentralized operations, we continue to review opportunities to integrate enterprise resource planning systems where practical. Any future implementations may risk potential disruption of our operations during the conversion periods and the implementations could require significantly more management time and higher implementation costs than currently estimated. As of December 31, ~~2022~~ **2023** , we had approximately $ 5. ~~1~~ **0** billion of principal indebtedness outstanding under a senior secured term loan facility (the " ~~New~~ Term Loan Facility ") comprised of three tranches: a $ **744** ~~1. 0 billion~~ **million** loan (the " USD Tranche A "), a $ 3. 6 billion loan (the " USD Tranche B ") and a ~~EUR 600~~ **€ 593** million loan (the " Euro Tranche B "). ~~We~~ **As of December 31, 2023, we** also ~~have~~ **had** $ 500 million of available borrowing capacity under a senior secured revolving credit facility (the " ~~New~~ Revolving Facility " and ~~,~~ together with the ~~New~~ Term Loan Facility, the " ~~New~~ Credit Facilities ") **. On January 22, 2024, we (i) increased our USD Tranche B by an aggregate principal amount of $ 490 million, (ii) increased our Euro Tranche B by an aggregate principal amount of € 250 million and (iii) used a portion of the proceeds of such increases to prepay our USD Tranche A in full (the " USD Tranche A Refinancing "). On February 13, 2024, we increased the available borrowing capacity under our Revolving Facility by $ 175 million (the " Revolving Facility Increase "). As a result of the USD Tranche A Refinancing, as of January 22, 2024, we had approximately $ 5. 0 billion of principal indebtedness under our Term Loan Facility comprised of a $ 4. 1 billion USD Tranche B and a € 843 million Euro Tranche B. As a result of the Revolving Facility Increase, as of February 13, 2024, we had $ 675 million of available borrowing capacity under our Revolving Facility** . This level of indebtedness could have the effect, among other things, of reducing our flexibility to respond to changing business, industry and economic conditions, limiting our ability to obtain financing in the future and increasing interest expense. We also have incurred and will continue to incur various costs and expenses associated with our indebtedness. The amount of cash required to pay interest on our increased indebtedness levels following completion of the Atotech Acquisition, and the demands on our cash resources that come from that debt, are significantly greater than the amount of cash flows required to service the levels of indebtedness we incurred prior to the Atotech Acquisition. Our increased levels of indebtedness following completion of the Atotech Acquisition could also reduce funds available for working capital, capital expenditures, acquisitions and other general corporate purposes and may create competitive disadvantages relative to other companies with lower debt levels. If we do not achieve the expected benefits and cost savings from the Atotech Acquisition, or if the financial performance of the combined company does not meet current expectations, then our ability to service our indebtedness may be adversely impacted. Despite our current level of indebtedness, we and our subsidiaries may still be able to incur more indebtedness. Although our debt agreements contain restrictions on the incurrence of additional indebtedness, these restrictions are subject to certain qualifications and exceptions, and thus, additional indebtedness may be incurred in compliance with these restrictions. This could further exacerbate the risks we describe. Moreover, we may be required to raise substantial additional financing to fund working capital, capital expenditures, acquisitions or other general corporate requirements. Our ability to arrange additional financing or refinancing will depend on, among other factors, our financial position and performance, as well as prevailing market conditions and other factors beyond our control. There can be no assurance that we will be able to obtain additional financing or refinancing on terms acceptable to us or at all. The terms of our ~~New~~ Term Loan Facility and ~~New~~ Revolving Facility impose significant financial obligations and risks upon us, limit our ability to take certain actions, and could discourage a change in control. As of December 31, ~~2022~~ **2023** , the total principal balance of our USD Tranche A was $ ~~889~~ **744** million, the total principal balance of our USD Tranche B was $ 3 ~~, 591~~ **. 6** ~~million~~ **billion** and the total principal balance of our Euro Tranche B was ~~EUR 585~~ **€ 593** million. ~~Our New~~ **As a result of the USD Tranche A Refinancing, as of January 22, 2024, no principal was outstanding under the USD Tranche A, the total principal balance of our USD Tranche B was $ 4. 1 billion and the total principal balance of our Euro Tranche B was € 843 million. As of December 31, 2023, our** Revolving Facility ~~provides~~ **provided** us with a senior secured revolving credit facility of up to $ 500 million. **As a result of the Revolving Facility Increase, as of February 13, 2024, our Revolving Facility provided us with a senior secured revolving credit facility of up to $ 675 million.** We have not borrowed against our ~~New~~ Revolving Facility as of ~~December 31~~ **February 13** , ~~2022~~ **2024** . All amounts outstanding under the ~~New~~ Term Loan Facility and the ~~New~~ Revolving Facility bear interest at a variable interest rate. Although we hedge some of the variable interest rate exposure, ~~if~~ **as** interest rates **have** ~~increase~~ **increased** , **debt service requirements on our** variable rate debt **have increased. Further interest rate increases, if they occur and we do not hedge such variable rates,** will create higher debt service requirements, which would adversely affect our cash flows. In addition, changes in our credit ratings could affect the cost and availability of future borrowings and, accordingly, our cost of capital. The ratings of our indebtedness reflect each nationally recognized statistical rating organization ~~'~~ **'** s opinion of our financial strength, operating performance and ability to meet our debt obligations. We cannot make any assurances that we will achieve or maintain a particular rating in the future. Our ~~New~~ Term Loan Facility and ~~New~~ Revolving Facility contain several negative covenants that, among other things and subject to certain exceptions, restrict our ability and / or our subsidiaries ~~'~~ **’** ability to: • Incur additional indebtedness; • Pay certain dividends on our capital stock or redeem, repurchase or retire certain capital stock or certain other indebtedness; • Make certain investments, loans and acquisitions; • Engage in certain transactions with our affiliates; • Sell assets, including capital stock of our subsidiaries; • Materially alter the business we conduct; • Consolidate or merge; • Incur liens; and • Engage in sale- leaseback transactions. In addition, **our** ~~the USD Tranche A and the New~~ Revolving Facility ~~require~~ **requires** that we meet ~~certain~~ **a** financial ~~covenants~~ **covenant** based on a consolidated leverage ratio test **in certain circumstances** . Under **our** ~~the USD Tranche A and the New~~ Revolving Facility, ~~so long as any loans under the USD Tranche A (or commitments in respect thereof) are outstanding, our total net leverage ratio cannot exceed 5. 50 to 1. 00, with an annual step- down of 0. 25: 1. 00 and subject to a step- up of 0. 50: 1. 00 for the four full fiscal quarter period following any material acquisition, not to exceed 5. 50 to 1. 00. In addition,~~ whenever ~~there are no loans under the USD Tranche A (or commitments in respect thereof) outstanding and~~ the aggregate amount of loans outstanding under the ~~New~~ Revolving Facility (net of (a) all letters of credit (whether cash collateralized or not) and (b) unrestricted cash of us and our restricted subsidiaries) exceeds 35 % of the aggregate commitments under the ~~New~~ Revolving Facility, our first lien net leverage ratio cannot exceed 6. 00 to 1. 00. Our ability to comply with these provisions may be affected by events beyond our control, including prevailing economic, financial and industry conditions. These restrictions on our ability to engage in or benefit from these actions may also limit our flexibility in planning for, or reacting to, changes in and opportunities for our business, such as limiting our ability to engage in mergers and acquisitions. This could place us at a competitive disadvantage. If the matters described in our other risk factors result in a material adverse effect on our business, financial condition or operating results, we may be unable to comply with the terms of our credit facilities or experience an event of default. Our ~~New~~ Term Loan Facility and ~~New~~ Revolving Facility contain customary events of default, including: • Failure to make required payments; • Failure to comply with certain agreements or covenants; • Materially breaching any representation or warranty; • Failure to pay, or cause acceleration of, certain other indebtedness; • Certain events of bankruptcy and insolvency; • Failure to pay certain judgments; and • A change in control of us. The amount of cash available to us for repayment of amounts owed under these credit facilities will depend on our usage of our existing cash balances and our operating performance and ability to generate cash flows from operations, which will be subject to financial, business and other factors affecting our operations, many of which are beyond our control. We cannot provide any assurances that we will generate sufficient cash flows from operations to service our debt obligations. Any failure to repay these obligations as they become due would result in an event of default under the credit facilities. If an event of default occurs, the lenders may end their obligation to make loans to us under the credit facilities and may declare any outstanding indebtedness under these credit facilities immediately due and payable. In such case, we would need to obtain additional financing or significantly deplete our available cash, or both, to repay this indebtedness. Any additional financing may not be available on reasonable terms or at all, and significant depletion of our available cash would harm our ability to fund our operations or execute our broader corporate objectives. If we were unable to repay outstanding indebtedness following an event of default, then in addition to other available rights and remedies, the lenders could initiate foreclosure proceedings on substantially all of our assets. Any such foreclosure proceedings or other rights and remedies successfully implemented by the lenders in an event of default would have a material adverse effect on our business, financial condition and operating results. Further, because a change in control of us constitutes an event of default under these credit facilities, this may be a deterrent to some potential acquirers, as it would likely require an acquirer to repay any outstanding borrowings under these credit facilities. As of December 31, ~~2022~~ **2023** , our goodwill and intangible assets, net, represented approximately $ ~~7.~~ 5 **. 2** billion, or ~~65~~ **57** % of our total assets. Goodwill is generated ~~in~~ **as a result of** our acquisitions when the cost of an acquisition exceeds the fair value of the net tangible and identifiable intangible assets we acquire. For example, as a result of the Atotech Acquisition, we added significant additional goodwill and intangible assets **because the cost of the Atotech Acquisition significantly exceeded the fair value of Atotech’ s net tangible and identifiable intangible assets. Intangible assets relate primarily to the developed technologies, customer relationships, trade names and trademarks acquired by us as part of our acquisitions of other companies** . Goodwill and indefinite- lived intangible assets are subject to an impairment analysis at least annually based on the fair value of the reporting unit ~~.~~ **in which the respective goodwill and** ~~Intangible~~ **intangible** assets **are recorded. In addition** ~~relate primarily to the developed technologies~~ , **intangible assets** ~~customer relationships, trade names~~ and **goodwill** ~~trademarks acquired by us as part of our acquisitions of other companies and~~ are subject to an impairment analysis whenever events or changes in circumstances ~~exist that~~ indicate that the carrying value of the intangible asset might not be recoverable. **As described in Note 13 to the Notes to Consolidated Financial Statements, following triggering events at each of our EL and GMF reporting units, which together constitute MSD, and the ESB reporting unit of PSD, we recorded goodwill and intangible asset impairments of $ 1. 8 billion during the quarter ended June 30, 2023 and, following an annual impairment analysis of all our reporting units, we recorded goodwill and intangible asset impairments of $ 75 million during the quarter ended December 31, 2023.** We will continue to monitor and evaluate the carrying value of goodwill and intangible assets. If market and economic conditions or business performance deteriorate, the likelihood that we would record ~~an~~ **another** impairment charge would increase ~~, which~~ **. Any** impairment charge could materially and adversely affect our financial condition and operating results **, including by significantly reducing our net income in future periods** . We rely on various **IT** ~~information technology~~ networks and systems, some of which are managed by third parties, to process, transmit and store electronic information and to carry out and support a variety of business activities, including, among others, finance and accounting, order management, human resources, communications, manufacturing, research and development, intellectual property, supply chain management, sales and **IT** ~~information technology~~ , including critical functions such as internet connectivity, network communications, and email. ~~Some~~ **Many** of these activities are processed via Software- as- a- Service (“ SaaS ”) products provided by third parties and hosted on their own networks and servers ~~,~~ or **on** third- party networks and servers. The data on such **IT** ~~various information technology~~ networks and systems includes confidential information, personally identifiable information, transactional information and intellectual property belonging to us and our employees, customers, suppliers and other business partners. We ~~are subject to ongoing cybersecurity threats, including ransomware or other malware, hacking, phishing, denial of service attacks, and other attacks. These threats may range from employee error or misuse to sophisticated and targeted attempts by bad actors to gain unauthorized access to information systems. We~~ and our third- party administrators ~~and~~ **,** vendors ~~have experienced,~~ and **partners are** ~~expect to continue to be~~ subject to ~~,~~ **ongoing** cybersecurity threats ~~and incidents~~ , including **ransomware** ~~industry- wide vulnerabilities,~~ and ~~we~~ **other malware, hacking, phishing, smishing, denial of service attacks, employee errors or malfeasance, telecommunication failures, system failures, natural disasters and other attacks and events. We** cannot guarantee that these threats ~~and incidents~~ will not have an adverse impact on our business, financial condition or results of operations. For example, **as further described in " Management' s Discussion and Analysis of Financial Condition and Results of Operations — Ransomware Event " in Part II, Item 7 of this Annual Report** on **Form 10- K, in** February ~~3,~~ 2023, we identified that we had become subject to a ransomware event. Based on our investigation, we concluded ransomware actors encrypted certain of our systems by deploying malware. This incident required us to temporarily suspend operations at certain of our facilities and ~~has~~ had a material impact ~~in~~ **during the** ~~the~~ **three** ~~first quarter of~~ **months ended March 31,** 2023 on **our** ~~the Company' s~~ ability to process orders, ship products and provide service to our Vacuum Solutions Division (" VSD ") and ~~Photonics Solutions Division ("~~ PSD ~~")~~ customers **. For the year ended December 31, 2023, we incurred net costs related to the incident of approximately $ 15 million** . We expect ~~this~~ **to continue to incur these and other costs related to the** incident **in** ~~will have a negative impact on our revenue for~~ the **future** ~~first quarter of 2023 of at least $ 200 million~~ . ~~As~~ **In addition, as** a result of the incident, **we were previously subject to two lawsuits,** ~~our relationship with our customers may be negatively impacted~~ and we may be subject to ~~subsequent~~ **future litigation,** investigations, claims or actions, in addition to ~~other costs,~~ fines, penalties, or other obligations related to impacted data, whether or not such data is misused. ~~For additional information regarding this incident, please refer to " Management' s Discussion and Analysis of Financial Condition and Results of Operations — Overview — Recent Events — Ransomware Event " in Part II, Item 7 of this Annual Report on Form 10- K. Despite the implementation of a variety of security controls and measures, as well as those of our third- party administrators and vendors, there is no assurance that such actions will be sufficient to prevent another cybersecurity incident, whether due to ransomware or other malware, attacks by hackers, employee error or malfeasance, computer viruses, telecommunication failures, systems failures, natural disasters, or other catastrophic events.~~ We ~~also~~ face the challenge of supporting our older **IT** systems and implementing necessary upgrades. Further, as we transition to using more cloud- based solutions that are dependent on the internet or other networks to operate, we expose ourselves to additional or different ~~cyber~~ **cybersecurity** and other data security threats, whether directly or through our third- party administrators ~~and~~ **,** vendors **and partners** . As ~~cyber~~ **cybersecurity** threats ~~continue to~~ rapidly evolve and become increasingly ~~more~~ difficult to detect and defend against, our current security controls and measures may not be effective in **detecting vulnerabilities or** preventing cybersecurity incidents ~~and we may not have the capabilities to detect certain vulnerabilities~~ . These risks may be further amplified by the increased reliance on remote access to **IT** ~~information technology~~ systems as a result of the use of SaaS software, cloud and remote services, and employees working remotely. Additionally, **we** ~~our merger, acquisition and divestiture activity~~ may ~~also require~~ **need to** ~~updates~~ - **update** ~~to~~ security protocols ~~or~~ **for ,** ~~transitions~~ - **transition** to or from, **or** ~~and the integration~~ **integrate** ~~of,~~ various information management systems **as a result of mergers, acquisitions and divestitures** . ~~Those~~ -- **The** systems that we acquire or that are used by acquired entities or businesses may ~~also~~ pose security risks of which we are unaware or unable to mitigate, particularly during the transition of these systems. **The** ~~While we continue to assess and address the implications of existing and new domestic and foreign regulations relating to data privacy, the~~ evolving regulatory landscape **for data privacy** presents a number of legal and operational challenges, and our efforts to comply with ~~these~~ **relevant** regulations may be unsuccessful. For example, regulations in the European Union (the " EU ") and China ~~have established a prohibition~~ --- **prohibit** ~~on~~ the transfer of personally identifiable information from their respective countries to other countries whose laws do not **adequately** protect personal data ~~to an adequate level of privacy or security~~ . While we have utilized certain permitted approaches for transferring personally identifiable information from these countries ~~to the United States~~ , these approaches may be ~~reviewed and~~ invalidated by courts or regulatory bodies and we may be required to ascertain an alternative legal basis for such transfers. Additionally, based on our investigation of the ransomware event we identified in February 2023, we became aware on February 13, 2023 ~~,~~ that the ransomware actors may have exfiltrated personal information from our systems. We provided notifications to individuals and to regulators ~~,~~ in accordance with applicable laws, and we may be required to provide additional notifications in the future ~~. On March 3, 2023, we became subject to a class action lawsuit filed in the Orange County Superior Court of the State of California seeking unspecified monetary damages, costs and attorneys' fees arising out of the ransomware event~~ . See " — We are exposed to various risks related to legal proceedings, including, for example, product liability claims, intellectual property infringement claims, **regulatory claims,** contractual claims and ~~security~~ class action litigation, which if successful, could have a material adverse effect on our commercial relationships, business, financial condition and operating results ~~.~~ " below for more information regarding legal risks associated with privacy- related matters. A failure to comply with the **evolving** ~~ever- changing~~ regulatory landscape, or a breach of our operational or security systems or infrastructure, or those of our customers, suppliers and other business partners, could disrupt our business, including business operations and manufacturing processes; result in the disclosure, misuse, corruption or loss of confidential or other valuable business information, including intellectual property, personally identifiable information and other critical data of ours and our employees, customers, suppliers and other business partners; result in competitive disadvantages to the extent the information is competitively sensitive; damage our reputation; negatively affect our relationships with our employees, customers, suppliers and other business partners, including loss of confidence, which could lead to loss of or reduction in orders; divert the attention of management; cause losses; result in litigation, investigations or liability under contracts; require notifications to regulatory authorities and impacted individuals; result in significant penalties and / or fines from regulatory bodies, including pursuant to privacy laws and export control laws; add to the complexity of our compliance obligations; increase our cybersecurity protection costs; and result in the incurrence of remediation costs. These adverse effects would likely be amplified in the event a breach of operational or security systems remains undetected for an extended period of time. The costs of compliance with, and other burdens imposed by, privacy, cybersecurity, data protection and data localization laws, regulations and policies, including restrictions on marketing activities, could have a material adverse effect on our business, financial condition and operating results. For example, as a result of the ransomware event described above, we have incurred costs, and we expect to continue to incur costs, which may be significant, in connection with efforts to investigate the incident, assess the impact of the incident, recover our systems, enhance our data security and protect against unauthorized access to, or manipulation of, our systems and data. Despite incurring these costs, we may not have identified and may not be able to remediate all of the potential causes of the incident, and similar incidents may occur in the future. Further, customers and third-party providers increasingly demand rigorous contractual provisions regarding privacy, cybersecurity, data protection, confidentiality, and intellectual property, which may also increase our overall compliance burden **and potential liability** . Although we maintain insurance related to cybersecurity risks, ~~all of~~ these costs, expenses, liability and other matters may not be **adequately** covered ~~adequately~~ by insurance and may result in an increase in our costs for insurance or insurance not being available to us on economically feasible terms, or at all. Insurers may also deny us coverage as to any future claim. Any of these results could harm our business, financial condition and reputation. Our success and ability to compete depend in large part upon protecting our proprietary technology. We rely on a combination of patent, trademark and trade secret protection and other agreements, such as nondisclosure agreements and other contractual agreements with our employees and third parties, to protect our proprietary rights. The steps we have taken may not be sufficient to prevent the misappropriation of our intellectual property, particularly in countries and regions outside, for example, the United States and Europe, where laws may not protect our proprietary rights as fully. For example, the patent prosecution and enforcement systems within China and India, where we have a significant customer base and manufacturing presence, ~~both of which have considerably increased following the completion of the Atotech Acquisition,~~ are less robust than these systems in certain other jurisdictions and **,** as a result, we may be limited in our ability to enforce our intellectual property rights there. We may also be at a disadvantage in any enforcement proceeding in China and India as a foreign entity seeking protection against a locally headquartered company. Patent and trademark laws and trade secret protection may not ~~be adequate~~ **adequately** ~~to~~ deter third **-** party infringement or misappropriation of our patents, trademarks, trade secrets and similar proprietary rights. In addition, patents issued to us may be challenged, invalidated or circumvented. The loss or expiration of any of our key patents could lead to a significant loss of sales of certain of our products and could materially affect our ~~future~~ operating results. We have in the past and may in the future be subject to or may initiate interference proceedings, validity challenges or opposition proceedings in the U. S. Patent and Trademark Office, the European Patent Office, or similar agencies, which can demand significant financial and management resources. The process of seeking patent protection can be time consuming and expensive and patents may not be issued from ~~currently~~ pending or future applications. Moreover, our existing patents or any new patents that may be issued may not be sufficient in scope or strength to provide meaningful protection or ~~any~~ **a** commercial advantage to us. We may initiate claims, enforcement actions or litigation against third parties for infringement of our proprietary rights in order to determine the scope and validity of our proprietary rights or the proprietary rights of our competitors, which claims could result in costly litigation, the diversion of our technical and management personnel and the assertion of counterclaims by defendants, including counterclaims asserting invalidity of our patents. We will take such actions where we believe that they are of sufficient strategic or economic importance to us to justify the cost. Our business depends on the timely supply of products and services that meet the rapidly changing technical and volume requirements of our customers, which depends in part on the timely delivery of raw materials, parts, components and subassemblies from **our** suppliers, including contract manufacturers. For example, ~~since~~ **from** the first quarter of 2021 **until the second half of 2023** , we ~~have~~ experienced significant constraints due to global supply chain disruptions, including procuring electronic components, which ~~have~~ negatively impacted ~~, and continue to impact,~~ our sales, costs and margins, and our ability to **timely** produce ~~timely~~ products to meet customer demand. Supply constraints and **the** potential for shortages ~~have~~ caused us to increase safety stock levels, which has increased the amount of inventory we hold. Cyclical industry conditions and volatility of demand for our products increase capital, technical, operational and other risks for us and for companies throughout our supply chain. We have experienced, and we expect to continue to experience, significant disruptions in our supply chain, interruptions of our manufacturing operations, delays in our ability to deliver products or services, increased costs, price volatility, and customer order cancellations, which have been, or may in the future be, as a result of: • Volatility in the availability and cost of materials, including electronic components, whether due to interruptions in production by suppliers, allocations of products to other purchasers, fluctuations in foreign currency exchange rates, changes in worldwide price levels ~~,~~ **(** whether **due to** ~~as a result of~~ inflationary pressures or otherwise **)** , environmental limitations, geopolitical issues or other factors; • Pandemics such as COVID- 19, natural disasters or other events beyond our control (such as earthquakes at our facilities in California or Oregon, floods or storms, wildfires, power outages, such as rolling blackouts previously experienced in China, regional economic downturns, social unrest, political instability, terrorism, or acts of war), particularly where we or our suppliers, subcontractors and contract manufacturers conduct manufacturing; • Global logistics network challenges, such as limited availability of and constraints on freight capacity; • **IT** ~~Information technology~~ or infrastructure failures; and • New laws or regulations. For example, ~~our Materials Solutions Division ("~~ MSD ~~")~~ uses certain raw materials derived from petrochemical based feedstocks, the prices of which have historically been subject to periods of rapid and significant upward and downward movement. We may not ~~always~~ be able to pass on price increases in raw materials, or price increases by our suppliers, to our customers due to competitive pricing pressure, and, even when we are able to do so, there may be a delay between price increases in raw materials and our ability to increase the prices of our products. In addition, if we need to rapidly increase our business and manufacturing capacity to meet increases in demand or expedited shipment schedules, this may exacerbate any interruptions in our manufacturing operations and supply chain and the associated effect on our working capital. Moreover, if actual demand for our products is different than expected, we may purchase more ~~/~~ **or** fewer parts than necessary or incur costs for canceling, postponing or expediting delivery of parts. If we purchase inventory in anticipation of customer demand that does not materialize, or if our customers reduce or delay orders, we may incur excess inventory charges. Any of these factors could materially and adversely affect our business, financial condition and operating results. Our dependence on sole and limited source suppliers and international suppliers has negatively impacted, and could continue to impact, our ability to manufacture products and systems. We rely on sole and limited source suppliers and international suppliers for some of our raw materials, components, subassemblies and software that are critical to manufacturing our products and / or our testing and operations processes due to unique properties or component designs as well as specialized quality and performance requirements. For example, **on a local basis,** MSD relies on a **limited number of** ~~local basis on single principal~~ suppliers of palladium, its most significant raw material input by value. Our reliance on sole and limited source suppliers and international suppliers involves a number of risks, including: • The inability to obtain an adequate supply of required raw materials or components, including if our suppliers cannot scale their manufacturing output to meet our demands; • Quality and reliability problems with raw materials or components, which in turn **may** adversely ~~affects~~ - **affect** our products' quality and reliability; • Prohibitively higher raw material or component prices due to the imposition of tariffs; • Supply chain disruptions, including as a result of the relocation of ~~our~~ **certain** low- cost and sole and limited source suppliers to less- developed countries ~~, such as the movement of some suppliers from China to the Philippines or Vietnam~~ ; • Reduced control over pricing and timing of delivery of raw materials and components; • The inability of our suppliers to develop technologically advanced products to support our growth and development of new products; • The unavailability of service and / or spare parts for critical capital equipment; and • The inability or unwillingness of our suppliers to continue to offer supplies or services on commercially acceptable terms. At times, we have not been able to, and in the future, we may not be able to, obtain and qualify alternative sources of these components on favorable terms, on a timely basis, or at all, whether because there are a limited number of suppliers or because we have entered into supply agreements with certain suppliers that contain certain minimum purchase requirements. The use of alternative sources could ~~also~~ require us to redesign our products, **which could** ~~resulting~~ --- **result** in increased costs, ~~likely~~ shipping delays and the ~~potential~~ need to requalify products with customers, particularly those **with** ~~who have~~ " copy exact " requirements. Any inability to redesign our products could result in further costs and shipping delays. Increased costs would decrease our profit margins if we could not pass ~~the~~ **these** costs to our customers. Further, shipping delays damage, and may continue to damage, our relationships with customers and have a material adverse effect on our business and operating results. Our failure to successfully manage the transition of certain of our products to other manufacturing locations ~~and /~~ **, the transition of certain of** ~~or~~ **our products** to **or from** contract manufacturers **,** and the transition of certain functions to centralized locations would likely harm our business, financial condition and operating results. As part of our continuous cost- reduction and business continuity efforts, we continue to relocate the manufacturing of certain of our existing product lines and subassemblies to, and initiate the manufacturing of certain new products in, our facilities in China, Israel, Mexico, Romania and Singapore, as well as to our significant subcontracted operations in Mexico and selected contract manufacturers in Asia. In addition, we have relocated certain segments of other functions to **, or initiated certain segments of other functions in,** centralized locations, including **relocating** certain procurement activity to Mexico and **Romania, relocating** certain **IT and** research and development activity to India **, relocating certain administrative finance, payroll, software and IT activity to Poland, and initiating engineering activity in India** . In the future, we may expand the level of functions that we **initiate in or** move to other global locations to take advantage of cost efficiencies ~~available to us in those locations~~ or for business continuity purposes. However, we may not **be able to** achieve ~~the~~ significant cost savings or other benefits ~~that we anticipate~~ from ~~moving~~ these ~~operations and functions~~ **actions . For example** , ~~and~~ costs may increase as development and manufacturing expense increase and labor, material, shipping and facility- related costs rise, as we have seen in our manufacturing locations in China. If these costs increase to the extent that we no longer realize the cost savings we anticipated, we may need to relocate these operations and functions to other lower- cost regions. Additionally, if we are unable to successfully manage the relocation, initiation or oversight of these operations and functions, including identifying, training and retaining skilled labor, our business, financial condition and operating results would be harmed. In particular, transferring product lines to other manufacturing locations and / or to **or from** our contract manufacturers' facilities often requires us to transplant complex manufacturing equipment and processes across a large geographical distance **,** ~~and to~~ train a completely new workforce concerning the use of this equipment and these processes **and comply with local regulations** . In addition, certain of our customers may require ~~the requalification of~~ **us to requalify** products supplied to them in connection with the relocation of manufacturing operations. If we are unable to manage these transfers and training smoothly and comprehensively, or if we are unable to requalify products in a timely manner, we could suffer manufacturing and supply chain delays, excessive product defects, harm to our operating results and our reputation ~~with our customers~~ , and loss of customers. Further, the utilization of overseas manufacturing locations and contract manufacturers may require additional transportation and shipping providers, customs tariffs or export licenses, which may be difficult or costly to obtain. Additionally, qualifying contract manufacturers and commencing volume production is expensive and time- consuming, and there is no guarantee we will continue to do so successfully. Further, our reliance on contract manufacturers reduces our control over compliance, ~~the~~ assembly ~~process~~ , quality assurance, production costs and material and component supply for our products. If we fail to manage our relationships with our contract manufacturers, or if any of our contract manufacturers violate laws or regulations or experience financial difficulty, delays, disruptions, capacity constraints or quality control problems ~~in their operations~~ , our ability to ship products to our customers could be impaired and our competitive position and reputation could be harmed. Further, if we or our contract manufacturers are unable to negotiate with suppliers for reduced material or component costs, our operating results could be harmed. In addition, our contract manufacturers may terminate our agreements with them **, including** ~~upon prior notice to us or~~ immediately ~~for reasons such as~~ if we become insolvent ~~,~~ or ~~if we~~ fail to perform a material obligation under the agreements. If we are required to change contract manufacturers or assume internal manufacturing operations ~~for any reason~~ , including **due to** the termination of one of our contract manufacturing contracts, we will likely suffer manufacturing and shipping delays, lost sales, increased costs and damage to our customer relationships, any of which would harm our business, financial condition and operating results. Many of our products are inherently complex in design and, in some cases, require extensive customization and / or ongoing regular maintenance. Further, the manufacturing of these products often involves a highly complex and precise process and the utilization of specially qualified materials or components that conform to stringent specifications. Many of our products also require highly skilled labor. As a result of the technical complexity of these products, design defects, skilled labor turnover, changes in our or our suppliers' manufacturing processes or the inadvertent use of defective or nonconforming materials **or software** by us or our suppliers could adversely affect our manufacturing yields and product reliability. This could in turn harm our business, operating results, financial condition and customer relationships. We provide warranties for our products, and we accrue allowances for estimated warranty costs at the time we recognize revenue for the sale of the products. The determination of such allowances requires us to make estimates of product return rates and expected costs to repair or replace the products under warranty. We establish warranty reserves based on historical warranty costs for our products. If actual return rates or repair and replacement costs differ significantly from our estimates, our operating results would be negatively impacted. Our customers may discover defects in our products after the products have been fully deployed and operated under peak stress conditions. In addition, some of our products are combined with ~~products from~~ other suppliers **’ products** , which may contain defects. Further, some of our customers use our products in ways other than their intended purpose. As a result, should problems occur, it may be difficult to identify the source of the problem. If we are unable to promptly identify and fix defects or other problems, we could experience, among other things: • Loss of customers; • Increased costs of product returns and warranty expenses; • Increased costs required to analyze and mitigate the defects or problems; • Damage to our reputation; • Failure to attract new customers or achieve market acceptance; • Diversion of development, engineering and service resources; and / or • Legal action by our customers or their customers. The occurrence of any of these factors could seriously harm our business, financial condition and operating results. The hazards associated with chemical manufacturing and the related storage and transportation of chemical raw materials, products and ~~wastes~~ - **waste** are inherent **to** ~~in operating~~ MSD **’ s operations** . These hazards could lead to an interruption or suspension of operations and have a material adverse effect on the productivity and profitability of a particular manufacturing facility or on our business as a whole. Potential risks include storage tank leaks and ruptures, explosions and fires, and chemical spills and other discharges or releases of toxic or hazardous substances or gases. These risks could be caused or exacerbated by mechanical failures, unscheduled downtime, labor difficulties, transportation interruptions, inclement weather, natural disasters, cybersecurity breaches or terrorist attacks. These hazards may result in personal injury and loss of life, damage to property, and contamination of the environment, which may result in a suspension of operations and the imposition of civil or criminal fines, penalties and other sanctions, cleanup costs, and claims by our employees, governmental entities or third parties. We are dependent on the continued operation of our production facilities, and the loss or shutdown of operations at any of our major operating facilities could have a material adverse effect on our business, financial condition and operating results. We outsource a number of services, including certain **IT** ~~information technology~~ systems and systems management, logistics ~~functions~~ , contract manufacturing, payroll and tax functions, to third- party service providers. While outsourcing arrangements may lower our cost of operations, they also reduce our direct control over the services rendered. This diminished control may have an adverse effect on the quality or quantity of services rendered, on our ability to quickly respond to changing market conditions, or on our ability to ensure compliance with all applicable domestic and foreign laws and regulations. If we do not effectively develop and manage our outsourcing strategies, if required export and other governmental approvals are not timely obtained, if our third- party service providers do not **comply with laws or** perform as anticipated, or do not adequately protect our data **, including** from ~~cyber- related security~~ **cybersecurity** breaches, or if there are delays or difficulties in enhancing business processes, we may experience operational difficulties ~~(such as limitations on our ability to pay suppliers in a timely manner)~~ , increased costs, manufacturing or service interruptions or delays, loss of intellectual property rights or other sensitive data, quality and compliance issues, and challenges in managing our product inventory or recording and reporting financial and management information, any of which could materially and adversely affect our business, financial condition and operating results. Our top ten customers accounted for approximately **30 %,** 42 % ~~,~~ **and** 46 ~~% and 44~~ % of our net revenues for **2023,** 2022 ~~,~~ **and** 2021 ~~and 2020, respectively. Our top two customers, Lam Research Corporation and Applied Materials, Inc., together accounted for approximately 24 %, 27 % and 24 % of net revenues for 2022, 2021 and 2020~~ , respectively. In any one reporting period, a single customer or several customers may contribute an even larger percentage of our consolidated net revenues. ~~Further, our equipment solutions business (“ ESB ”), a component of PSD, also depends on a few significant customers for a large portion of its revenue in any given quarter.~~ While the Atotech Acquisition has mitigated our reliance on these customers to some degree, the loss of any of these customers or any significant reduction in orders by these customers, including reductions due to economic, market or competitive conditions or regulatory requirements, would likely ~~still~~ have a material adverse effect on our business, financial condition and operating results. None of our significant customers has entered into an agreement with us requiring it to purchase any minimum quantity of our products. Attempts to lessen the adverse effect of any loss or reduction of net revenues through the rapid addition of new customers would be difficult because a relatively small number of companies dominate the semiconductor and electronics manufacturing industries. Further, prospective customers typically require lengthy qualification periods prior to placing volume orders with a new supplier. Our future success will continue to depend upon: • Our ability to maintain relationships with existing key customers; • Our ability to attract new customers and satisfy any required qualification periods; • Our ability to introduce new products in a timely manner for existing and new customers; • The successes of our original equipment manufacturer (“ OEM ”) customers in creating demand for their capital equipment products that incorporate our products; and • Our ability to gain significant customers in new, emerging segments of our markets. Our ability to maintain and grow our business is directly related to the service of our employees ~~in each area of our business~~ , ~~as~~ **who** we consider ~~talent~~ to be a significant asset. Our performance is directly tied to our ability to hire, train, motivate and retain qualified personnel, including highly skilled technical, financial, managerial, and sales and marketing personnel. There is significant competition for personnel in the technology and sciences marketplace, particularly in certain geographies where we are located, including the Boston area, ~~the~~ Orange County **and** ~~, California area,~~ the San Francisco Bay area **of California** , China, Germany, Japan and Singapore. Also, employees in our industries are increasingly able to work remotely, which could increase employee mobility and turnover, making it more difficult for us to attract and retain employees. In addition, many of our product manufacturing processes and product services require deep technical expertise, and it can be particularly challenging to identify and attract candidates and retain employees possessing such expertise. We have experienced, and may continue to experience, attrition in certain key positions **. For example, Seth H. Bagshaw, our Executive Vice President, Chief Financial Officer and Treasurer, will retire from these positions on April 1, 2024, and as of February 27, 2024, we had yet to appoint his replacement** . A related challenge is that a significant portion of our technical talent is nearing retirement age, and we may have difficulty attracting a sufficient number of employees with the necessary skills to replace them. If we are unable to hire sufficient numbers of qualified employees or retain and motivate existing employees, ~~including our employees from the Atotech Acquisition,~~ our business and operating results would be harmed. Our business ~~has depended~~ **depends** upon ~~the~~ capital expenditures of semiconductor device manufacturers (which in turn depends upon the demand for semiconductors) **, electronics manufacturers** and ~~the capital expenditures~~ **Tier 1 and Tier 2 suppliers** for ~~electronics manufacturing. As a result of the Atotech Acquisition, we also expect to experience increased dependence on~~ the automotive industry. All of these industries have historically experienced cyclical variations in product supply and demand. For example, while our sales to semiconductor capital equipment manufacturers and semiconductor device manufacturers sequentially increased 12 % in 2022, ~~we anticipate that~~ our semiconductor revenue ~~could~~ **sequentially** ~~decrease~~ **decreased 28 %** in 2023, as a result of ~~expected~~ softening in the market. These sometimes sudden and severe cycles can result from many factors, including overall consumer and industrial spending and demand for electronic products that drive manufacturer production. These cycles can also result from manufacturers' capacity utilization, timing of new product introductions, demand for customers' products, inventory levels relative to demand, access to affordable capital, labor conditions, prices of commodities and energy costs. The timing, severity and duration of these cycles are difficult to predict, and we may not be able to respond effectively to these cycles. During downturns in the semiconductor and electronics manufacturing industries, periods of overcapacity have resulted in ~~rapid and~~ significantly reduced demand for our products, which may result in lower gross margins due to reduced absorption of manufacturing overhead, as our ability to **rapidly and effectively** reduce our cost structure ~~rapidly and effectively~~ in response to such downturns is limited by the fixed nature of many of our expenses in the near term. During downturns in the automotive industry, we ~~would expect~~ **have experienced** a similar effect on the gross margins **of the GMF business** of MSD. Further, our ability to reduce our long- term expenses is constrained by our need to continue ~~investment~~ **investing** in next- generation product technology and to support and service our products. In addition, due to the relatively long manufacturing lead times for some of the products we sell to these industries, we may incur expenditures or purchase raw materials or components for products we are unable to sell. As a result, downturns in these industries may materially harm our business, financial condition and operating results. Conversely, during upturns in these industries, we may have difficulty rapidly and effectively increasing our manufacturing capacity to meet sudden increases in customer demand. If we fail to do so, we may lose business to our competitors and our relationships with our customers may be harmed. We operate in highly competitive markets characterized by rapid technological advances, frequent product introductions and enhancements, changing customer requirements, evolving industry standards, substantial capital investment and increasing price pressure. Our success depends upon our ability to continuously develop, market and support superior products, processes and solutions. Factors that could harm our competitive position include: • Our failure to anticipate demand for and internally develop or acquire new, improved and disruptive technologies; • Our investment in emerging applications that do not achieve widespread adoption or significant growth; • Delays in introducing new, enhanced and differentiated products, many of which are difficult to design and manufacture because of their sophistication and complexity; • Reduced manufacturing capabilities, customer service or support; • Our inability to have semiconductor device manufacturers direct semiconductor capital equipment manufacturers to use our products at their semiconductor fabrication facilities; • Our inability to have global electronics OEMs specify our products in their manufacturing processes for the rigid **PCB** ~~printed circuit board~~ manufacturers they use; • Failure of customers to achieve market demand for their products that incorporate our technologies; • Efforts of customers to internally develop products that compete with our technologies or to engage subcontract manufacturers or system integrators to manufacture competitive products on their behalf; • Competitors that develop products that offer superior performance or technological features; • Competitors with greater financial, technical, marketing and other resources, including ownership by or affiliations with members of government, political entities or larger, multinational businesses, which may offer a number of competitive advantages, such as the ability to incur lower costs due to control over sources of components and raw materials or exclusive agreements with suppliers thereof; • Competitors with greater recognition and stronger presences in specific product niches and / or regions, including in the specialty chemicals industry; • Competitors, particularly in ~~China~~ **Asia** , that are able to develop low- cost competitive products; • Difficulties in displacing competitors' products that are designed into customers' products; • Pricing pressure from customers and competitors, particularly new competitors that offer aggressive price and payment terms in an attempt to gain market share, and especially during cyclical downturns in our markets, when end-markets become more sensitive to costs and competitors are more likely to seek to maintain or increase market share, reduce inventory or introduce more technologically advanced or lower- cost products; • Industry consolidation among competitors, which could exacerbate certain of these factors; and • Regulatory changes that prevent or **restrict the** ~~make it difficult to~~ supply **of** our products and services to a particular industry, market or country. Certain of these factors could cause customers to defer or cancel orders for our products and / or place orders for our competitors' products. This is particularly significant to us, as our success depends on many of our products being designed into new generations of equipment and manufacturing processes. Certain markets in which we operate, such as the semiconductor capital equipment market and the mobile phone market, which is part of our ~~industrial technologies~~ **electronics and packaging** market, experience cyclicality and unevenness in capital spending. If we are unable to introduce new products in a timely manner or are otherwise unsuccessful in making sales to customers, we may miss market upturns or fail to have our products or subsystems designed into our customers' products. For example, new products designed by capital equipment manufacturers historically have had a lifespan of five to fifteen years. We must develop products that are technologically advanced in a timely manner so that they are positioned to be chosen for use in each successive generation of capital equipment. These factors could also prompt us to agree to pricing concessions or extended payment terms with our customers, in an effort to expand into new markets, gain volume orders or improve customer cost of ownership in highly competitive applications. In other cases, we may discontinue selling certain products if we cannot offset price erosion through shifts in operations. Finally, these factors could render the portfolios of products or lines of business from which we generate significant net revenues obsolete. For example, MSD has lost business to customers who identify alternative materials or processes and therefore no longer require as much or any specialty chemicals. If our customers or the industries we serve shift to other technologies, our business, financial condition and operating results would be harmed. We offer products for very diverse markets ~~, the scope and number of which expanded as a result of the Atotech Acquisition~~ . Because we operate in multiple markets, we must work constantly to understand the needs, standards and technical requirements of many different applications within these markets, and must devote significant resources to developing different products for these markets. Product development is costly and time consuming. We must anticipate trends in our customers' industries and develop products before our customers' products and processes are commercialized. If we do not anticipate our customers' needs and future activities, we may invest substantial resources in developing products that do not achieve broad market acceptance. Our growth prospects rely in part on successful entry into new markets, which depends on displacing competitors who are more familiar with these markets and better known to customers. In many cases, we are attempting to enter or expand our presence in these new markets with newly introduced products that are not yet proven in the industry. Our decision to continue to offer products to a given market or to penetrate new markets is based in part on our judgment of the size, growth rate, profitability and other factors that contribute to the attractiveness of a particular market. If our product offerings in any particular market are not competitive, our analyses of a market are incorrect or our sales and marketing approach for a market is ineffective, we may not achieve anticipated growth rates in this market, and our business, financial condition and operating results would be harmed. Further, serving diverse markets requires an understanding of different sales cycles and customer types, and the development and maintenance of a complex global sales team and sales channels to support ~~the~~ **each** ~~markets~~ - **market** ~~'~~ **' s** differing needs. It also requires dynamic operations that can support both complex, customized product builds as well as quick turn- around for commercial off- the- shelf sales. If we fail to provide sales and operational support for our diverse markets, our business, financial condition and operating results would be harmed. We face significant risks from our substantial operations in, sales to, and purchases from international markets ~~, which has considerably increased following the completion of the Atotech Acquisition~~ . Our presence and operations in international markets, and the risks associated with doing business internationally, may continue to change and will likely increase if our business grows. These risks, many of which we have experienced, include: • Adverse changes or instability in political or economic conditions in countries or regions where we and our customers and suppliers are located, including currency devaluations, debt defaults, lack of liquidity and recessions; • Challenges of administering our diverse business and product lines globally; • Actions of government regulatory authorities, including embargoes, sanctions (including " anti- blocking " rules), executive orders, import, export, and reexport restrictions, antiboycott laws, tariffs (including anti- dumping and countervailing duties), currency controls, trade restrictions and trade barriers (including retaliatory actions), license requirements (including license- specific restrictions and provisos), citizenship requirements, nationality restrictions, environmental requirements and other rules and regulations (including extraterritorial rules and regulations) applicable to the manufacture, import, export, reexport or end- use of our products, all of which may be complicated and conflicting, require significant investments in cost, time and resources for compliance, negatively impact revenues and margins, and impose strict and severe penalties for **non-** ~~noncompliance~~ --- **compliance** ; • Political and social attitudes, laws, rules, regulations and policies within countries that favor domestic companies over non- domestic companies, including customer- or government- supported efforts to promote the development and growth of local competitors; • Greater risk of violations of U. S. and international laws and regulations, including anti- corruption and trade laws, and our code of conduct, by our employees, sales representatives, distributors or other agents; • Ambiguous or vague laws that make collecting payments or seeking recourse difficult; • Increased credit risk and differing financial conditions of customers and distributors, resulting in longer accounts receivable collection periods and payment cycles, increased bad debt write- offs and additions to reserves; • Overlapping, burdensome and differing tax structures and laws; • Potential for certain tax benefits to be revoked or reclaimed; • Reduced, inconsistent or differing protection of intellectual property, including unequal recognition and treatment of multi- national corporations ~~'~~ **'** rights by hostile or indifferent governments; • Increasingly stringent privacy, security, consumer and data protection laws, such as the **EU** ~~E. U.~~ General Data Protection Regulation, the Data Security Law of China and the China Personal Information Protection Law; • Shipping, logistics and other supply chain complications or cargo security requirements, including forced- labor mitigation rules and **increased** ~~inflationary rates of~~ shipping costs **, the latter of which certain parts of our business are experiencing as a result of the attacks on shipping in the Red Sea** ; • Adverse currency exchange rate fluctuations; • Restrictions on currency conversion or the transfer of funds, including restrictions on certain financial institutions themselves; • Compliance costs, withholding taxes and legal and contractual restrictions associated with repatriating overseas earnings; • Increased risk of exposure to significant health concerns (such as Monkeypox, COVID- 19, Sudden Acute Respiratory Syndrome, Avian Influenza and the H7N9, Ebola or Zika viruses); • Differences in business practices, culture, language and management style; • Complex, burdensome and differing labor and employment laws and practices; • Changing labor conditions and difficulties staffing, managing, and rationalizing our foreign operations, including, rising wages and other labor costs, retention of employees, the formation of labor unions and works councils and the maintenance of defined benefit pension plans; • Nationalization or other expropriation of private enterprises or land; • Involuntary geopolitical annexations or accessions through military force or otherwise; and • Increased risk of exposure to civil unrest, terrorism, government sanctioned and non- government sanctioned acts of violence, and military activities. If we experience any of the risks associated with doing business internationally, our business, financial condition and operating results could be significantly harmed. We have significant facilities and operations and a considerable number of employees in Israel. A number of our products are manufactured in facilities located in Israel. ~~The~~ **Following the Hamas attack on Israel in October 2023, some of our employees in Israel were called for active military duty. While, as of February 27, 2024, our facilities in Israel remain operational, the continuation, escalation or expansion of the Israel- Hamas war, including the expansion of hostilities into other parts of the** Middle East ~~remains a volatile~~ **, and other** ~~region~~ **regional** ~~,~~ **conflicts could negatively affect business conditions** and **significantly disrupt our operations in Israel. More broadly,** the future of peace efforts between Israel and **its** neighboring countries remains extremely uncertain. Any **other** armed conflicts or ~~significant~~ **further** political instability in the region **could similarly** ~~is likely to~~ negatively affect **our** business **, including if additional employees** ~~conditions and could significantly disrupt our operations~~ in Israel **are** ~~. Further, many of our employees in Israel may be~~ called for active military duty ~~under emergency circumstances~~ . If ~~a~~ **the Israel- Hamas war continues, escalates or expands, or another** military conflict or war **in the region** arises, our operations in Israel could be disrupted **, including** by the absence of one or more key employees or a significant number of other employees. Any such disruptions could adversely affect our business. MSD has limited operations and employees in Belarus ~~and recently ceased operations in Russia~~ . Historically, we have made immaterial sales into Russia and Belarus. As a result of the ongoing military conflict between Russia and Ukraine, including the imposition of sanctions on Russia, Belarus and related parties, ~~our sales operations in Russia and~~ our sales into Belarus and Russia have ceased. Any additional disruptions, including the expansion of sanctions in connection with the conflict, could adversely affect our business. The U. S. government continues to take action against certain of our customers, particularly our customers located in Asia, including indictments for various criminal charges, and in some cases, restrictions on doing business with these customers (or restrictions on third parties from engaging designated entities), including the suspension of our ability to fill outstanding orders. These actions have caused us, and will in the future cause us, to lose anticipated revenue from product sales, the amount of which could be significant. In addition, these or other customers could elect to purchase products from unaffected non- U. S. competitors, even when trade restrictions are not in place, jeopardizing our long- term relationship with them. Further, compliance with regulatory restrictions may cause us to breach contractual obligations, which could result in costs, penalties and litigation. Additionally, potential customers in certain countries, particularly in Asia, have a strong preference for technology and products developed by suppliers based in their home countries. The trade dispute between the U. S. government and the Chinese government has reinforced and broadened this preference, as potential and existing customers seek to avoid the uncertainty related to the trade dispute. While we have attempted to mitigate these issues by establishing a significant local presence in many of these countries, companies like us that are based elsewhere remain at a disadvantage. The Atotech Acquisition significantly increased our operations and assets in **, and revenues generated from,** China. As a result of our presence in China, we are subject to the following significant risks: • Adverse changes in Chinese political, economic or social conditions or Chinese laws, regulations or policies, including the imposition of unexpected or confiscatory taxation, restrictions on currency conversion, imports and sources of supply, devaluations of currency, the nationalization or other expropriation of private enterprises, or the reversal of economic reform policies that encourage private economic activity, foreign investments and greater economic decentralization; • ~~Restrictions or limitations on our ability to repatriate funds from our Chinese operations, including penalties for non- compliance with applicable Chinese law; •~~ Differing economic practices compared to most developed countries, including with respect to the amount of government involvement, control of foreign exchange and allocation of resources; • Uncertainties presented by the Chinese legal system, which is not fully integrated and continues to rapidly evolve, impeding our ability to interpret certain Chinese laws and regulations, predict and evaluate the outcome of administrative and court proceedings and the level of legal protection in China and enforce contracts we have entered into in China; and • Chinese controls on the convertibility of Renminbi into foreign currencies and, in certain cases, the remittance of currency out of China, restricting our ability to remit sufficient foreign currency to pay dividends or make other payments to us, or otherwise satisfy foreign currency- denominated obligations. If we experience any of the risks associated with doing business in China, our business, financial condition and operating results could be significantly harmed. Although we report our financial position and operating results in U. S. dollars, a significant portion of our net revenues are from customers in international markets where we invoice in currencies other than the U. S. dollar, and we have facilities where costs are incurred in currencies other than the U. S. dollar. In addition, we carry certain assets and liabilities in currencies other than the U. S. dollar. The indebtedness we incurred in connection with the Atotech Acquisition includes a Euro tranche of ~~EUR 600~~ **€ 843** million **as of January 22, 2024, the date of the USD Tranche A Refinancing** . Currency exchange rate fluctuations could have an adverse effect on our assets, liabilities, net revenues, expenses and operating results and we could experience losses with respect to our hedging activities. Unfavorable exchange rate fluctuations could require us to increase or decrease prices to customers, which could result in lower net revenues from such customers. Alternatively, if we do not adjust the prices for our products in response to unfavorable currency fluctuations, our operating results could be adversely affected by declining net revenues or profit margins for our products. Such exchange rate fluctuations could also increase the costs and expenses of our non- U. S. operations when translated into U. S. dollars or require us to modify our current business practices. In addition, most sales made by our foreign subsidiaries are denominated in the currency of the country in which these products are sold and the currency they receive in payment for such sales could be less valuable on a U. S. dollar basis at the time of receipt as a result of exchange rate fluctuations. We enter into foreign exchange forward contracts to reduce a portion of our currency exposure arising from intercompany sales of inventory as well as intercompany accounts receivable and intercompany loans. However, we cannot be certain that our efforts will be adequate to protect us from significant exchange rate fluctuations or that such efforts will not expose us to additional exchange rate risks. Section 404 of the Sarbanes- Oxley Act of 2002 requires that companies evaluate and report on the effectiveness of their internal control over financial reporting. In addition to the Company' s evaluation, our independent registered public accounting firm provides an opinion regarding the effectiveness of our internal control over financial reporting. As disclosed in more detail in Part II, Item 9A, " Controls and Procedures " below, following the ransomware incident **in** ~~we identified on~~ February ~~3,~~ 2023, we identified a material weakness as of December 31, 2022 in our internal control over financial reporting. Our assessment was we did not maintain sufficient ~~information technology ("~~ IT ~~")~~ controls to prevent or detect, on a timely basis, unauthorized access to our financial reporting systems. Specifically, we did not design or maintain effective controls with respect to our financial reporting systems related to access authentication, intrusion detection and response capability, and backup and restoration such that recovery from a cybersecurity incident could be performed in a more timely manner. Internal controls related to our financial reporting systems are important to accurately reflect our financial position and results of operations in our financial reports. Due to the material weakness in our internal control over financial reporting, we ~~have~~ also concluded our disclosure controls and procedures were not effective as of December 31, 2022. Failure to have effective internal control over financial reporting and disclosure controls and procedures can impair our ability to produce accurate financial statements on a timely basis and could lead to a restatement of our financial statements. If, as a result of the ineffectiveness of our internal control over financial reporting and disclosure controls and procedures, we cannot provide reliable financial statements, our business decision processes may be adversely affected, our business and results of operations could be harmed, investors could lose confidence in our reported financial information and our ability to obtain additional financing, or additional financing on favorable terms, could be adversely affected. Our management **took** ~~has taken~~ action to ~~begin remediating~~ **remediate** the material weakness ~~; however~~ , ~~certain~~ **concluding that the material weakness had been fully** ~~remedial~~ **remediated** ~~actions have only recently commenced and other remedial actions have not yet started, and while we expect to continue to implement our remediation plans, we cannot be certain~~ as **of December 31, 2023** ~~to when remediation will be fully completed or if our remediation efforts will be successful~~ . Additional details regarding the ~~initial~~ remediation efforts are disclosed in ~~more detail in~~ Part II, Item 9A, " Controls and Procedures " below. ~~In addition~~ **Although we remediated this material weakness** , we could in the future identify additional internal control deficiencies that could rise to the level of a significant deficiency or material weakness or uncover other errors in financial reporting. ~~During the course of our evaluation, we may identify areas requiring improvement and may be required to design additional enhanced processes and controls to address issues identified through this review. In addition, there~~ **There** can be no assurance that ~~such~~ **future** remediation efforts will be successful, that our internal control over financial reporting will be effective as a result of these efforts **,** or that any ~~such~~ future significant deficiencies ~~identified~~ may not be material weaknesses that would be required to be reported in future periods. In addition, we cannot provide assurance that our independent registered public accounting firm will be able to attest that such internal controls are effective when they are required to do so. If we fail to remediate ~~the~~ **any future** material ~~weakness~~ **weaknesses** and maintain effective disclosure controls and procedures or internal control over financial reporting, our ability to accurately record, process, and report financial information and, consequently, our ability to prepare financial statements within required time periods could be adversely affected. Failure to maintain effective internal controls could result in a failure to comply with SEC rules and regulations, stock exchange listing requirements, and the covenants under our debt agreements, subject us to litigation, investigations or enforcement actions, negatively affect investor confidence in our financial statements, and adversely impact our stock price and ability to access capital markets. The defense of any such claims, investigations or enforcement actions could cause the diversion of the Company' s attention and resources and could cause us to incur significant legal and other expenses even if the matters are resolved in our favor. Trade tensions between the United States and China have increased substantially in recent years, resulting in significant trade restrictions that have significantly harmed our business. These regulations include tariff increases, additional sanctions against specified entities, and the broadening of restrictions and license requirements for specified end- uses of those of our products that are subject to these restrictions, including restrictions surrounding specific product groups, applications and / or end uses. **The** U. S. ~~Government~~ **government** concerns relate to, among other things, national security concerns and the concept of ~~'~~ **"** military / civil fusion ~~'~~ **"** in China ~~-~~ **,** a national strategy in which military technologies are developed or produced alongside commercial, non- military items, often by private or quasi- government companies. In addition to targeted comprehensive sanctions against specific firms, in recent years, " Entity List " designations and " military end- user " controls have been significantly modified, as were some rules relating to items produced outside the United States that incorporate more than de minimis levels of U. S. controlled content or derived from (i. e., the " direct product " of) U. S. origin technologies. ~~Most recently~~ **Recently** , in October 2022, the U. S. Department of Commerce ~~'~~ **'** s Bureau of Industry and Security (" BIS ") **implemented** ~~published regulations that introduce~~ new and novel restrictions related to end- uses in semiconductor, semiconductor manufacturing, supercomputer, and advanced computing, along with certain equipment used to develop and produce them, as well as controls around the activities of U. S. persons **in certain markets, including China. These regulations, which BIS amended in October 2023** (**as amended,** the " ~~New~~ BIS Rules ") **,** ~~. These regulations~~ have resulted in, and may in the future result in, loss of business, both directly to China end- customers, and indirectly through our OEM customers, as well as additional export license requirements on shipments of our products, parts and supplies, and associated increased administrative burdens. **For example, as a result of the BIS Rules, we estimate our net revenues were reduced by approximately $ 200 to $ 250 million in 2023.** The extraordinary complexity ~~and evolving nature~~ of these rules ~~also~~ **, combined with the likelihood of further amendments from BIS,** significantly increases our risk of non- compliance, which could result in fines and **other** penalties **, and could change how these rules impact us** . While we continue to adjust our policies and practices to ensure compliance with these regulations, and we will seek to mitigate their impact, there can be no assurances that current or future regulations and tariffs will not have a material adverse effect on our business. Since the beginning of 2019, ~~the pace at which~~ regulatory changes have been implemented ~~has been~~ **at an** extraordinarily high **pace**, which increases the resources needed to monitor and comply with regulations, while heightening the risk of non- compliance. Such regulatory changes include the addition by BIS of China- based Huawei Technologies Co., Ltd. (" Huawei "), Semiconductor Manufacturing International Corporation (" SMIC "), Yangtze Memory Technologies Corp (" YMTC ") and many of their respective affiliates onto its Entity List. Accordingly, we have implemented additional monitoring processes and suspended orders from Huawei, SMIC, YMTC and certain other designated Chinese- based customers, where those orders are subject to U. S. jurisdiction. We have also been negatively impacted by the cancellation of orders from customers who are suppliers to these firms. BIS has also modified the Foreign Direct Product and " military end- use " rules, expanded the scope of products and technologies that would require licenses for military end- uses, primarily in China, and expanded the list of " military end users, " mostly in China. ~~In~~ **Beginning in** October 2022, the ~~New~~ BIS Rules imposed new restrictions on our ability to sell, ship, service and support certain equipment and otherwise conduct business with certain counterparties, primarily China- based companies involved in semiconductor manufacturing, which has negatively impacted, and we expect will continue to negatively impact, our revenues. At the same time, BIS also added numerous China- based companies, including companies with which we do business, to its " Unverified List. " Placement on the Unverified List may be an indication of additional future restrictions by BIS, as was the case with YMTC, which was added to the Unverified List in October 2022 and was then added to the Entity List in December 2022. Increased restrictions on China may lead to regulatory retaliation by the Chinese government and ~~possibly~~ further escalate geopolitical tensions between China and Taiwan. China has adopted, and announced its intention to further adopt, new regulations, which could have an adverse effect on our operations. For example, in response to the imposition of U. S. tariffs in 2018 and 2019, China imposed its own retaliatory tariffs. In ~~May~~ 2019, China ~~'~~ **'** s Ministry of Commerce **also** announced an " unreliable entity list " under which non- Chinese entities that cut off supply to Chinese companies may be subject to government action. **Because many of the mechanisms for being named to the list, removed from the list, and enforcement remain ill- defined and unavailable to the public, the potential impacts of the regulation remain unknown.** In ~~September~~ **addition, in** ~~2020~~ **2023**, ~~it disclosed potential enforcement mechanisms in the form of~~ **China adopted export curbs on crucial raw materials, including gallium, germanium,** ~~an~~ **and graphite** ~~" Unreliable Entity List. " This regulation has yet to be implemented~~, **that may have both direct** and ~~its effects are unknown at this time~~ **indirect adverse impacts on our business and supply chain**. The ongoing geopolitical tensions and economic uncertainty between the United States and China caused by recent tariffs, Entity List and " military end user " designations, foreign- made product rules and the ~~New~~ BIS Rules, and the unknown impact of current and future Chinese trade regulations, may continue to ~~cause increased~~ - **increase** costs, as well as ~~restrictions~~ ---- **restrict** ~~on~~ our ability to sell, or ~~a decreased~~ - **decrease** demand from customers to purchase, our products, directly and indirectly, which could materially harm our business, financial condition and operating results. This trade uncertainty has caused, and may continue to cause, customers to delay or cancel orders, as they mitigate their own supply chain and cost exposure by sourcing from locally ~~-~~ based suppliers or suppliers based in other countries. Such delays and cancellations could have a material impact on our business, financial condition and operating results. It is possible that additional **trade** restrictions ~~on trade~~ will be imposed, and that existing tariffs will be increased on imports of our products or the components used in our products and / or that our business will be impacted by additional retaliatory tariffs or restrictions imposed and / or increased by China or other countries in response to existing or future tariffs ~~, causing~~ **. These developments could cause** us to ~~potentially~~ lose additional sales and customers, incur increased costs and lower margins, seek alternative suppliers, raise prices or make changes to our operations, any of which could materially harm our business, financial condition and operating results. We are subject to trade compliance laws in both the United States and other jurisdictions where we operate. For example, exports of our products and technology developed or manufactured in the United States are subject to export controls imposed by the U. S. ~~Government~~ **government** and administered by the U. S. Departments of Commerce and, to a lesser extent, State and Treasury. Export regulations govern exports of our products and technology developed or manufactured in other countries, including, for example, Austria, China, France, Germany, Israel, Romania and Singapore. In certain instances, these regulations may require obtaining licenses from the administering agency prior to exporting products or technology to international locations or foreign nationals, including foreign nationals employed by us in the United States and abroad. For products and technology subject to the U. S. Export Administration Regulations administered by BIS, the requirement for a license is dependent on the type and end use of the product and technology, the final destination and the identity and nationality of the end user. Virtually all exports from the United States of defense articles subject to the International Traffic in Arms Regulations, administered by the Department of State ~~'~~ **'** s Directorate of Defense Trade Controls, require a license. The Israeli Ministry of Economy and the Defense Export Control Agency of the Israeli Ministry of Defense administer similar export regulations and license requirements, which apply to many of our products and technology developed or manufactured in Israel. In addition, the Romanian Ministry of Foreign Affairs and the Department for Export Controls administer similar export regulations and license requirements, which apply to many of our products and technology developed or manufactured in Romania. Obtaining export licenses can be difficult and time- consuming, and we may not be successful in obtaining them. Failure to obtain export licenses to enable product and technology exports could reduce our net revenues, harm our relationships with our customers and could adversely affect our business, financial condition and operating results. Compliance with export regulations may also subject us to additional fees and costs. The absence of comparable export restrictions on competitors, whether due to technical specifications or ~~the~~ **such** ~~competitor~~ **competitors '** ~~' s~~ geography, may adversely affect our competitive position. In addition, if we or our international representatives or distributors fail to comply with any of these export regulations, we or they could be subject to civil and criminal and monetary and non- monetary penalties and costly consent decrees, and we could experience disruptions to our business, restrictions on our ability to export products and technology, damage to our reputation and significant harm to our business and operating results. **We are engaged in a systematic, risk- based review of our compliance- related activities to identify and remediate known and suspected weakness (e. g., product export classification). In connection with that review, we identified certain activities that were non- compliant with applicable trade regulations, and have submitted appropriate voluntary disclosures to applicable authorities to report such non- compliance.** While **such instances of non- compliance have not had a material adverse impact on us to date, it is not yet known whether, or to what extent, this continuing review will yield additional reportable non- compliance. Additionally, while** we have implemented policies and procedures to comply with these laws, we cannot be certain that our employees, contractors, suppliers or agents will not violate such laws or our policies. As a global company, we are subject to taxation in the United States and various other countries. Significant judgment is required to determine and estimate worldwide tax liabilities. Our future annual and quarterly effective tax rates could be **materially** affected by numerous factors, including changes in the **following:** applicable tax laws **; the organizational structure of our business, including reorganizations, location of assets and outstanding indebtedness** ; composition of pre- tax income in countries with differing tax rates; our determinations of tax liabilities; and / or valuation of our deferred tax assets and liabilities. ~~The enactment of~~ **Changes in U. S. tax law, such as** the Tax Cuts and Jobs Act ~~(~~ **,** the ~~“ TCJA ”)~~ **Inflation Reduction Act, and changes** in **regulations and** ~~December 2017 significantly affected U. S.~~ tax ~~law by changing how~~ **guidance may affect our business. Additionally,** the United States ~~imposes~~ **is considering various corporate and international income** tax **proposals, which, if enacted, could have a material impact** on ~~multinational corporations. The U. S. Department of Treasury has broad authority under the TCJA to issue regulations and interpretive guidance. Some of the proposed and final regulations that have been issued regarding the TCJA have been challenged in court~~ -- **our provision for income taxes and effective** ~~. We have applied available guidance to estimate our~~ tax ~~obligations, but new guidance issued by~~ **rate. Many countries in which we operate are implementing legislation and** ~~the~~ **other** ~~U. S. Treasury Department may cause us to adjust our~~ tax **changes to align** ~~estimates in future periods. The ultimate impact of the~~ **their** ~~TCJA on our U. S.~~ tax **systems with** ~~liabilities is based upon our understanding and interpretation of the regulatory guidance that has been issued regarding the TCJA. On October 4, 2021, 136 members of~~ the Organisation for Economic Co- operation and Development ~~(“ OECD ”) agreed to a~~ global minimum tax rate ~~of 15 %. On December 20, 2021, OECD published its model rules on the agreed minimum tax~~ known as **Pillar Two of** the Global Anti- Base Erosion (“ GloBE ”) rules. The GloBE rules provide a framework for a coordinated multi- country system of taxation intended to ensure large multinational enterprise groups pay a minimum level of tax on the income arising in each of the jurisdictions where they operate. **Many jurisdictions** ~~On December 14~~ , ~~2022~~ **including many EU countries** , **have enacted certain provisions** ~~the European Council approved its directive to implement Pillar Two~~ of the GloBE rules **effective** ~~regarding a 15 % global minimum tax rate. Many EU countries have already indicated they plan to enact certain provisions of this directive~~ as of January 1, 2024. **The GloBE rules could** ~~In addition, many G20 nations~~ have **a** ~~indicated their plan to follow the OECD guidance as early as January 1, 2024. Pillar Two may~~ materially **adverse** ~~increase our future effective~~ --- **effect** ~~tax rate~~ **on our financial condition and operating results** . We are subject to regular examination by the U. S. Internal Revenue Service and state, local and foreign tax authorities. We regularly assess the likelihood of favorable or unfavorable outcomes resulting from these examinations to determine the adequacy of our provision for income taxes. Although we believe our tax estimates are reasonable, we can make no assurances that any final determination of tax liability will not be materially different from the treatment reflected in our historical income tax provisions and accruals, which could materially and adversely affect our financial condition and operating results. We qualify for tax incentives based on our ability to meet, on a continuing basis, various tests relating to our employment levels, research and development expenditures and other qualification requirements in a particular jurisdiction. While we intend to operate in such a manner to maintain and maximize our tax incentives, we can make no assurances that we have so qualified or that we will so qualify for any particular year or jurisdiction. If we fail to qualify or remain qualified for certain tax incentives, the tax incentives we previously received may be terminated and / or retroactively revoked, requiring repayment of past tax benefits, and we would be subject to an increase in our effective tax rate, which ~~would~~ **could have a materially** ~~adversely~~ -- **adverse** impact our financial results. As MSD manufactures specialty chemicals, we are subject to chemicals approvals, registrations and regulations around the world, including European Union ~~Regulation~~ **Regulations** on Registration, Evaluation, Authorisation and Restriction of Chemicals (“ EU REACH ”) **in the EU** , the Toxic Substances Control Act (“ TSCA ”) in the United States, and similar laws and regulations in certain other jurisdictions in which we and our customers operate. In recent years, changes to existing laws and regulations and the adoption of new laws and regulations have imposed new obligations, including restrictions and prohibitions on highly hazardous substances, could also force us to reformulate or discontinue certain of our products. Governmental, regulatory, and societal demands for increasing levels of product safety and environmental protection are resulting in increased pressure for more stringent regulatory control with respect to the chemical industry, including with respect to manufacturing, importing and using chemicals. For example, ~~the~~ EU REACH imposes comprehensive compliance obligations and establishes mechanisms to identify and restrict high- concern chemicals, and comparable regulatory requirements have now been adopted in several other countries. As another example, in the United States, the core provisions of ~~the~~ TSCA were amended in June 2016 for the first time in nearly 40 years. Among the more significant changes, the amended TSCA mandates risk evaluation of existing “ high priority ” chemicals. In addition, the U. S. Environmental Protection Agency (the “ EPA ”) must make a no “ unreasonable risk ” finding before a new chemical can be fully commercialized. These laws and regulations generally create uncertainty about whether existing chemicals important to our business may be designated for restriction and whether the approval process for new chemicals may become more difficult and costly. These changes could adversely impact our ability to supply certain products to our customers and could also result in compliance obligations, fines, ongoing monitoring and other future business activity restrictions, which could have a material adverse effect on our business, financial condition and operating results. Perfluorooctanesulfonic acid and other per- and polyfluoroaklyl substances (“ PFAS ”) are chemical agents that have been targeted for risk assessment, restriction, regulation and high- priority remediation and are the subject of litigation and governmental investigations in the United States and other countries. While we have developed a suite of products that do not require any PFAS chemicals and, when adopted by the industry, will obviate the need for PFAS- containing mist suppressants and wetting agents, we continue to sell a limited number of products that contain permissible levels of PFAS. We have been named as a defendant in a lawsuit related to PFAS and we have received a request for information from, and responded to, a state agency. International environmental protection requirements, including chemical regulation requirements, and enforcement of these requirements, may become more stringent in the future and could result in material costs relating to regulatory compliance, liabilities, litigation proceedings, or other impacts, such as restrictions or prohibitions on our products. Future regulatory or other developments could also restrict or eliminate the use of, or require us to make modifications to, our products, packaging, manufacturing processes, transportation methods, and technology, which could have a material adverse effect on our business, financial condition, and operating results. Our production facilities require permits, such as environmental, operating, and product- related permits and import / export permits, which are subject to renewal and, in some circumstances, revocation. We may not obtain the necessary permits **. In addition** , ~~existing~~ permits may be discontinued **or** ~~,~~ ~~and any newly issued permits~~ may contain significant and costly new requirements. If a permit for a production facility ~~would~~ **is** not ~~be~~ renewed or **is** ~~would be~~ revoked, the facility may need to be closed temporarily or permanently, which may have a material adverse effect on our business, financial condition and operating results. Failure to obtain or maintain permits for our facilities or other failure to comply with applicable environmental regulations could result in the shutdown of, or suspension of operations at, our plants. Many of our customers are subject to the same or similar environmental regulations. The impact of these regulations on our customers and our customers' ability to comply with these regulations is outside of our control. However, **non-** ~~noncompliance~~ --- **compliance** by our customers could have an indirect negative effect on our business. We must monitor relevant chemical regulatory developments in order to limit the associated risks of new developments by triggering countermeasures, such as alternative products and phase- outs, at the right time. Our operations are subject to various federal, state, local and international laws and regulations relating to environmental protection, including those governing discharges of pollutants into the air, water and land, the reporting, generation, use, handling, storage, transportation, treatment and disposal of hazardous substances, waste and other materials and the cleanup of contaminated sites. In the United States, we are subject to the federal regulation and control of the EPA, and we are subject to regulations and controls of comparable authorities in other countries. Some of our operations, including our chemical operations, require environmental permits and controls to prevent and reduce air and water pollution, and these permits are subject to modification, renewal and revocation by issuing authorities. Future developments, administrative actions or liabilities relating to environmental matters, including sanctions such as capital expenditure obligations, clean- up and removal costs, long- term monitoring and maintenance costs, costs of waste disposal, natural resource damages and payments for property damage and personal injury, could have a material adverse effect on our business, financial condition or operating results. Although we believe that our safety procedures for using, handling, storing and disposing of such materials comply with the standards required by applicable federal, state, local and international laws and regulations, we cannot completely eliminate the risk of accidental contamination or injury from these materials, including risks related to our chemical products, which are inherently hazardous. We have been, and may in the future be, subject to claims by employees or third parties alleging contamination or injury, and could be liable for damages, which liability could exceed the amount of our liability insurance coverage (if any) and the resources of our business. Certain portions of the soil at the former facility of our Spectra- Physics lasers business, located in Mountain View, California, and certain portions of the aquifer surrounding the facility, through which contaminated groundwater flows, are part of an EPA- designated Superfund site and are subject to a cleanup and abatement order from the California Regional Water Quality Control Board. Spectra- Physics, which we acquired as part of the Newport acquisition in April 2016 and which had been acquired by Newport in 2004, along with other entities with facilities located near the Mountain View, California facility, were identified as responsible parties with respect to this Superfund site, due to releases of hazardous substances during the 1960s, 1970s and 1980s. Spectra- Physics and the other responsible parties entered into cost- sharing agreements covering the costs of remediating the off- site groundwater impact. The site is mature, and investigations, monitoring and remediation efforts by the responsible parties have been ongoing for approximately ~~30~~ **35** years. We have certain ongoing costs related to investigation, monitoring and remediation of the site that have not been material to us as a whole in the recent past. However, while we ~~benefitted~~ - **benefited** from the indemnification of certain costs by a third party in the past, that indemnification is now in a transition period, and we will become subject to a greater portion of costs of remediation going forward. Our ultimate costs of remediation and other potential liabilities are difficult to predict. In the event that the EPA and the California Regional Water Quality Control Board determine that the site cleanup requires additional measures to ensure that it meets current standards for environmental contamination, or if they enhance any of the applicable required standards, we will likely become subject to additional remediation obligations in the future. In addition to our investigation, monitoring and remediation obligations, we may be liable for property damage or personal injury claims relating to this site. While we are not aware of any material claims at this time, such claims could be made against us in the future. If significant costs or other liability relating to this site arise in the future, our business, financial condition and operating results would be adversely affected. In addition, some of MSD' s manufacturing facilities and former facilities have an extended history of chemical manufacturing operations or other industrial activities, and contaminants have been detected at some of those sites. We or our predecessors have in the past been, and are currently, required to remediate contamination at several of these current and former sites, and there remains some risk that further investigation and remediation might be necessary. The environmental regulations that we are subject to include a variety of federal, state, local and international regulations that restrict the use and disposal of materials used in the manufacture of our products or require design changes or recycling of our products. If we fail to comply with any present or future regulations, we could be subject to future liabilities, the suspension of manufacturing or a prohibition on the sale of products we manufacture. In addition, these regulations could restrict our ability to equip our facilities or could require us to acquire costly equipment, or to incur other significant expenses to comply with environmental regulations, including expenses associated with the recall of any non- compliant product and the management of historical waste. For example, in addition to EU REACH, which regulates the use of certain hazardous substances in certain products, the EU has enacted the Waste Electrical and Electronic Equipment Directive, which requires the collection, reuse and recycling of waste from certain products. Compliance with such laws requires significant resources. These regulations may require us to redesign our products or source alternative components to ensure compliance with applicable requirements, for example by mandating the use of different types of materials in certain components. Any such redesign or alternative sourcing may increase the cost of our products, adversely impact the performance of our products, add greater testing lead- times for product introductions, or in some cases limit the markets for certain products. Further, such environmental laws are frequently amended, which increases the cost and complexity of compliance. For example, such amendments have in the past **resulted in** , and may in the future ~~,~~ result in **,** certain of our products falling ~~in~~ **within** the scope of a directive, even if they were initially exempt. In addition, certain of our customers, particularly OEM customers whose end products may be subject to these directives, may require that the products we supply to them comply with these directives, even if not mandated by law. Because certain directives, for example, those issued from the EU, are implemented in individual member states, compliance is particularly challenging. Our failure to comply with any of such regulatory requirements or contractual obligations could result in our being directly or indirectly liable for costs, fines or penalties and third- party claims, and could jeopardize our ability to conduct business in certain countries ~~. We are exposed to various risks related to legal proceedings, including, for example, product liability claims, intellectual property infringement claims, contractual claims and securities class action litigation, which if successful, could have a material adverse effect on our commercial relationships, business, financial condition and operating results~~ . From time to time, we may be involved in legal proceedings, enforcement actions or claims regarding product performance, product warranty, product certification, product liability, patent infringement, misappropriation of trade secrets, other intellectual property rights, data privacy, antitrust, environmental regulations, trade regulations, securities, contracts, unfair competition, employment, workplace safety, and other matters. We can provide no assurance of the outcome of these legal proceedings, enforcement actions or claims or that the insurance we maintain will be adequate to cover them. For example, some of our products, such as certain ultrafast lasers, are used in medical and scientific research applications where malfunctions could result in serious injury. Certain of our products may be hazardous if not operated properly or if defective. Other products of ours, including our chemicals products and laser systems, are inherently hazardous and must be used with particular care. We are exposed to significant risks for product liability claims in the event of a significant line down situation or if death, personal injury or property damage results from the handling, use or storage of our products, including our chemical products and laser systems. We may experience material product liability losses in the future. We currently maintain insurance for certain product liability claims. However, our insurance coverage may not continue to be available on acceptable terms, if at all. This insurance coverage also may not adequately cover liabilities that we incur. Further, if our products are defective, we may be required to recall or redesign these products. A successful claim against us that exceeds our insurance coverage level or that is not covered by insurance, or any product recall, could have a material adverse effect on our commercial relationships, business, financial condition and operating results. In addition, securities class action lawsuits and derivative lawsuits are often brought against companies who have entered into business combinations and acquisitions. We were previously involved in securities class action litigation in connection with the acquisitions of Newport and ESI. In each case, the plaintiffs alleged, among other things, that the then- current directors of the acquired company breached their fiduciary duties to their respective shareholders by agreeing to sell the company through an inadequate and unfair process, leading to inadequate and unfair consideration, by agreeing to unfair deal protection devices, and by omitting material information from the proxy statement. We, or the companies we acquire, may be subject to additional securities class action litigation in connection with other recently completed or future business combinations and acquisitions. ~~Regardless of the outcome, securities class action litigation such as this can be time- consuming, result in significant expense to us and divert attention and resources of our management and other key employees. Costs and expenses, or an unfavorable outcome in such cases, could exceed applicable insurance coverage, if any. Any such unfavorable outcome could have a material adverse effect on our business, financial condition, operating results and cash flows.~~ With respect to data privacy and intellectual property, as a result of the ransomware event described under " Risks Related to Cybersecurity, Data Privacy and Intellectual Property Protection " above, and under " Management' s Discussion and Analysis of Financial Condition and Results of Operations — Ransomware Event " below, we ~~are~~ **were previously** subject to ~~litigation, investigations or liability under contracts. For example, on March 3, 2023, we became subject to~~ **two** ~~a class action lawsuit~~ **lawsuits** ~~filed in the Orange County Superior Court of the State of California seeking unspecified monetary damages~~ , ~~costs~~ and ~~attorneys' fees arising out of the ransomware event. We are unable to predict at this time the potential timing and outcome of the claim and whether~~ we may be subject to **future** ~~further private~~ litigation ~~or inquiries and proceedings by various government agencies~~ , ~~law enforcement and~~ **investigations, claims or actions, in addition to fines, penalties, or** other ~~governmental authorities~~ **obligations related to impacted data, whether or not such data is misused** . While we intend to vigorously defend ~~this lawsuit, and~~ any ~~additional such~~ lawsuits, in light of the inherent uncertainties involved in such proceedings, we may incur losses associated with any such proceedings. Additionally, ongoing legal and other costs related to ~~this lawsuit, as well as~~ any potential future proceedings and inquiries, may be substantial, and losses associated with any adverse judgments, settlements, penalties or other resolutions of such proceedings and inquiries could be significant and have a material adverse impact on our business, reputation, financial condition, cash flows and operating results. In addition, we have from time to time received claims from third parties alleging that we are infringing certain trademarks, patents or other intellectual property rights held by them. Such infringement claims have in the past **resulted in,** and may in the future result in **,** litigation, settlement or enforcement action. Any such action could be protracted and costly, and we could become subject to damages for infringement, or to an injunction preventing us from making, selling or using certain of our products or services, or using certain of our trademarks. Such claims could also result in the necessity of obtaining a license or paying damages relating to one or more of our products, services or current or future technologies, which may not be available on commercially ~~reasonable~~ **acceptable** terms or at all. Any intellectual property action and the failure to obtain necessary licenses or other rights or develop substitute technology may divert management ~~'~~**’**s attention from other matters and could have a material adverse effect on our business, financial condition and operating results. In addition, the terms of some of our customer contracts require us to indemnify the customer for any claim of infringement brought by a third party based on our products. Claims of this kind may have a material adverse effect on our commercial relationships, business, financial condition or operating results. Although our standard commercial documentation sets forth the terms and conditions that we intend to apply to commercial transactions with our business partners, counterparties to these transactions may not explicitly agree to our terms and conditions. In situations where we engage in business with a third party without an explicit written agreement regarding the applicable terms and conditions, or where the commercial documentation applicable to the transaction is subject to interpretation, we may have disputes with those third parties regarding the applicable terms and conditions of our transaction with them. These disputes could result in deterioration of commercial relationships, costly and time- consuming litigation or additional concessions or obligations being offered by us to resolve these disputes, or could impact our net revenue or cost recognition. Any of these outcomes could materially and adversely affect our business, financial condition and operating results. In addition, from time to time in the normal course of business we indemnify parties with whom we enter into contractual relationships, including customers, suppliers, consultants and lessors, with respect to certain matters. We have agreed, under certain conditions, to hold these parties harmless against losses, such as those arising from a breach of representations or covenants, negligence or willful misconduct, and other third- party claims that our products and / or technologies infringe intellectual property rights. We may be compelled to enter into or accrue for probable settlements of alleged indemnification obligations, or we may be subject to potential liability arising from our customers ~~'~~**’** involvement in legal disputes. In addition, notwithstanding the provisions related to limitations on our liability that we seek to include in our business agreements, the counterparties to such agreements may dispute our interpretation or application of such provisions, and a court of law may not interpret or apply such provisions in our favor, any of which could result in an obligation for us to pay significant additional damages and engage in costly legal proceedings. It is difficult to determine the maximum potential amount of liability under any indemnification obligations, whether or not asserted, due to the unique facts and circumstances likely to be involved in any particular claim. Our business, financial condition and operating results in a reported fiscal period could be materially and adversely affected if we expend significant amounts in defending or settling any asserted claims, regardless of their merit or outcomes. Legal proceedings, enforcement actions and claims, whether with or without merit, and associated internal investigations, may be time- consuming and expensive to prosecute, defend or conduct; divert management ~~'~~**’**s attention and other resources; inhibit our ability to sell our products or services; result in adverse judgments for damages, injunctive relief, penalties and fines; and negatively affect our business **, including result in a material adverse effect on our financial condition, operating results and cash flows** . We can make no assurances regarding the outcome of current or future legal proceedings, enforcement actions, claims or investigations or that the insurance we maintain will be adequate to cover them. The COVID- 19 pandemic subjected, and the ~~continued effects of the COVID- 19 pandemic or the~~ emergence of other widespread health crises may ~~continue to~~ subject, our business, financial condition and operating results to a number of risks, including: • Supply chain disruptions and other operational challenges, including shortages of and significant price increases and increased lead times for raw materials, components and subassemblies, in particular where we rely on sole and limited source suppliers, increased employee turnover, increased health and safety measures, site closures, and other restrictions on the movement of people, goods and raw materials, which could reduce our ability to obtain materials from suppliers and meet customer demand, in each case on favorable terms, on a timely basis, or at all, harming our relationships with customers, creating opportunities for competitors and exposing us to contractual disputes or liability; • The implementation of government mandates and other regulatory actions, including periodic business shutdowns, manufacturing restrictions, and quarantines, which could reduce or halt our operations or the operations of our customers and suppliers, carry into the future for an extended or unknown duration, and contain complex requirements that make compliance difficult; • Decreased employee productivity or availability, whether due to illnesses or due to the measures we or government authorities may take to mitigate their spread and effects, including site closures, restrictions on travel and vaccine mandates, which could lead to employee attrition; and • A decline in industry and global economic conditions that reduces demand from and weakens the financial health of our customers, resulting in delayed or canceled orders, requests for payment deferrals or other contract modifications, and, if we do not anticipate significant or sudden decreases in order patterns, excess inventory. These risks may be heightened in certain geographies, segments and markets. For example, some of our **GMF** ~~general metal finishing~~ customers were negatively impacted by disruptions associated with COVID- 19 in China ~~in~~ **from** the fourth quarter of 2022 **into the first quarter of 2023** . In addition, ~~the continued effects of~~ the COVID- 19 pandemic **exacerbated,** and the emergence of other widespread health crises could exacerbate **,** the other risks described here and in our future filings with the SEC. A substantial portion of our shipments occurs shortly after an order is received, and therefore we generally operate with a relatively low level of backlog. As a result, a decrease in demand for our products from one or more customers could occur with limited advance notice and could have a significant adverse effect on our operating results in any particular period. Further, we often recognize a significant portion of the revenue of certain of our business lines in the last month of ~~each~~ **a** fiscal quarter, due in part to the tendency of some customers to wait until late in a quarter to commit to purchase our products as a result of capital expenditure approvals and budgeting constraints occurring at the end of a quarter, or the hope of obtaining more favorable pricing from a competitor. Thus, variations in timing of sales can cause significant fluctuations in our quarterly sales, gross margin and profitability. In addition, orders expected to ship in one period could shift to another period due to changes in the timing of our customers ~~'~~**’** purchase decisions, requests for rescheduled delivery dates, material shortages, manufacturing capacity constraints or logistics delays. Our orders are generally subject to rescheduling ~~without penalty~~ or cancellation without penalty other than reimbursement in certain cases for certain labor and material costs. Our operating results for a particular period may be adversely affected if our customers, particularly our largest customers, cancel or reschedule orders, or if we cannot fill orders in time due to material shortages, capacity constraints or unexpected delays in manufacturing, testing, shipping, delivery or product acceptance. Also, we base our manufacturing plans on our forecasted product mix. If the actual product mix varies significantly from our forecast, we may not be able to fill some orders, which would result in delays in the shipment of our products and could shift sales to a subsequent period. Moreover, a significant percentage of our expenses are fixed and based in part on expectations of net revenues. Our inability to adjust spending quickly enough to compensate for any shortfall would magnify the adverse impact of a shortfall in net revenues on our operating results. Customers of our high- value, more complex products often require substantial time to qualify our products and make purchase decisions. In addition, some of our sales to defense and security customers are under major defense programs that involve lengthy competitive bidding and qualification processes. These customers often perform, or require us to perform, extensive configuration, testing and evaluation of our products before committing to ~~purchasing~~ **purchase** them, which can require a significant upfront investment in time and resources. The sales cycle for these products from initial contact through shipment varies significantly, is difficult to predict and can last more than a year. If we fail to anticipate the likelihood of, or the costs or timing associated with, sales of these products, or the cancellation or rescheduling of orders for these products, our business and operating results would be harmed. Our worldwide sales to customers in the research and defense markets rely to a large extent on government funding for research and defense- related programs. Any decline in government funding as a result of reduced budgets in connection with fiscal austerity measures, revised budget priorities or other causes would likely result in reduced sales of our products that are purchased either directly or indirectly with government funding, which would have an adverse impact on our operating results. Concerns regarding the global availability of credit may also make it more difficult for our customers to raise capital, whether debt or equity, to finance their projects and purchases of capital equipment, which would adversely affect sales of our products and therefore harm our business and operating results. Market seasonality also causes fluctuations in our operating results. MSD has generally experienced its strongest revenue in the second half of the fiscal year, mostly driven by consumption trends during the holiday season, and its lowest revenue in the first quarter of the fiscal year, mostly driven by the slowdown in production in China as a result of the ~~Chinese~~ **Lunar** New Year. In addition, we typically experience our strongest revenue in the research market in the fourth quarter of our fiscal year as a result of government spending patterns, and our highest revenue in the electronics manufacturing market in the second half of our fiscal year as a result of consumer spending during the holiday season. Other factors that could cause fluctuations in our financial results include: • A worldwide economic slowdown or disruption in the global financial markets; • Fluctuations in our customers ~~'~~ **’** capital spending, industry cyclicality (particularly in the semiconductor, electronics manufacturing and automotive industries), levels of government funding available to our customers (particularly in the life and health sciences ~~,~~ and **the** research and defense markets) and other economic conditions within the markets we serve; • The timing of the receipt of orders within a given period; • Demand for our products and the products sold by our customers; • Disruption in sources of supply; • Production capacity constraints; • Regulatory and trade restrictions in the countries **where** we source ~~from~~ , manufacture or sell our products; • Specific features requested by customers; • Natural disasters or other events beyond our control (such as earthquakes, floods or storms, regional economic downturns, pandemics, social unrest, political instability, terrorism, or acts of war); • The timing of product shipments and revenue recognition within a given quarter; • Changes in our pricing practices or in the pricing practices of our competitors or suppliers, including as a result of inflationary pressures; • Our and our competitors ~~'~~ **’** timing in introducing new products; • Engineering and development investments relating to new product introductions, and significant changes to our manufacturing and outsourcing operations; • Market acceptance of any new or enhanced versions of our products; • The timing and level of inventory obsolescence, scrap and warranty expenses; • The availability, quality and cost of components and raw materials we use to manufacture our products; • Changes in our effective tax rates; • Changes in our capital structure, including cash, marketable securities and debt balances, and changes in interest rates; • Changes in bad debt expense based on the collectability of our accounts receivable; • The timing, type and size of acquisitions and divestitures, and related expenses and charges; • Fluctuations in currency exchange rates; • Our expense levels; • Impairment ~~of~~ **charges for** goodwill **,** ~~, and amortization of~~ intangible **assets or long- lived** assets; and • Fees, expenses and settlement costs or judgments against us relating to litigation or regulatory compliance. ~~•~~ As a result of these factors, among others, we may experience quarterly or annual fluctuations in our operating results, and our operating results for any period may fall below our expectations or the expectations of public market analysts or investors. In any such event, the price of our common stock could fluctuate or decline significantly. Consequently, we believe that quarter- to- quarter and year- to- year comparisons of our operating results, or any other similar period- to- period comparisons, may not be reliable indicators of our future performance. ~~In connection with the Atotech Acquisition, we entered into an agreement (the “ Investor Rights Agreement ”) with Carlyle Partners VI Cayman Holdings L. P., CEP IV Participations S. A. R. L Sicar and Gamma Holding Company Limited (collectively, the “ Carlyle Shareholders ”) to grant the Carlyle Shareholders certain registration rights with respect to the shares of our common stock they received upon consummation of the Atotech Acquisition (the “ Company Shares ”). As of December 31, 2022, the Carlyle Shareholders beneficially owned approximately 13 % of our outstanding common stock. Pursuant to the Investor Rights Agreement, the Carlyle Shareholders have registration rights for the Company Shares, and we filed a resale “ shelf ” registration statement to register such Company Shares and are obligated to use commercially reasonable efforts to keep such registration statement effective thereafter. In addition, and alternatively, shares of common stock that are owned by the Carlyle Shareholders are eligible for sale in the public market to the extent permitted by the provisions of Rule 144 and Rule 701 under the Securities Act of 1933, as amended. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the trading price of our common stock could decline. Sales of a substantial number of shares of our common stock pursuant to the resale registration statement in the public market could occur at any time the registration statement remains effective. In addition, the Carlyle Shareholders can request~~

~~underwritten offerings to sell their securities. These sales, or the perception in the market that the holders of a large number of shares intend to sell shares, could reduce the market price of our common stock.~~ The stock market has from time to time experienced, and is likely to continue to experience, extreme price and volume fluctuations. For example, the closing price of our common stock ranged from a high of $ ~~180~~ **112** . ~~69~~ **97** to a low of $ 65. ~~09~~ **32** between January 1, ~~2022~~ **2023** and December 31, ~~2022~~ **2023** . Prices of securities of technology companies have been especially volatile and have often fluctuated for reasons that are unrelated to the operating performance of the companies. Historically, the market price of shares of our common stock has fluctuated greatly and could continue to fluctuate due to a variety of factors. In the past, companies that have experienced volatility in the market price of their stock have been the ~~objects~~ **subject** of securities class action litigation. If we become the subject of securities class action litigation, it could result in substantial costs and a diversion of our management ~~'~~**’**s attention and resources. We may not pay dividends on our common stock. Holders of our common stock are only entitled to receive dividends when and if they are declared by our Board of Directors. Our credit facilities restrict our ability to pay dividends on our capital stock under certain circumstances. Although we have declared cash dividends on our common stock since 2011, and occasionally increased the dividends from prior quarters, we are not required to do so, and we may reduce or eliminate our cash dividend in the future. This could adversely affect the market price of our common stock. Some provisions of our restated articles of organization, as amended, our amended and restated by- laws and Massachusetts law could discourage potential acquisition proposals and could delay or prevent a change in control. Anti- takeover provisions could diminish opportunities for stockholders to participate in tender offers, including tender offers at a price above the then- current market price of our common stock. Such provisions may also inhibit increases in the market price of our common stock that could result from takeover attempts. For example, while we have no present plans to issue any preferred stock, our Board of Directors, without further stockholder approval, may issue preferred stock that could have the effect of delaying, deterring or preventing a change in control of us. The issuance of preferred stock could adversely affect the voting power of the holders of our common stock, including the loss of voting control to others. In addition, our amended and restated by- laws provide for a classified Board of Directors consisting of three classes. Our classified board could also have the effect of delaying or deterring a change in control of our Company.