

Scope 3 GHG Inventory 2023

Content

- 1. Introduction**
- 2. Overview Scope 3 GHG emissions 2023**
- 3. Scope 3 GHG emissions details**

1. Introduction

Merck KGaA, Darmstadt, Germany, reports Greenhouse Gas (GHG) emissions according to the "Greenhouse Gas Protocol, A corporate accounting and reporting standard, Revised Edition" by the Greenhouse Gas Protocol Initiative, a partnership between the World Resources Institute and the World Business Council for Sustainable Development.

For our Scope 3 GHG Inventory, the following documents have been used:

- "Corporate Value Chain (Scope 3) Accounting and Reporting Standard", GHG Protocol, 2011
- "Technical Guidance for Calculating Scope 3 Emissions (version 1.0)", GHG Protocol, 2013
- "Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain", wbcscd chemicals, 2013
- DEFRA - UK Government GHG Conversion Factors for Company Reporting, full factor set 2023

Reporting period covered: Jan. 1, 2023 – Dec. 31, 2023



2. Overview Scope 3 GHG emissions 2023

| Scope 3 category | Metric kilotons CO2e |
|---|----------------------|
| 1. Purchased goods & services | 2,517 |
| 2. Capital goods | 340 |
| 3. Fuel- and energy-related activities | 115 |
| 4. Upstream transportation & distribution | 236 |
| 5. Waste generated in operations | 32 |
| 6. Business travel | 86 |
| 7. Employee commuting | 76 |
| 8. Upstream leased assets | 0 ¹⁾ |
| 9. Downstream transportation & distribution | 10 |
| 10. Processing of sold products | 0 ²⁾ |
| 11. Use of sold products | 1,137 |
| 12. End-of-life treatment of sold products | 42 |
| 13. Downstream leased assets | 2 |
| 14. Franchises | 0 |
| 15. Investments | 1 |

1) Already covered under Scope 1/2 emissions.

2) Our company produces a huge variety of intermediate products for various purposes. Due to their many applications and our customer structure, the associated GHG emissions cannot be tracked in a reasonable fashion.



3. Scope 3 GHG emissions details

| Scope 3 category | Data available | Metric kilotons CO2e | Methodology used/Explanations |
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| Purchased goods & services | yes; 3rd party verified | 2,517 | <p>Category 1 includes all upstream (i.e., cradle-to-gate) emissions from the extraction, production, and transportation of goods/services purchased or acquired by the reporting company in the reporting year.</p> <p>Emissions from products are calculated with a spend-based approach based on a procurement data management system (which integrates various ERP systems) and environmentally extended input-output (EEIO) data (source: US Environmentally-Extended Input-Output (USEEIO) Technical Content, United States Environmental Protection Agency, 2023). USEEIO provides emission factors on spend basis for different industrial sectors; regional variations are not considered. These factors have been updated in our calculation in 2023 to use the latest released version. Emissions from services are calculated with a spend-based approach based on the same procurement data management system. The calculation methodology takes primary supplier emission data into account.</p> <p>The procurement system contains 95-97% of our total spend; i.e., there is a minor under-reporting. The gap is related to our smaller companies that either do not have a system in place or that have a very specific system setup (e.g., a small local ERP system).</p> <p>In a next step, we are working on a weight-based approach to further increase accuracy. Final target is to use supplier-specific data to calculate these emissions.</p> |
| Capital goods | yes; 3rd party verified | 340 | <p>Category 2 includes all upstream (i.e., cradle-to-gate) emissions from the extraction, production, and transportation of capital goods purchased or acquired by the reporting company in the reporting year.</p> <p>As for category 1, emissions are calculated with a spend-based approach based on a procurement data management system (which integrates</p> |



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| | | | <p>various ERP systems) and environmentally extended input-output (EEIO) data (source: US Environmentally-Extended Input-Output (USEEIO) Technical Content, United States Environmental Protection Agency, 2023). USEEIO provides emission factors on spend basis for different industrial sectors; regional variations are not considered. These factors have been updated in our calculations in 2023 to use the latest released version.</p> <p>The procurement system contains 95-97% of our total spend; i.e., there is a minor under-reporting. The gap is related to our smaller companies that either do not have a system in place or that have a very specific system setup (e.g., a small local ERP system).</p> <p>In a next step, we are working on a weight-based approach to further increase accuracy. Final target is to use supplier-specific data to calculate these emissions.</p> |
| Fuel- and energy-related activities | yes; 3rd party verified | 115 | <p>Category 3 includes emissions related to the production of fuel and energy purchased and consumed by the reporting company in the reporting year that are not included in scope 1 or scope 2. Data on purchased and consumed fuels (mainly natural gas) and electricity, steam/heat and cold which are basis to calculate category 3 emissions are collected via our central EHS data management system.</p> <p>To determine upstream emissions of purchased fuels, the fuel quantities are multiplied with well-to-tank emission factors (source: DEFRA, 2023, WTT - fuels).</p> <p>Upstream emissions as well as transportation and distribution (T&D) losses of purchased heat/steam and cold are calculated by multiplying consumption figures with respective emission factors (source: DEFRA, 2023; WTT - heat and steam (WTT - heat and steam - District heat and steam) and respectively DEFRA, 2023, WTT - heat and steam (WTT - district heat & steam distribution, 5% loss) for losses. To calculate emissions from the generation and T&D of minor quantities of purchased cold the same emission factors are used</p> |



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| | | | <p>as for heat/steam as no specific factors are available.</p> <p>Upstream emissions from electricity purchased are determined by multiplying consumption figures with respective emission factors (source: DEFRA, 2023; WTT- overseas electricity (generation)). Hereby, electricity purchased from renewable sources is deducted (direct supply of renewable electricity as well as electricity covered by energy attribute certificates)</p> <p>Electricity T&D losses are determined based on the quantities of electricity purchased and country-specific loss factors. Basis for country-specific electric power transmission and distribution losses: IEA 2023. Hereby, electricity purchased from renewable sources (direct supply of renewable electricity) is deducted.</p> <p>Emissions from the generation of purchased electricity sold to end users is not relevant for us because we do not sell purchased electricity.</p> <p>A number of small commercial affiliates, labs, etc. have not been incorporated into our EHS data management system. For one, integrating these sites requires a huge effort for GHG emissions that are minor in relation to the sites already included in our accounting. Secondly, very often these small sites are not able to provide the necessary data because they use rented offices and do not receive energy-related information from their landlord. We assume that the accounted emissions cover the vast majority of our emissions.</p> |
| Upstream transportation & distribution | yes; 3rd party verified | 236 | <p>Category 4 covers the transportation and distribution of products purchased by the reporting company in the reporting year between a company's tier 1 suppliers and its own operations (in vehicles and facilities not owned or controlled by the reporting company) as well as the transportation and distribution of services purchased by the reporting company in the reporting year, including inbound logistics, outbound logistics (e.g., of sold products), and transportation and distribution between a company's own facilities (in vehicles and facilities not owned or controlled by the reporting company).</p> |



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| | | | <p>To calculate emissions of these transportation categories, we use a mixed approach. Primary data from Suppliers/Logistics Service Providers are integrated in reporting (i.e., CO₂e emissions are provided by the suppliers/Logistics Service Providers). If these data are not available the CO₂e emissions are calculated by the 3rd party provider EcoTransIT (as of 2023), using an energy based bottom-up approach. Partly, a spend based approach is needed.</p> <p>For the business sector Life Science shipment data from forwarders serve as main data source, whereas for the business sector Electronics delivery notes from own ERP-systems are the basis for calculation. For Healthcare there are multiple sources: forwarder data plus data from various ERP systems. These data are consolidated in internal systems together with primary data from Suppliers/Logistics Service Providers. If no primary data is available an energy based bottom-up approach is taken. Respective shipment data is sent to the 3rd party provider EcoTransIT and processed there. Processing steps are: routing from origin to destination (based on zip- and port-codes), determination of fuel consumption, energy and emission calculation, summation of all section emissions (per mode of transportation).</p> <p>For our Life Science business sector, no data on road transportations for the LATAM and Asia regions are available. Therefore, a spend-based approach is used to estimate these emissions. Not included are shipments from suppliers where transportation is not paid by us. In case data is not yet available for the whole year appropriate extrapolations are conducted.</p> |
| Waste generated in operations | yes; 3rd party verified | 32 | <p>Category 5 includes emissions from third-party disposal and treatment of waste generated in facilities owned or controlled by us (including disposal of both solid waste and wastewater). The calculation of emissions from waste generated in operations and disposed of by third parties is based on primary data from our manufacturing sites collected on</p> |



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| | | | <p>an annual basis via our central EHS data management system. This data is split up into various waste types (e.g., solvent waste, soil waste) and waste disposal methods (e.g., waste-to-energy, landfill, recycling). Emission factors based on the carbon content of the waste were taken from the "Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain". The emission factor for external waste recycling/recovery and for external waste incineration with energy recovery is 0 kg CO₂e/metric ton carbon (it is assumed that recycling and energy recovery are attributed to the organization that uses the recycled material, or that uses the waste to generate energy); the emission factor for external waste incineration without energy recovery is 1 kg CO₂e/metric ton carbon; the emission factor for external landfill waste is 13 kg CO₂e/metric ton carbon. Carbon content factors are mainly taken from the "2006 IPCC Guidelines for National Greenhouse Gas Inventories" (e.g., solvent waste: 80%; construction and demolition waste: 24%; plastic waste: 75%). These data are then multiplied with each other. Emissions resulting from the transportation of waste materials are not taken into account.</p> <p>To calculate greenhouse gas emissions from wastewater treatment in third party municipal or industrial wastewater treatment plants, we use primary data from our manufacturing sites, which is collected on an annual basis via our central EHS data management system. Wastewater quantities are multiplied by the DEFRA emission factor for water treatment.</p> <p>Our waste and wastewater accounting mainly covers manufacturing sites. Pure warehouse sites, labs or commercial affiliates are only partially included in our waste reporting. Nevertheless, it is expected that the accounting covers more than 95% of our overall waste quantity. Additionally, it can be assumed that the majority of waste not taken into account is recycled (paper, cardboard, plastic, etc.).</p> |
| Business travel | yes; 3rd party verified | 86 | Category 6 includes emissions from the transportation of employees for business |



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| | | | <p>related activities in vehicles owned or operated by third parties, such as aircraft, trains, buses, and passenger cars.</p> <p>Air travel: Based on our flight booking and billing processes, our payment solution service provider supplies detailed data of all flights booked. Greenhouse gas emissions are calculated by atmosfair (www.atmosfair.de), a recognized non-governmental organization dealing with climate protection with a focus on travel. The figure shows emissions including high altitudes effects (Radiation Forcing Index RFI of 2.7).</p> <p>Rail travel: Rail travel is considered relevant in some European countries (e.g. Germany, France, Spain). In non-European countries, it is seen as rather negligible. At this time, data for rail travel is only available for Germany and is provided by Deutsche Bahn AG.</p> <p>Rental cars: Emissions data is provided by our global rental car providers on an annual basis. Data on other means of transportation (e.g., trams, taxis and buses) are not available. Their impact on our overall emissions is expected to be negligible.</p> <p>Hotel accomodation: Emissions from hotel stays are calculated based on the number of hotel stays per country (source: internal ERP system) and the DEFRA emission factors for hotel stays.</p> |
| Employee commuting | yes; 3rd party verified | 76 | <p>Category 7 includes emissions from the transportation of employees between their homes and work.</p> <p>We run a global employee engagement survey each year. COVID-19 pandemic changed working habits towards a more flexible remote working approach. Given this fact and our ambition towards more transparency and accuracy on GHG emissions we have included commuting habits in the employee engagement survey as of 2022. This calculation approach will be used to calculate 2023 GHG emissions onwards replacing the previous approach that was based on publicly available statistics.</p> <p>With a participation rate of 84% globally we build our calculation on a profound basis and extrapolate to global employee population and combine this with</p> |



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| | | | <p>assumption of 220 working days derived from `Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain.</p> <p>Emission factors for modes of transport are taken from DEFRA, 2023, Business travel-land and include electrical vehicles and home office as well.</p> |
| Upstream leased assets | Scope 1/2 emissions; third party verified | 0 | <p>Category 8 includes emissions from the operation of assets that we lease and that are not already included in our scope 1 or scope 2 reporting.</p> <p>Emissions from this category are not relevant for our scope 3 reporting because leased assets (e.g., rented offices, labs or warehouses) are integrated in the annual EHS data collection processes and are part of our scope 1 and 2 GHG inventory.</p> <p>A number of small commercial affiliates, labs, etc. have not been incorporated into our EHS data management system. For one, integrating these sites requires a huge effort for GHG emissions that are minor in relation to the sites already included in our accounting. Secondly, very often these small sites are not able to provide the necessary data because they use rented offices and do not receive energy-related information from their landlord.</p> |
| Downstream transportation & distribution | yes; 3rd party verified | 10 | <p>Category 9 covers transportation and distribution of products sold by the reporting company in the reporting year between the reporting company's operations and the end consumer (if not paid for by the reporting company), including retail and storage (in vehicles and facilities not owned or controlled by the reporting company).</p> <p>The approach to calculate category 9 emissions is similar as the one for category 4. The emissions are calculated by the 3rd party provider EcoTransIT (as of 2023), using an energy based bottom-up approach. By this, we can provide emissions data for our business sectors Electronics and Healthcare. Category 9 downstream data from Life Science is negligible. To safeguard effectiveness of logistic processes, transports of Life Science products are organized and contracted by our business sector Life</p> |



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| | | | Science and are therefore covered in category 4. |
| Processing of sold products | no | - | <p>Category 10 includes emissions from the processing of sold intermediate products by third parties (e.g., manufacturers) subsequent to sale by the reporting company.</p> <p>We produce a huge variety of intermediate products for various purposes. Due to the range of potential applications and our customer structure, the related GHG emissions cannot be tracked in a practical fashion. Reliable figures are difficult to obtain. Here, we adhere to the recommendation of the "Guidance for Accounting and Reporting Corporate GHG Emissions in the Chemical Sector Value Chain of the WBCSD", which states that "Chemical companies are not required to report Scope 3, category 10 emissions, since reliable figures are difficult to obtain, due to the diverse application and customer structure".</p> |
| Use of sold products | yes; 3rd party verified | 1,137 | <p>Category 11 includes emissions from the use of goods and services sold by the reporting company in the reporting year. Internal expert assessments of our huge and very diverse product portfolio show that for our 'Greenhouse gases and products that contain or form greenhouse gases that are emitted during use' are the main driver of greenhouse gas emissions in this category. 'Products that directly consume energy (fuels or electricity) during use' contribute to a much lesser extent to the overall emissions. 'Fuels and feedstocks' as well as indirect use-phase emissions are not relevant for us. 'Indirect use-phase emissions' are optional and are not reported by us.</p> <p>Electronics business sector: Among the broad Electronics product portfolio there are some specialty gases with high Global Warming Potential (GWP) that are emitted during use phase. Emissions are calculated based on technical expertise of internal experts on the percentage of gas quantities that escape the processes at our customers and abatement efficiency, sales volumes and global warming potentials (source: IPCC, 6th Assessment Report). Besides this, some product control devices consume electricity.</p> |



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| | | | <p>Emissions of these devices are calculated based on runtime, average lifetime, and an estimated global emission factor. Other product lines are negligible or do not contribute at all to the overall emissions within this category.</p> <p>Our Life Science business sector offers two product lines that consume electricity during use-phase. Emission calculation is based on product energy consumption (internal expert estimations), sales volumes, and respective emissions factors per country (source: IEA 2023). Sales data covers approx. 90-95% of sales (internal expert knowledge).</p> <p>Our Healthcare business sector offers some battery-based injection devices that fall under category 11. Emissions are calculated based on energy consumption (expert estimate), sales volumes, and respective emission factors per country (source: IEA 2023).</p> <p>Compared to other Scope 3 categories, the screening of the emissions in this category contains more uncertainties and is meant to provide a first indication of the impact of those Scope 3 emissions. Their impact cannot be estimated more precisely at this time. We are already working on improving the accuracy of these data.</p> |
| End-of-life treatment of sold products | yes; 3rd party verified | 42 | <p>Category 12 includes emissions from the waste disposal and treatment of products sold by the reporting company (in the reporting year) at the end of their life. Emissions from the disposal of sold products and respective packaging materials are calculated based on sales data, weight data of products and packaging material, average weighted emission factors based on statistical data on regional disposal methods and DEFRA emission factors (source: DEFRA 2023). For the Healthcare sector, the approach is slightly different than for the other business sectors. Here, only packaging material is considered as it is assumed that all healthcare products will be consumed by the customer/patient (e.g., drugs, medicine, etc.).</p> <p>Compared to other Scope 3 categories, the screening of the emissions in this category contains more uncertainties and is meant to provide a first indication of the impact of those Scope 3 emissions.</p> |



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| | | | <p>Their impact cannot be estimated more precisely at this time. We are already working on improving the accuracy of these data.</p> |
| Downstream leased assets | yes; 3rd party verified | 2 | <p>Category 13 includes emissions from the operation of assets that are owned by the reporting company (acting as lessor) and leased to other entities.</p> <p>At Darmstadt, Germany, we are lessor of a few residential and commercial buildings.</p> <p>Emissions are calculated based on building master data (e.g., energy demand from energy certificates) and respective emission factors.</p> <p>To split up the energy demand into heating and electricity for residential and commercial buildings International Energy Agency (IEA) data is used. Emissions from heating energy are calculated by using the fuel type and DEFRA emission factors. Emissions from electricity demand is calculated by using the German grid emission factor provided by Bundesverband der Energie- und Wasserwirtschaft e.V (BDEW).</p> |
| Franchises | not relevant; third party verified | 0 | <p>Category 14 includes emissions from the operation of franchises.</p> <p>This category is not relevant for us as we do not operate franchises, i.e., businesses operating under a license to sell or distribute another company's goods or services within a certain location. Out-licensing in the pharmaceutical sector is not regarded as franchising.</p> |
| Investments | yes; 3rd party verified | 1 | <p>Category 15 includes emissions from the operation of investments (including equity and debt investments and project finance) in the reporting year, not included in Scope 1 or Scope 2.</p> <p>Emissions are calculated based on direct share of capital, respective annual revenue and environmentally extended input-output (EEIO) data (source: US Environmentally-Extended Input-Output (USEEIO) Technical Content, United States Environmental Protection Agency, 2023). USEEIO provides emission factors on spend basis for different industrial sectors; regional variations are not considered.</p> |

