Merck KGaA
Darmstadt, Germany

# Scope 3 GHG Inventory 2016

**Content**



## 1. Introduction

Merck KGaA Darmstadt, Germany reports its 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 were 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", wbcsd chemicals, 2013
- DEFRA - UK Government GHG Conversion Factors for Company Reporting, full factor set 2016

Reporting period covered: Jan. 1, 2016 – Dec. 31, 2016

## 2. Overview Scope 3 GHG emissions 2016

| Scope 3 category | Metric kilotons $CO_2e$[1)] |
|---|---|
| 1. Purchased goods & services | - [2)] |
| 2. Capital goods | - [2)] |
| 3. Fuel- and energy-related activities | 127 |
| 4. Upstream transportation & distribution | - [2)] |
| 5. Waste generated in operations | 127 |
| 6. Business travel | 104 |
| 7. Employee commuting | 68 |
| 8. Upstream leased assets | 0[3)] |
| 9. Downstream transportation & distribution | - [2)] |
| 10. Processing of sold products | 0[4)] |
| 11. Use of sold products | - [2)] |
| 12. End-of-life treatment of sold products | - [2)] |
| 13. Downstream leased assets | 0 |
| 14. Franchises | 0 |
| 15. Investments | - [2)] |

1) The figure does not include data from Sigma-Aldrich since the integration process is still underway.
2) no data available
3) Already covered under Scope 1/2 emissions.
4) We produce 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 $CO_2e$ | Methodology used/Explanations |
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| Purchased goods & services | no | - | Emissions from purchased goods and services are expected to be highly relevant to our company. As a global pharmaceutical and chemical company, we use raw materials, packaging materials, etc. from various suppliers. Merck KGaA Darmstadt, Germany purchases 4,000 to 5,000 different raw materials and more than 10,000 different types of packaging. Among these, no one material is purchased in noticeably higher quantities than the others, and an initial review has not revealed materials sourced in large amounts with an exceptionally high Product Carbon Footprint. These facts do not provide a good starting point for prioritization. |
| Capital goods | no | - | Emissions from the production of capital goods purchased by us are expected to be medium to highly relevant, but no figures are available at this time. |
| Fuel- and energy-related activities | yes; 3rd party verified | 127 | 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 fuel (mainly natural gas) which are basis to calculate category 3 emissions are collected via our central EHS data management system.<br>To determine upstream emissions of purchased fuel, the fuel quantities are multiplied with cradle-to-gate emission factors (source: mainly DEFRA, 2016; partially ecoinvent Data V2.2, 2010). Upstream emissions of purchased electricity, steam, heating and cooling are calculated based on the amount of energy purchased, fuel efficiencies, global fuel shares of electricity generation, and emission factors. The amount of primary energy is determined based on the quantities of purchased electricity, heating, steam, and cooling, as well as |

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| | | | the respective fuel efficiencies (85% for steam/heat/cold generation, 37% for electricity generation). The proportion of the different fuel types relative to the total amount of primary energy is calculated based on the fuel shares of global electricity generation (source: "Key World Energy STATISTICS", IEA 2016). Transmission and distribution (T&D) losses are determined based on the quantities of electricity and steam/heating/cooling purchased as well as country-specific loss factors. Basis for country-specific electric power transmission and distribution losses: DEFRA 2016. Basis for the loss factor for purchased heat/steam (5%): DEFRA 2016. The same factor is used for cooling.<br>Emissions from the generation of purchased electricity sold to end users is not relevant for our company because we do not sell purchased electricity.<br>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. |
| Upstream transportation & distribution | no | - | Being a global company, Merck KGaA Darmstadt, Germany operates in 66 countries. We therefore expect that transportation and distribution of goods purchased by our company, as well as products manufactured by us, to be an emission source of moderate relevance. Nevertheless, reliable data for our transport operations is not yet available Group-wide. |
| Waste generated in operations | yes; 3rd party verified | 127 | Category 5 includes emissions from third-party disposal and treatment of waste generated in facilities owned or controlled by Merck KGaA Darmstadt, Germany (including disposal of both solid waste and wastewater). |

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| | | | 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 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 $CO_2e$/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 $CO_2e$/metric ton carbon; the emission factor for external landfill waste is 13 kg $CO_2e$/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: 20%; plastic waste: 75%). These data are then multiplied with each other. Emissions resulting from the transportation of waste materials are not taken into account.<br>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 an emission factor (0.708 kg $CO_2e/m^3$ wastewater) from DEFRA, 2016.<br>Our company's waste and wastewater accounting only covers manufacturing sites. Pure warehouse sites, labs or commercial affiliates are not included in our waste reporting. Nevertheless, it is expected that the accounting covers more than 95% of our company's overall waste quantity. Additionally, it can be assumed that the majority of waste not |

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| | | | taken into account is recycled (paper, cardboard, plastic, etc.). |
| Business travel | yes; 3rd party verified | 104 | Category 6 includes emissions from the transportation of employees for business related activities in vehicles owned or operated by third parties, such as aircraft, trains, buses, and passenger cars. Air travel: Based on its 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. Methodology used: DEFRA/GHG Protocol. Data covers approximately 80% to 85% of the business flights of our employees. When the greenhouse effect at high altitudes is taken into account, the emissions from air travel add up to 224 metric kilotons $CO_2$eq (Radiation Forcing Index RFI of 2.7). 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 in Germany. This data is provided by Deutsche Bahn AG Emission factors used per type of train: long distance trains: 0 kg $CO_2$/passenger-km (the Deutsche Bahn AG switched to renewable energy for long distance trains); short distance service: 0.0752 kg $CO_2$/passenger-km. Rental cars: Emissions data is provided by our global rental car provider on an annual basis. The emissions reported include car rental globally. Data on other means of transportation (e.g. trams, taxis and buses) are not available. Their impact on our company‘s overall emissions is expected to be negligible. |
| Employee commuting | yes; 3rd party verified | 68 | Category 7 includes emissions from the transportation of employees between their homes and work.<br>Within Merck KGaA Darmstadt, Germany, there is no detailed data available on how employees commute to work (means of transport), the distance they travel each day, and how often they commute to work per year. Therefore, the assessment of the GHG emissions is based on |

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| | | | estimates and assumptions. For this, we use the "Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain" along with statistical data. For Darmstadt, our largest site with approx. 9,400 employees, the number of parking spots and Job-Tickets (we support the use of public transportation at the Darmstadt facility) are taken into account when estimating the percentages for the different modes of transportation. For the rest of Europe and North America, statistical data from internet research is used. We then take this data and calculate estimates for the Emerging Markets (Latin America and Asia without Japan) and ROW (Rest of World). For Darmstadt, it was assumed that 37.2% of the employees travel by car, 10.9% travel by rail, 19.2% travel by tram/subway, 10.9% travel by bus, and 21.6% are non-motorized (on foot, by bike etc.; incl. passengers car-pooling). For Europe, it was assumed that 61.8% of the employees travel by car, 4.8% travel by rail, 8.4% travel by tram/subway, 4.8% travel by bus, and 20.4% are non-motorized. For North America, it was assumed that 82% of the employees travel by car, 0.6% travel by rail, 1.7% travel by tram/subway, 2.8% travel by bus, and 13% are non-motorized. For Latin America, Asia/Pacific and Middle East/Africa, it was assumed that 10% of the employees travel by car, 10% travel by rail, 35% travel by tram/subway, 30% travel by bus, and 15% are non-motorized. The average number of trips per year and employee (440) as well as the average travel distance (30 km by car or rail, 20 km by bus or tram/subway; single trips) are taken from the "Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain". Emission factors for modes of transport are taken from "UK Government conversion factors for Company Reporting", 2016 (cars: 186.95 g $CO_2$e/km; rail: 48.85 g $CO_2$e/km; tram/subway: 53.63 g $CO_2$e/km); bus: 101.72 g $CO_2$e/km. |
| Upstream leased assets | Scope 1/2 emissions; | 0 | Category 8 includes emissions from the operation of assets that are leased by our |

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| | third party verified | | company and that are not already included in the reporting company's scope 1 or scope 2 inventories. 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. 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. |
| Downstream transportation & distribution | no | | Emissions from downstream transportation and distribution processes are expected to be of low relevance for Merck KGaA Darmstadt, Germany. Reliable data for our transport operations is not yet available Group-wide. |
| Processing of sold products | no | - | Category 10 includes emissions from the processing of sold intermediate products by third parties (e.g. manufacturers) subsequent to sale by the reporting company. Merck KGaA Darmstadt, Germany produces 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. |
| Use of sold products | no | | Emissions from the use of sold products are expected to be of low relevance because of our product portfolio. |
| End-of-life treatment of sold products | no | | Emissions from the end-of-life treatment of sold products are expected to be of low relevance because of our product portfolio. |
| Downstream leased assets | not relevant; third party verified | 0 | Category 13 includes emissions from the operation of assets that are owned by the reporting company (acting as lessor) and leased to other entities. This category is |

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| | | | not relevant for our company because we essentially do not lease out real estate or other fixed assets (as assessed by our experts). |
| Franchises | not relevant; third party verified | 0 | Category 14 includes emissions from the operation of franchises.<br>This category is not relevant for us as our company does 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. |
| Investments | no | | Emissions from investments are expected to be of low relevance as our company normally has operational control when investing in (emission-intensive) sites; in this case, GHG emissions are covered via scope 1 and 2 emissions. |