Scope 3 GHG Measurement & Reporting Protocols:

Sector Guidance for Food & Drink Businesses

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Annex E : Guidance for including and adjusting emission factors in scope 3 GHG accounting for Food and Drink

Glossary

Activity data	A quantitative measure of an activity that results in GHG emissions. Activity data are multiplied by emissions factor to derive the GHG emissions associated with a process or an operation. Examples of activity data are kWh of electricity, used, quantity of fuel used and monetary or volume measures of purchased goods, etc. Further detail on activity data for purchased goods is included in **Section 6.3**.
Adjustment factor	A factor used to inform a proportional reduction or increase to emissions that can be applied to an emission factor, or part of it, to account for changes to GHG emissions as a result of an intervention. i.e., an intervention results in x% lower emissions. Further detail on how to include adjustment factors is included in **Annex E**.
Avoided emissions	Avoided emissions relate to reductions in GHG emissions that fall outside of the company's organisational boundary but result from the actions or activities of the company. These emissions reductions can impact different scope 3 categories. Examples include interventions that reduce demand for food in a different value chain. (e.g., donating food to a redistribution charity) (see **Section 7.4**).
Biogenic CO_2 emissions	Biogenic CO_2 emissions refer to any CO_2 emissions from the combustion or biodegradation of biomass (e.g., plant material, organic wastes).
Carbon removals	Carbon removals refer to instances in which CO_2 is removed from the atmosphere or stored in pools/reservoirs (carbon sequestration). Examples are through afforestation, reforestation, forest restoration, urban tree planting, agroforestry, building soil carbon, etc.
CO_2 equivalent (CO_2e)	The universal unit of measurement to indicate the global warming potential (GWP) of each of the six greenhouse gases (listed below), expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate releasing (or avoiding releasing) different greenhouse gases against a common basis.
Courtauld 2030 (C2030)	The Courtauld Commitment 2030 is a voluntary agreement that enables collaborative action across the entire UK food chain to deliver farm-to-fork reductions in food waste, greenhouse gas (GHG) emissions and water stress that will help the UK food & drink sector achieve global environmental goals. For more information **see here**.
Cradle-to-gate emissions	Emissions linked to part of a product's full life cycle – with reference to the boundaries shown in **Figure 2**.
Emission factor	A factor that converts activity data into GHG emissions data (e.g., kg CO_2e emitted per litre of fuel consumed, kg CO_2e emitted per km travelled, etc.).
Embodied emissions data	In the context of purchased goods, this refers to the emission factors that are used to convert activity data (purchase volumes) into GHG emission values (GHG emissions linked to purchases). 'Embodied emissions' refer to the amount of GHGs emitted in the production of a given quantity of product or ingredient purchased (e.g. kg CO_2e per kg chicken). Further detail on embodied emissions data is included in **Section 6.4**.

Greenhouse gas (GHG)	For the purposes of these Protocols (and the GHG Protocol Scope 3 Standard), GHGs are the six gases covered by the United Nations Framework Convention on Climate Change (UNFCCC): carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6).
Global Warming Potential (GWP)	A factor describing the radiative forcing impact (degree of harm to the atmosphere) of one unit of a given GHG relative to one unit of CO_2.
Interventions	An action taken to change a process, which results in a change in emissions of the system that the process is a part of.
Scope 3 inventory	A quantified list of an organisation's GHG emissions and removals, covering the activities and emissions included within the chosen scope 3 inventory boundary. This is also referred to as a 'scope 3 footprint'.
Scope 3 inventory boundary	The scope 3 inventory boundary determines which activities, emissions, and removals are measured and reported by the company. See **Section 5** for more information.
Land-use change	Land-use change (LUC) emissions are those that occur when the demand for a specific land use results in a change in carbon stocks on that land, due to either a conversion from one land-use category to another or conversion within a land-use category. The land-use categories include forest land, cropland, grassland, wetlands, settlements, and other lands. This source of GHG emissions can be significant within the production or supply chains for some products and ingredients for the food & drink sector.
Life cycle assessment (LCA)	Compilation and evaluation of the inputs, outputs, and the potential environmental impacts of a product system throughout its life cycle - from raw material acquisition to end of life.
Primary data	Data from specific activities within a company's value chain. Such data may take the form of activity data or embodied emissions data /emission factors.
Secondary data	Data that is not from specific activities within a company's value chain but from databases, scientific reports, or other sources.
Upstream / downstream	Within a company's value chain, upstream emissions are those generated from cradle-to-gate (i.e., the portion of a product's lifecycle from extraction up until the point of purchase). Downstream emissions are generated after a product or service leaves the company's control / ownership. See **Section 1.2** for more information.

NB – supply chain and value chain are used interchangeably throughout this document

Section 1

Introduction

1.1 The purpose of this document

These *Scope 3 measurement and reporting protocols for Food & Drink* businesses provide requirements and best practice recommendations for quantifying scope 3 greenhouse gas (GHG) emissions specific to the UK food & drink sector. The use of this document is voluntary but it is the agreed guidance for the UK food & drink sector and has been proposed to be formally endorsed as such by UK government under the **Food Data Transparency Partnership**. When reporting their organisational scope 3 footprint, food and drink businesses should state that their scope 3 inventory values have been quantified in conformance with the requirements and recommendations of these protocols.

The development of this guidance, both versions 1 and 2, have included a multi-stakeholder consultation process – in particular, consulting with the Courtauld 2030 GHG Working Group convened by WRAP, which includes representation from across the whole supply chain including retailers, Hospitality and Food Service (HaFS) companies, supply chain businesses, farming bodies, industry bodies, standards bodies, and government departments.

This document is intended to be used by businesses and organisations ('companies') of all sizes operating within the UK food & drink sector. This includes retailers, HaFS businesses, and food & drink manufacturers and processors. **It is not intended for use directly by primary producers, although some advice relevant to this sector is given in Section 1.4.** The detailed guidance is also predominantly focused on food & drink products, as opposed to non-food items or services.

There are several reasons why a company needs to calculate and report scope 3 emissions, as set out in **Section 3**. However, the overarching reason is that companies that measure their scope 3 emissions robustly will be better informed on emissions sources and will therefore be in a much better position to target emission reduction efforts.

Particular emphasis is placed on category 1: purchased goods and services because this is likely the most material source of emissions for food & drink businesses and must be included in a scope 3 inventory. The category captures all emissions from the extraction, production, and transportation of goods and services that have been purchased or acquired by a company that are not covered in other upstream scope 3 emissions categories. An important example of emissions covered elsewhere within scope 3 inventories, and therefore not to be included within category 1 is transportation of goods and services from a tier one supplier to a reporting company; the related emissions are accounted for in category 4: upstream transportation and distribution. Scope 3 category 1 is also the primary point of intervention for food and drink companies to take action to lower emissions.

To tackle the emissions associated with the production of food at sufficient pace relies heavily on collaboration across the supply chain. Those at the end of the supply chain (retailers/hospitality) can help pull reduction levers those at the start of the supply chain (primary producers) cannot shift in isolation and respectively those at the end of the supply chain are reliant on primary producers to reduce their emissions if they are to meet reduction targets. Only through looking at the bigger picture of scope 3, rather than working in silo on scope 1 and 2, do we have a chance of seeing the reductions needed to keep warming below 1.5 degrees.

This document:

- Refers to the requirements of existing global standards as a starting point, in particular:
    - The **GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard** (referred to as the 'GHG Protocol Scope 3 Standard' throughout this document);
    - The (draft) **GHG Protocol Land Sector and Removals Guidance**;
    - The **Science Based Target Initiative (SBTi) Corporate Net Zero Standard** and guidance on setting **Forest, Land and Agriculture (FLAG) targets**; and
    - WRAP's **Emission Factor Inclusion and Adjustment Guidance (v1)**

- Builds on these documents by providing best practice recommendations in those areas that create uncertainty and inconsistency when measuring and reporting scope 3 emissions within the food & drink sector.

It does not replace any of the existing global standards, but instead summarises their requirements and provides additional steer relevant to the food & drink sector, in accordance with the GHG Protocol requirements for '**sector guidance**'. It also provides guidance on measuring in a way that allows for target setting, including FLAG target setting (see **Section 7.1**) – but it specifically defers to the SBTi framework for target- setting and reporting progress against targets. **It does not replace SBTi requirements.**

This document, 'Version 2', as with Version 1, was drafted at a time of rapid change in the methodologies, techniques and approaches to measuring GHG emissions. This updated document reflects the publication of the draft GHG Protocol Land Sector and Removals Guidance published in 2023 and the SBTi Forest Land use and Agriculture Guidance published in 2022. Additional case studies, improvements to text and 'top tips' have been included throughout after a piloting period in 2022. **Case studies** are paraphrased from the full text available on the website.

There were still significant changes in play as we updated this V2 of the protocols, as such, these Protocols will be reviewed and refreshed periodically to ensure they are fit for purpose and include the most recent advances in science and calculation methodologies as relevant to the sector.

Review points will include:

- When the new GHG Protocol Land Sector and Removals Guidance is published in its final form in 2024
- When the GHG Protocol has completed their review of the scope 3 corporate accounting guidance; and
- Every 2 years thereafter – unless any other major changes to the published global standards occur.

1.2 Explaining scope 3 emissions

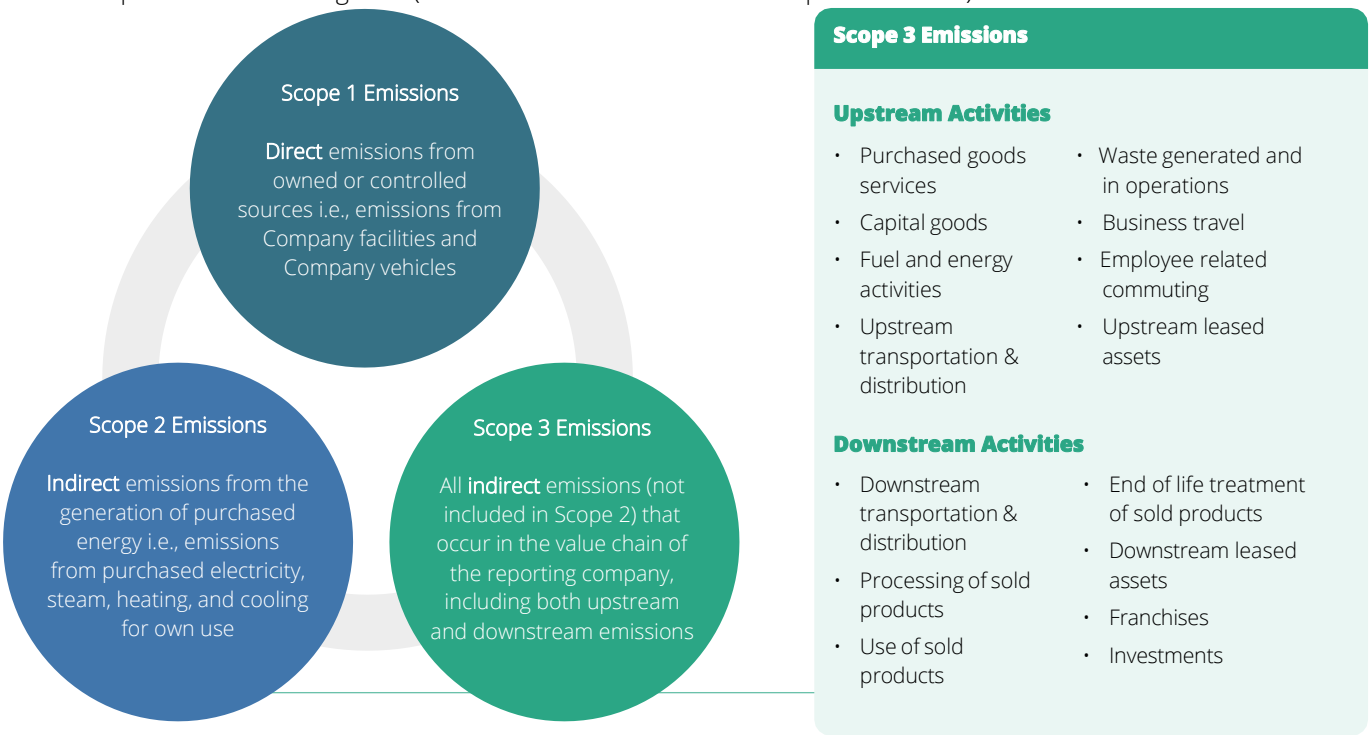
Definitions of scope 1, scope 2, and scope 3 emissions are provided in **Figure 1**.

For food & drink businesses, scope 3 emissions are typically a substantial proportion of their total organisational footprint, and there is increasing pressure from customers, investors, and other stakeholders to measure, report, and reduce these emissions (for examples, see **Table 3**).

Scope 3 emissions encompass the indirect emissions that occur outside of a company's direct control, which arise from the wider value chain - from cradle-to-grave (see **Figure 2**).

Scope 3 is often broken down into 'upstream' emissions – those that occur within a company's supply chain / before arriving at the company's site – and 'downstream' emissions, which are emitted following the sale of the product or service by the reporting company

Figure 1: Scope 3 emission categories (taken from the GHG Protocol Scope 3 Standard)



Upstream and downstream emissions will differ for every type of organisation. For example, a food processor's downstream emissions could be a retail or hospitality company's upstream emissions. **Figure 2** sets out an illustrative example of this.

The term 'cradle-to-gate' is also illustrated in **Figure 2**. This is an important term used when describing the boundaries of emissions data – particularly for purchased goods - and is referred to frequently throughout this document.

As set out in the GHG Protocol Scope 3 Standard, and as for scope 1 and 2 emissions, the gases included in the calculation for scope 3 are as outlined in **Table 1**.

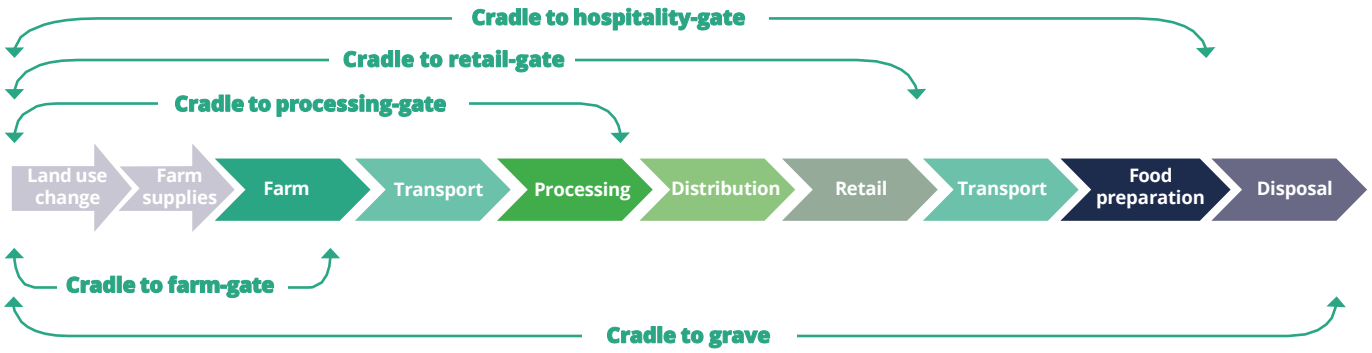
Recommendation – latest GWP values

A scope 3 inventory should whenever possible use the latest 100-year Global Warming Potential (GWP) values from the IPCC. This is not a requirement due to the complexities that can be involved in using the latest figures, but it is a strong recommendation.

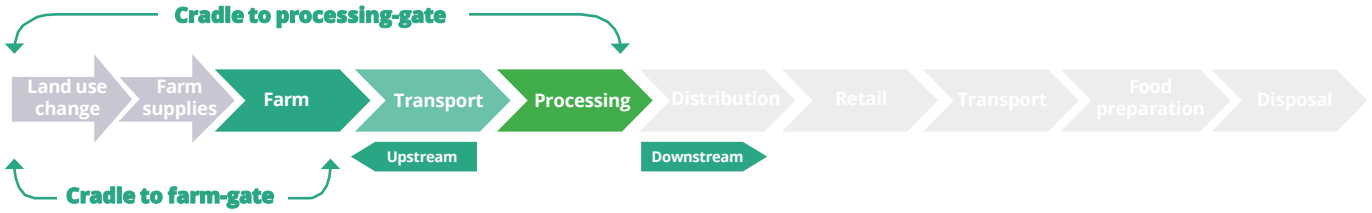
Table 1 – Greenhouse gases required to be included within a scope 3 inventory, as specified by the **Greenhouse Gas Protocol's Required Greenhouse Gases in Inventories** amendment.

GHGs	Examples of emissions sources relevant to the food & drink sector
Carbon Dioxide (CO_2)	• Combustion of fossil fuels. • Land-use change resulting in changes in, above, or below ground carbon stocks (e.g., deforestation or soil degradation). Including those associated with livestock feed. • Application of urea and lime.
Methane (CH_4)	• Livestock rearing – enteric emissions and manure management. • Rice cultivation. • Aquaculture ponds. • Landfill of organic wastes (e.g., food waste). • Land management i.e., emissions related to on-farm vehicles and fertiliser production.
Nitrous Oxide (N_2O)	• Forest and residue burning. • Cultivation of drained organic soils. • Soil emissions from fertiliser use. • Manure management. • Wastewater treatment
Hydrofluorocarbons (HFCs)	• Air conditioning and refrigeration – within buildings and vehicles
Perfluorocarbons (PFCs)	These gases are not specifically associated with food & drink value chains.
Sulphur Hexafluoride (SF_6)	
Nitrogen Trifluoride (NF_3)	

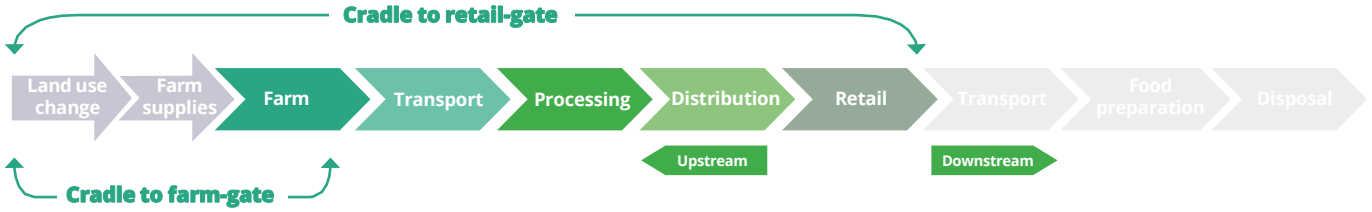
Figure 2: Upstream and downstream emissions profiles for different types of businesses



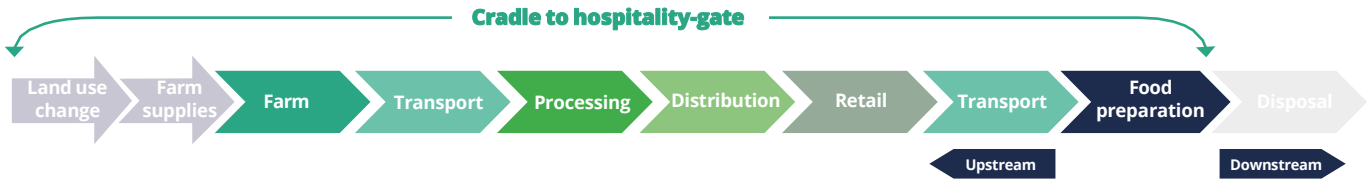
Processor

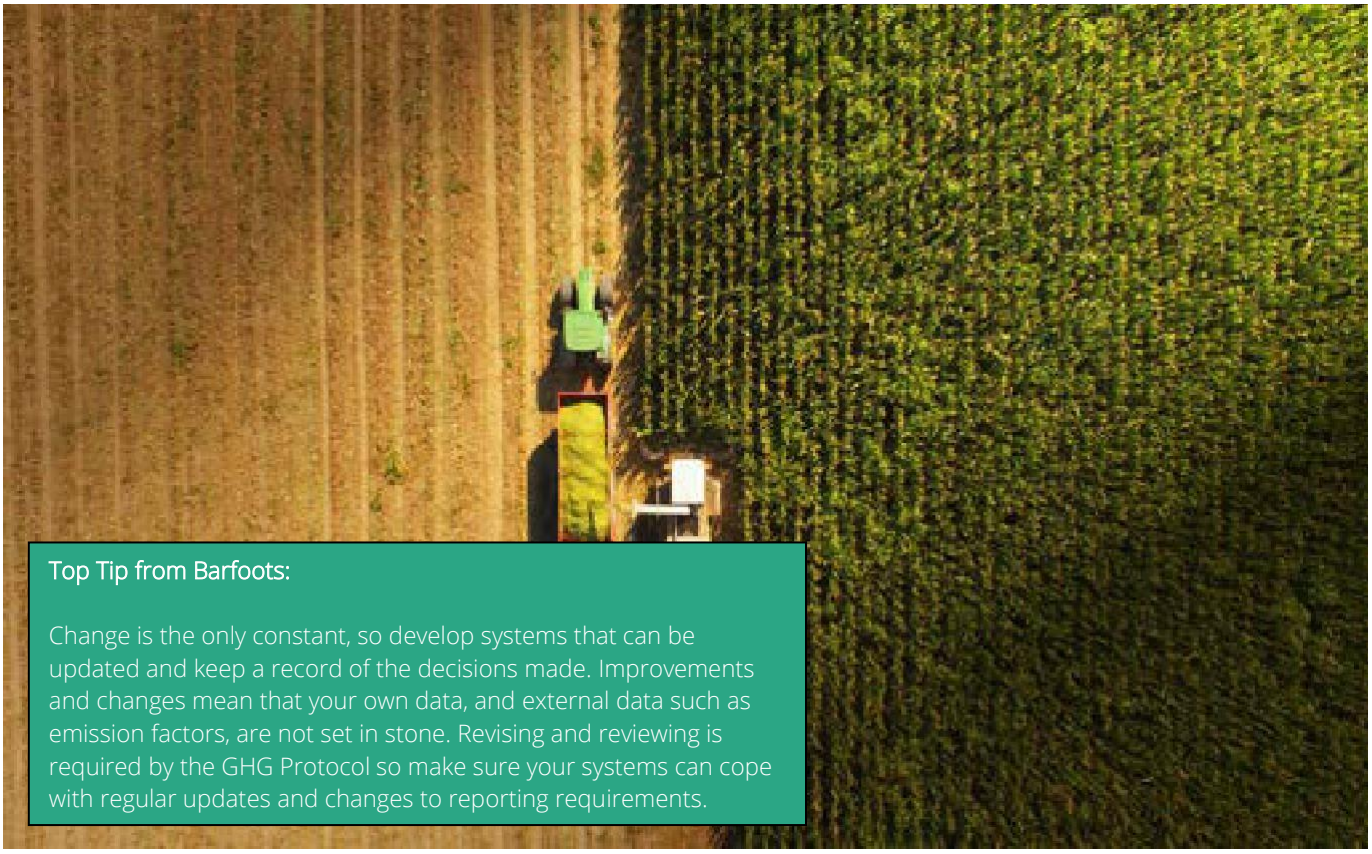


Retailer



Hospitality & Food Service





Top Tip from Barfoots:

Change is the only constant, so develop systems that can be updated and keep a record of the decisions made. Improvements and changes mean that your own data, and external data such as emission factors, are not set in stone. Revising and reviewing is required by the GHG Protocol so make sure your systems can cope with regular updates and changes to reporting requirements.

1.3 The challenges of measuring scope 3 emissions

Measuring and reporting scope 1 and 2 emissions has been standard practice for many years, but few companies have measured scope 3 emissions consistently and completely. Organisations that have been measuring scope 3 emissions have usually focussed on categories such as business and employee travel and have focussed abatement efforts on influencing certain aspects of scope 3 emissions, such as through the management of waste generated from operations.

A comprehensive approach to the measurement and reporting of scope 3 emissions is relatively new for most companies. Value chains can be complex, long, and not always transparent or traceable. Measuring scope 3 emissions, therefore, has numerous challenges particularly related to data availability, accuracy, comparability, access, collection, management, and associated resource costs.

This document provides guidance, in particular, on some of the key trade-offs between completeness and the complexities and costs of data gathering. Such trade-offs are important to acknowledge, as is the need for continual improvement in completeness of and robustness of data.

The eventual aim is that the scope 3 GHG inventory represents a faithful, true, and fair account of the GHG emissions related to a company's value chain. This is important so that it can be used as a sound basis to drive reduction efforts and track progress against targets.

Measuring scope 3 will inherently involve assumptions and estimates, some examples of which have been highlighted in case studies throughout this document. It is best to look at scope 3 measurement as an iterative process, one that will be revisited and revised over time as methodologies (both external and internal) improve. Most companies will start with very generic data and progressively improve data quality in the most material areas first. The initial aim is to create a top-level picture of a company's scope 3

emissions, to enable targeting of where they have the most impact and the most influence and to highlight areas to work collaboratively with others where they may have less influence.

This document summarises key points from the major international standards relating to scope 3 emissions accounting and reporting, alongside recommendations and requirements to ensure confidence that reporting and accounting in line with the rest of the UK food and drink sector. There are also many sources of guidance and support aimed at specific audiences that may also be useful to refer to. Some are listed in **Table 2**.

1.4 Initial steer for primary producers

The activity of primary producers often falls under category 1 : purchased goods and services for organisations both upstream and downstream in the supply chain, which is often the largest category contributing to their scope 3 emissions. For primary producers interested in measuring their own scope 3 emissions, there are a plethora of on-farm carbon accounting tools which cover these emissions to varying degrees - limited to upstream emissions - alongside measuring scope 1 and 2. For example, most tools cover emissions associated with production of fertiliser, while others extend to production of farm machinery. The extent of coverage should be found in methodology literature produced by tool providers, or through discussions with user support.

While carbon accounting tools are a valuable resource for measuring and informing actions for mitigation, the proliferation of tools and their results have led to low confidence and uptake. Defra has recently completed a project on the harmonisation of carbon accounting tools and will be setting out how these findings will be implemented. By 2024 Defra will also set out how farmers will be supported to measure their emissions.

The GHG Protocols have produced Agriculture Guidance for measuring GHG emissions, however this will be superseded by the Land Sector and Removals Guidance (LSRG). A list of Land Sector Calculation Resources can be found in the LSRG supporting resources.

Other useful resources are:

- The Livestock Environmental Assessment and Performance Partnership (LEAP) have developed guidance for the livestock sectors on how to assess environmental performance
- The International Dairy Federation and the Global Roundtable for Sustainable Beef have both developed guidelines on carbon accounting on-farm
- Engage the Chain have produced a resource with a breakdown of different carbon accounting tools
- Sector specific plans have been produced by both AHDB and the NFU, to provide guidance on reducing on-farm emissions and improving resilience
- A guide to practical measures for reducing GHG emissions has been produced by Innovation for Agriculture

Other barriers to measuring emissions include the time, resources, and guidance required to complete the data asks of carbon accounting tools; organisations requesting such information from their primary producers should be mindful of these pressures and how one producer or supplier may receive multiple requests for data, and may consider what support they can offer.

Table 2 – Further sources of guidance and support

Author	Publication name	Purpose of guidance	Links
UK Government	UK Business and SME Climate Hub	Beginner's guides to emission reduction (particularly scope 1 and 2 emissions) that may be helpful to share with suppliers. The SME Climate hub also hosts tools and resources that can help all SMEs take concrete steps towards climate action, including the 1.5-degree supplier engagement guide.	UK – SME Climate Hub Tools – SME Climate Hub (businessclimatehub.org) 1.5°C Supplier Engagement Guide – SME Climate Hub (available on above link)
WWF	WWF Emission Possible	Beginner's guides to emission reporting (particularly scope 1 and 2 emissions) that may be helpful to share with suppliers.	WWF Emission Possible
Institute of Grocery Distribution (IGD)	Building your Net Zero roadmap: a guide for industry leaders and decision-makers	Designed to help business leaders and decision-makers kick start their net zero journey. It includes the business case for urgent action and a framework for a robust net zero strategy, including how to make a start and build momentum.	Building your Net Zero roadmap: a guide for industry leaders and decision makers (igd.com)
Food & drink Federation (FDF)	FDF's Achieving Net Zero: A Handbook For The Food and Dink Sector	Provides practical guidance for food & drinks manufacturers in implementing their decarbonisation roadmaps.	Net Zero Handbook Overview | The Food & Drink Federation (fdf.org.uk)
Net Zero Now	Net Zero Pubs, Net Zero Bars and Net Zero Restaurant	Aims to provide consistency about what constitutes net zero for a range of hospitality sub-sectors, the tools to get there, and a standard against which businesses that want to claim net zero can be certified.	Net Zero Now | Sector Based Business Tools | United Kingdom
Zero Carbon Forum	Zero Carbon Hospitality & Brewing Roadmap	Outlines net zero ambitions, target years, milestones, and pathways for different HaFS sub-sectors.	Zero Carbon Forum – Home Page
Federation of Wholesale Distributers	Wholesale sector Net Zero roadmap	FWD have developed this sector roadmap to help wholesalers, particularly those at the early stages of developing their net-zero strategy, with clear practical actions to take. Provides a greater understanding of the direct emissions of the sector, offers help to those aiming to understand their own emissions, and contains interim pledges as well as key indicators such as the percentage of renewable energy or low-carbon refrigerants.	Wholesale sector on the road to Net Zero - FWD

Tourism Declares partnership	Net Zero Methodology for Hotels V1.0	This methodology has been developed to support hotels and the wider hotel industry as they seek to make net zero commitments and take action to achieve them.	**Net-Zero-Methodology-for-Hotels-First-Edition-December-2021.pdf (greenview.sg)**
Transition Plan Taskforce	Draft sector guidance for food and beverage sector	The Transition Plan Taskforce Food & Beverage Sector Guidance adds further depth and detail for preparers of transition plans that are operating in the Food & Beverage sector.	**Food & Beverage sector Guidance**

1.5 Limits of these Protocols

This document is only focused on GHG emissions, and so does not consider the relevance of many other important environmental and social impacts of a company's operations and supply chains.

This document does not advance the methodological discussion of product-level GHG measurement (for example, discussions on the allocation of GHG emissions to products based on economic or other factors). However, the document does set out some of the differences in product vs corporate accounting approaches to scope 3 GHG emissions, **Section 1.6** provides further information on product level GHG measurement approaches. **Annex E** also provides further guidance on ensuring a consistent methodological approach is taken by the data sources chosen when compiling a scope 3 inventory.

Further than signposting and summarising requirements and guidance from other initiatives (specifically the SBTi and GHG Protocol), this document does not specify requirements related to carbon offsetting. It refers to methodologies for quantifying carbon removals (see **Section 5.5.2**) – but only in the context of measuring and reporting a scope 3 inventory. For further guidance on carbon offsetting, a report published in 2021 by **Green Alliance** provides a good overview of the state of play in the UK with regard to carbon markets, the difference between offsetting and insetting, different ways carbon credits can be used, and associated challenges – but only in the context of measuring and reporting a scope 3 inventory.

Equally this document does not explicitly cover requirements set out by the **Task Force on Climate-related Financial Disclosure** (TCFD) or the **Task Force on Nature-related Financial Disclosure** (TNFD). However, both rest on a deeper understanding of a company's supply chain and a company's impact. Both these aspects can be gained whilst completing a scope 3 footprint. TCFD and TNFD also require mitigation plans to address the risks identified during the reporting process, this can be designed to complement any GHG reduction plans a company may have to also improve the resilience of supply chains to climate risk.

For specific guidance and examples of best practice for food and drink businesses planning to implement TCFD reporting, you can refer to WBCSD's **TCFD implementation for food, agriculture & forest products - World Business Council for Sustainable Development (WBCSD)**

TNFD have developed a set of disclosure recommendations and guidance for organisations to report and act on evolving nature-related dependencies, impacts, risks and opportunities. The recommendations and guidance will enable business and finance to integrate nature into decision making, and ultimately support a shift in global financial flows away from nature-negative outcomes and toward nature-positive outcomes. TNFD's disclosure recommendations are structured around four pillars, consistent with the TCFD and the International Sustainability Standards Board (ISSB). More guidance can be found **here**.

The Trustees of the International Financial Reporting Standards (IFRS) Foundation announced the formation of the International Sustainability Standards Board (ISSB) on 3 November 2021 at COP26 in Glasgow, following strong market demand for its establishment. The ISSB is developing—in the public interest—standards that will result in a high-quality, comprehensive global baseline of sustainability disclosures focused on the needs of investors and the financial markets. At the time of publication, ISSB have released two sustainability disclosure standards, **IFRS S1** and **IFRS S2**. IFRS S1 relates to general sustainability disclosures and provides the general requirements for disclosure that IFRS S2 builds on, IFRS S2 is a complementary disclosure framework to S1 aimed specifically at climate-related disclosures. Importantly, IFRS S2 requires the disclosure of climate-related metrics including scope 3 emissions in line with the GHG Protocol, for which this guidance can be followed. The IFRS S1 and IFRS S2 frameworks are broadly consistent with TCFD, and where there are differences, these are either additional disclosure recommendations within IFRS S2 or differences between IFRS S2 and TCFD guidance, not from the TCFD recommendations. The four core recommendations and 11 recommended disclosures within the TCFD are consistent with the IFRS S1 and S2 disclosure frameworks. A comparison between TCFD disclosure recommendations and IFRS S2 guidance can be found **here**.

1.6 Environmental reporting at product and organisation level

This protocol is focused on organisational scope 3 accounting and reporting, not product footprinting.

However, there are opportunities for synergies between organisational and product reporting that are important to consider before designing and implementing your scope 3 data collection and quantification. As such, many of the data considerations outlined in **Section 6.4** are the same.

The environmental impacts of products can be estimated quantitatively using Life Cycle Assessment (LCA), a longstanding methodology for considering environmental impacts across a product's whole life cycle. LCA methods are set out in standards such as ISO14067 and the EU Product Environmental Footprint (PEF) methodologies. LCA methods have also informed the development of 'single issue' product carbon footprinting standards and guidance such as PAS 2050 and the Greenhouse Gas (GHG) Protocol Product Standard.

Although product and organisational GHG accounting share many underlying concepts and methods, the differences in accounting standards and norms means that a total scopes 1, 2 and 3 inventory does not always match the sum of all life cycle product carbon footprints of products produced or sold by a business. This is driven by, but not limited to: how activity data is collected, and the functional unit applied to organisations.

Box 1: Practical and methodological differences.

Activity data:
Activity data collection refers to how data on specific processes is captured. Organisations can either collect 'bottom-up' or 'top-down' activity data. Bottom-up activity data captures emissions from specific processes and/or products, which is then summed to estimate the whole inventory for a supply chain stage. Top-down activity data captures emissions from an entire supply chain stage or site, which can then be disaggregated (via allocation) to estimate emissions from specific products.

The two levels have different incentives: For organisational reporting, only the aggregate 'top-down' approach is needed, and businesses may already collect this data. For more accurate product footprints, however, bottom-up data is preferable. The choice for businesses is therefore about balancing the added burden of more involved data collection with the level of accuracy desired.

Functional unit:
This applies primarily in the GHG Protocol. Functional units can impact results in cases where purchased products accumulate across multiple time periods.

For example, a retailer might split a single product footprint into 'upstream' activities, reported as a 'purchased good' in one time period, and 'downstream' activities, reported as a 'sold good' in a subsequent time period.

Reconciling this is not an impossible task: overcoming it simply requires that product footprints have data split out for particular stages. When this is the case, the data can be allocated to the appropriate stage. The availability of data split by stage may impact how data is gathered and shared, with aggregated (sometimes called 'black box') product footprints being less useful than those with clearly disaggregated stages.

Practical considerations:
Where accuracy and the ability to disaggregate footprints are priorities, supply chain actors collecting activity data should consider doing so at product level. However, the strict methodological requirements underpinning LCA footprints may be too resource-intensive to be considered feasible in businesses with large product portfolios.

The product level approach is preferred because i) bottom-up data disaggregated by products is more accurate than recasting top-down data based on 'allocation keys' such as mass, volume, or economic value; ii) it allows greater transparency as to what has been included or not at any given supply chain stage, allowing data to be shared throughout the supply chain more easily, for example if a retailer asks a supplier for emission data; iii) there is greater ability to identify and account for supply chain interventions (for more details see **Annex E**). However, there is a trade-off to manage between these benefits and the added complexity.

Overall, the uncertainty caused by discrepancies between bottom-up and top-down data are likely to be less significant than potential errors introduced by using generic data, particularly for primary production of food products. Using specific data – for example, collected from suppliers – rather than generic data helps quantify product-level emissions that better reflect the real supply chain stages and purchased goods in a company's scope 3 footprint. When this approach is used widely, the stage- and product-specific emissions can be summed to create a more accurate total scope 3 inventory.

In the pursuit of accurate product and organisation inventories, getting accurate, specific data on primary production is vital for accurate product and

organisation inventories. The potential for generic data to introduce errors is particularly pronounced when it comes to food products. This is because of the widely varying kinds of processes that can be used to produce similar goods, as well as the substantial variations in lifecycle emissions from place to place.

For a detailed consideration of the extent to which data gathered for product-level environmental accounting is applicable to organisation-level, and vice versa, see WRAP's report Analysis of Challenges For Environmental Reporting At Product And Organisation Level.

Endnotes

1 GHG Protocol Scope 3 Guidance, Section 1.9:
"The development of sector-specific implementation guidance and tools can drive more consistent corporate GHG measurement, reporting, and performance tracking practices for a particular sector. Helpful sector-level information could include guidance on interpreting the standard for a specific sector, guidance, and tools for calculating emissions from sector-specific activities, recommended performance metrics, specific guidance for identifying the largest sector emissions sources, and suggested data sources and emissions factors. Sectors should develop guidance through an inclusive multi-stakeholder process to ensure broad acceptance and facilitate increased consistency and credibility".

Section 2

Steps needed for measuring and reporting scope 3 emissions

The steps needed for measuring and reporting scope 3 emissions are outlined in the **GHG Protocol Scope 3 Standard**, reproduced in **Figure 3**.

Figure 3: Steps needed for measuring and reporting scope 3 emissions.

The GHG Protocol Scope 3 Standard uses the following convention regarding terminologies:

- The term **"shall"** is used to indicate what is required for a GHG inventory to be in conformance with the GHG Protocol Scope 3 Standard.
- The term **"should"** is used to indicate a recommendation, but not a requirement.

This document is structured to mirror these steps and conventions. All requirements are in conformance with the GHG Protocol Scope 3 Standard. There are additional best practice recommendations that provide additional specificity and consistency in measuring scope 3 GHG emissions for food & drink businesses.

Section 3 - outlines key business goals and expectations for the food & drink sector.

Section 4 - summarises the key measurement principles of the GHG Protocol and how this document helps food & businesses achieve them.

Section 5 - defines which scope 3 activities food & drink businesses should include in their scope 3 inventory and other boundary considerations, such as measuring the emissions associated with land-use change, carbon removals and downstream emissions.

Section 6 - focuses specifically on category 1 - purchased goods. It outlines data recommendations and detailed guidance on data sources.

Note - **Annex A** – also outlines data sources for other scope 3 categories.

Section 7 – summarises existing guidance and requirements for setting GHG reduction targets and tracking emissions over time.

Section 8 - outlines reporting and assurance requirements and recommendations.

Annex A – outlines data requirements and sources for scope 3 categories other than category 1.

Annex B – provides a list of things to check for when reviewing embodied emissions data for purchased goods.

Annex C – provides a recommended format for supplier questions relating to GHG emissions.

Annex D - provides a brief summary of the international standards referenced throughout this document, and other key standards and guidance related to scope 3 emissions calculation and reporting along the value chain.

Annex E – provides additional guidance on including and adjusting emission data to best reflect a company's supply chain.

Section 3

Step 1 – Define business goals

Bidfood Case Study:
In our case, the 'purchased goods' category make up a staggering 92% of our overall carbon footprint, so it would be misleading to report on only scope 1 and 2, which are the most commonly reported categories.
Measurement is the first step toward reduction, so now we are focused on both data improvement (as the measurement is currently based purely on 'spend' data, the most basic method acceptable to the GHG Protocol) and engaging with suppliers to both measure and reduce their emissions.
It is a huge challenge.

The GHG Protocol Scope 3 Standard gives guidance that "before accounting for scope 3 emissions, companies should consider which business goal or goals they intend to achieve".

Developing a scope 3 emissions inventory can support a range of different business objectives. Some of the most common are highlighted in **Table 3**.

Because of reliance on agricultural products, scope 3 emissions can contribute up to 95% of total GHG emissions for companies in the food & drinks sector.

For this reason, it is increasingly an expected best practice that scope 3 emissions are included within any reported GHG inventories and targets. This document specifies in more detail which scope 3 activities should be included in the inventory and how they should be reported (see **Section 5**).

Table 3 – Common business goals and requirements for scope 3 measurement and reporting

Business Goals	Publication name
Establishing targets For those companies looking to report SBTi-validated emissions reduction targets, capturing an accurate picture of scope 3 emissions is critical. Inclusion of scope 3 is a requirement of SBTi and other frameworks.	SBTi requires that targets collectively cover at least two-thirds (67%) of a company's total scope 3 emissions for near-term targets, and 90% coverage for long-term targets. For food & drink businesses this will require, as a minimum, inclusion of scope 3 category 1 – purchased goods. **Section 5** includes further information on what must be included in the scope 3 inventory for food & drink businesses. Further detail on target setting and SBTi requirements is included in **Section 7.1**.
Enhancing transparency Voluntary public reporting and increased transparency over companies' full value chain impacts can help enhance reputation and accountability to a wide range of stakeholders, including investors, customers, governments, and wider civil society.	The **Global Reporting Initiative (GRI)** is a widely relied-upon framework for sustainability disclosures. **Disclosure number 305-3** of the framework requires that companies reporting at either core or comprehensive level disclose scope 3 GHG emissions. Reporting guidance refers to the GHG Protocol Scope 3 Standard, but there are no specific considerations for the food & drink sector.
	Carbon Disclosure Project (CDP) reporting offers detailed quantitative and qualitative disclosures to stakeholders, increasing transparency around boundaries and methodologies for GHG management and reporting. CDP reports are widely recognised and relied on by investors, regulators, and civil society groups. The food, beverage, and tobacco category within CDP reporting requests companies provide a breakdown of scope 3 emissions by relevant business activity, with reference to the GHG Protocol Scope 3 Standard. It notes that the sector inherits climate-related risks from the agricultural activities in its supply chain and that a breakdown of scope 3 emissions can therefore inform assessments of climate-related risk exposure.

Table 3 – Common business goals and requirements for scope 3 measurement and reporting (cont.)

Business Goals	Publication name
Meeting investors' needs Growing focus from investors on climate impacts and risks is resulting in increased demand for more accurate and granular disclosure of scope 3 emissions.	**The Taskforce on Climate-related Financial Disclosure (TCFD)** has become the central lens for investor focus on climate change. TCFD strongly encourages all organisations to disclose scope 3 GHG emissions, with reference to the GHG Protocol Scope 3 Standard. This disclosure forms a critical aspect to enable investors to understand the climate risks companies face throughout their entire value chains and is therefore increasingly being requested by investors and other market participants. The World Business Council for Sustainable Development (WBCSD) has created a guide to TCFD disclosures specifically tailored to food & drink businesses - **TCFD implementation for food, agriculture & forest products - World Business Council for Sustainable Development (WBCSD).** In 2023, the **IFRS ISSB** developed further disclosure frameworks that complement and align with the TCFD guidance. The IFRS S1 and IFRS S2 disclosure frameworks and guidance provide requirements and recommendations for disclosing sustainability-related and climate-related risks, with the IFRS S2 guidance particularly focussing on climate-related disclosures including disclosure of scope 3 emissions.
Meeting future disclosure requirements The growth in legislated GHG and climate reporting requirements is driving a need for standardised and reliable approaches to scope 3 emissions reporting.	From April 2022, over 1,300 of the largest UK registered companies will be required to disclose against the TCFD framework on a comply or explain basis. This is due to apply to both publicly listed, as well as large private companies[2]. Accurate scope 3 emissions data is important to TCFD disclosure both due to the requirement to meet the **Metrics and targets** requirement to disclose scope 3 emissions, in addition to being a valuable input to climate scenario analysis required under the **Strategy pillar** (as noted above). Moreover, at the time of publication, governments including the UK government are considering the adoption of requirements to disclose against the IFRS S1 and IFRS S2 frameworks. These multiple disclosure requirements and frameworks make the landscape for disclosure increasingly complex. A comparison between the core recommendations of TCFD and the IFRS S2 disclosure framework can be found **here**. With much of the food & drink sector supplying large UK businesses, demand to capture accurate scope 3 data is anticipated to increase, even if companies are not currently required to report themselves. The disclosure should include an explanation of the definition and scope applied. WBCSD has created a guide to TCFD disclosures specifically tailored to food & drink businesses - **TCFD implementation for food, agriculture & forest products - World Business Council for Sustainable Development (WBCSD)**.
Informing strategic decisions Developing a robust scope 3 inventory enables a company to prioritise emissions hotspots, identify risks in their value chain and inform internal strategies for emission reduction through supply chain interventions and engagement.	Managing a downward trajectory in scope 3 emissions relies on making strategic choices relating to how a company engages with its suppliers and partners. Establishing a robust scope 3 baseline is an important step to ensure that these decisions can be taken on a rigorous basis. Being able to track progress over time on a robust basis is also critical, to understand if actions taken are having the right effect in reducing emissions, or if alternative approaches might be needed.

Endnotes

2 **UK to enshrine mandatory climate disclosures for largest companies in law**, UK Government website, October 2021.

Section 4

Step 2 – Review measurement & reporting principles

The GHG Protocol Scope 3 Standard requires that measurement and reporting of a scope 3 inventory shall be based on the following principles: relevance, completeness, consistency, transparency, and accuracy. The Land Sector and Removals guidance adds the principles of conservativeness, permanence, and comparability. The permanence principle has particularly important implications for monitoring of removals.

The primary function of these seven principles is to guide the implementation of the GHG Protocol Scope 3 Standard and the assurance of the scope 3 inventory. In practice, companies may encounter trade-offs between principles when completing a scope 3 inventory. For example, a company may find that achieving the most complete scope 3 inventory requires using less accurate data, compromising overall accuracy. Conversely, achieving the most accurate scope 3 inventory may require excluding activities with low accuracy, compromising overall completeness.

Companies should balance trade-offs between principles depending on their individual business goals. For example, tracking performance toward a specific scope 3 reduction target may require more accurate data. Over time, as the accuracy and completeness of scope 3 GHG data increases, the trade-off between these scope 3 measurement principles will likely diminish.

These Protocols support the achievement of the overarching principles by considering aspects of scope 3 measurement and reporting specific to the food & drink sector and setting more consistent best practice recommendations for companies.

Avara Foods:

"To ensure full transparency of our calculations, we keep a detailed methodology, which allows consistency when completing the footprint annually. This methodology includes the data origin, conversion factors used, their source and any calculations completed."

Tesco:

"As we move forward, we hope to introduce quality assurance mechanisms such as external validation and audit of data collected at the supplier and farm level, in line with our shareholders wish to link our scope 3 KPIs to financial mechanisms which rely on assured and verifiable data."

Table 4 – GHG Protocol Scope 3 Standard principles and how this document supports these.

Measurement & Reporting Principle	How this document helps food & drink businesses achieve this
Relevance - Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users – both internal and external to the company.	• Defines scope 3 activities that shall be included, based on significance for food & drink businesses (see **Section 5**) • Defines consistent boundaries and data quality thresholds for purchased goods (the most significant category for food & drink) (see **Section 5.4** and **Section 6**). • Provides default sources of data to inform the measurement of emissions, relevant to UK food & drink businesses - covering purchased food products & ingredients, packaging, transport, and waste management (see **Section 6.4** and **Annex A**). • Provides consistent formats for supplier questionnaires and data reporting (see **Annex C**). • Provides a recommendation for what to include when reporting a scope 3 inventory (see **Section 8.1**)
Consistency - Use consistent methodologies to allow for meaningful performance tracking of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.	
Completeness - Account for and report on all GHG emission sources and activities within the inventory boundary. Disclose and justify any specific exclusions.	
Accuracy - Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable confidence as to the integrity of the reported information.	
Transparency - Address all relevant issues factually and coherently, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.	
Conservativeness - Use conservative assumptions, values, and procedures when uncertainty is high. Conservative values and assumptions are those that are more likely to overestimate GHG emissions and underestimate removals.	
Permanence - Ensure mechanisms are in place to monitor the continued storage of reported removals, account for reversals, and report emissions from associated carbon pools.	
Companies should also follow the principle of comparability where relevant: **Comparability -** Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.	

Our scope 3 inventory boundary was aligned to the requirements of the SBTi. Our consultancy confirmed that for large organisations with complex structures the exercise of identifying the organisational boundary is an important one to get right and requires strong cooperation between the team that is developing the GHG report and the organisation's management.

- **AB World Foods**

To align to the definitions set out by the Greenhouse Gas Protocol, we calculate our scope 1&2 emissions in accordance with 'operational control'. All other emissions are categorised as scope 3.
In order to create a clear scope 3 boundary, we used an expenditure report to allocate the suppliers to the 12 relevant categories within scope 3 (GHG Protocol). To ensure that we are capturing all the information, we have subdivided the categories from the GHG protocol further.
For example, PG&S (purchased goods and services) is subdivided into Feed & Grain, PPE (personal protective equipment), Chicks & Eggs etc. This helps us internally to manage calculations and measure improvements.
We have included a number of categories in our scope 3 SBTi as they contribute more than 90% of the emissions. The categories included are:
Category 1: Purchased goods and services.
Category 4: Upstream transport and distribution.
Category 5: Waste generated in operations.

- **Avara Foods**

Section 5

Steps 3 and 4 – Identify relevant scope 3 activities and set the inventory boundary

5.1 Summary of requirements

This section outlines how to identify which of the 15 categories of scope 3 emissions are most significant and which activities must therefore be included within the company's scope 3 inventory. This can then be used to set a scope 3 inventory boundary and prioritise where to concentrate data collection efforts.

Determining which scope 3 emissions to include in the inventory (i.e., setting the boundary) is a critical decision in the inventory process. The **GHG Protocol Corporate Standard** allows companies flexibility in choosing which scope 3 activities to include in the GHG inventory when the company defines its operational boundaries. The **GHG Protocol Scope 3 Standard** creates additional completeness and consistency in scope 3 measurement and reporting by defining some scope 3 boundary requirements. In turn, this document provides further consistency, relevance, and transparency by defining additional scope 3 boundary requirements for food & drink businesses.

Table 5 summarises the GHG Protocol Scope 3 Standard boundary setting requirements, and where there are specific requirements for food & drink businesses. Further detail can be found in chapters 5 and 6 of the GHG Protocol Scope 3 Standard.

Table 5 – GHG Protocol Scope 3 Standard boundary requirements and additional builds in this document

GHG Protocol Scope 3 Standard requirements	Conformance and specific requirements for food & drink businesses within this document
Companies shall account for all scope 3 emissions and disclose and justify any exclusions.	To help food & drink businesses focus efforts on the most significant scope 3 emissions, **Section 5.2 outlines requirements for food & drink businesses in terms of scope 3 emissions coverage and which scope 3 categories to include (particularly where publicly reporting)**. The remainder of scope 3 categories are optional to include – or can be excluded, with justification on the basis of their level of significance being low.
Companies shall account for emissions from each scope 3 category according to the minimum boundaries provided in Chapter 5 of the GHG Protocol Scope 3 Standard (Table 5.4).	Throughout this document, minimum boundaries for each category of scope 3 emissions are consistent with those described in Table 5.4 of the GHG Protocol Scope 3 Standard. For example, **for purchased goods & services the boundary shall include all upstream (cradle-to-gate) emissions** excluding transportation to the reporting company. Additionally, clarifications are made with regard to accounting for land management, land use change and carbon removals in **Sections 5.4** and **5.5**.
Companies shall account for scope 3 emissions of CO_2, CH_4,N_2O, HFCs, PFCs, and SF_6 if they are emitted in the value chain.	**Section 6.4** and **Annex A** recommend data sources for use by food & drink businesses – all of which encompass these greenhouse gases.
Biogenic CO_2 emissions that occur in the value chain shall not be included in the scopes, but shall be included and separately reported in the public report.	This protocol builds on draft GHG Protocol Land Sector Guidance to specify more precisely which types of biogenic CO_2 emissions should be included in GHG scopes. While CO_2 from crop biofuel combustion remains outside of scopes, biogenic CO_2 from land carbon stock changes (e.g., land use change and land management) are reported within relevant scope (most likely scope 3 for a food and drink business).

5.2 Scope 3 categories which must be included for different types of food & drink business

Requirements for food & drink businesses in terms of scope 3 emissions coverage and which scope 3 categories to include, particularly where publicly reporting, are as follows.

Requirement – Minimum scope 3 coverage

Scope 3 categories that encompass at least 67% of total emissions* shall be included in the inventory, **as a minimum**.

NOTE. **For any food & drink business this must include category 1 – purchased goods.** **Section 5.4** provides more detail on boundary requirements for purchased goods.
A key requirement is that all upstream (cradle-to- gate, excluding transportation to the reporting company) emissions must be included for purchased goods. **Section 6** also provides recommended best practice data quality thresholds for purchased goods.

* In line with SBTi requirements for near-term target setting

Requirement – Scope 3 screening

Companies preferably shall undertake an initial GHG estimation/screening to identify % coverage but can alternatively use the priorities identified in **Table 5** as a starting point, as these categories will cover at least 67% of scope 3 emissions in the majority of instances.

Recommendation – Best practice scope 3 coverage

According to the GHG Protocol Scope 3 Standard, companies should strive for complete scope 3 inventory that should not exclude any activity that would compromise the relevance of the reported inventory. **It is recommended that at least 90% of total scope 3 emissions are included in an inventory – especially if setting long-term (net zero) targets. This aligns with current SBTi requirements for net-zero targets.**

5.2.1 Initial screening to identify relevant scope 3 categories

Companies should prioritise data collection efforts on the scope 3 activities that are expected to have the most significant GHG emissions. Collecting higher quality data for priority activities allows companies to focus resources on the most significant GHG emissions in the value chain, more effectively set reduction targets, and track and demonstrate GHG reductions over time.

Companies preferably should undertake an initial GHG estimation - or 'screening' - step to determine which scope 3 activities are expected to be most significant in size. Data sources that can be helpful for this task are outlined in **Annex A**.

Businesses are advised to undertake their own screening exercise to determine significant scope 3 categories, but can use **Table 6** as guidance on categories that are recommended to be included as a minimum, as these categories will cover at least 67% of scope 3 emissions in the majority of instances.

> **NOTE:** Category 1 'Purchased Goods' will be the most significant category for any food & drink business and **must** be included in the scope 3 inventory. A subsequent screening step specifically for purchased goods is recommended in order to further prioritise data collection efforts. This is described in **Section 6.2**.

Table 6 – Scope 3 categories which are recommended to be included **as a minimum** for different food & drink businesses

NOTE: This Table refers to food & drink products / operations only. Where other products or services are produced or sold (e.g., fuel, clothing, electricals), then other categories may become important. Onsite energy and materials use (i.e., scope 1 and 2 emissions) may also be materially significant for some of the operations listed below – e.g. food processors and manufacturers. Table 6 is a guide and not definitive; where a company has knowledge of their significant scope 3 emissions categories this should supersede the Table.

Food & Drink Manufacture/ Processors [1]

1. Purchased goods and services	4. Upstream transportation and distribution	5. Waste generation in operations	9. Downstream transportation and distribution	10. Processing of sold products	11. Use of sold products	12. End of life treatment of sold products
E.g. fresh ingredients This represents the largest source of Scope 3 emissions	*E.g. transportation by suppliers of produce to warehouses*	*E.g. landfill disposal by suppliers* Note: Some food waste occurring in supply chain will already be accounted for within embodied emissions factors for Category 1 (purchased goods). See Section 7.6 for further details	*E.g. transportation of purchased goods by retailer customer*	*E.g. baking of purchased part-baked bread into final product* Note: This is dependent on products sold, and whether they require further processing	*E.g. energy required to microwave ready meal* Note: Could be significant for some products – screen for materiality (see Section 5.2.2)	*E.g. composting of purchased product by customer* Note: Could be significant for some products – screen for materiality. Some food waste occurring in supply chain will already be accounted for within embodied emissions factors for Category 1 (purchased goods). See Section 7.6 for further details
Upstream			Downstream			

Wholesale [1]

1. Purchased goods and services	4. Upstream transportation and distribution	9. Downstream transportation and distribution	11. Use of sold products	12. End of life treatment of sold products
E.g. fresh ingredients This represents the largest source of Scope 3 emissions	*E.g. transportation by suppliers of produce to wholesaler*	*E.g. transportation of purchased goods by customer*	*E.g. energy required to microwave ready meal* Note: Could be significant for some products – screen for materiality (see Section 5.2.2)	*E.g. composting of purchased product by consumer* Note: Could be significant for some products – screen for materiality. Some food waste occurring in supply chain will already be accounted for within embodied emissions factors for Category 1 (purchased goods). See Section 7.6 for further details
Upstream		Downstream		

Retailer [1]

1. Purchased goods and services	4. Upstream transportation and distribution	9. Downstream transportation and distribution	11. Use of sold products	12. End of life treatment of sold products
E.g. fresh ingredients This represents the largest source of Scope 3 emissions	*E.g. transportation by suppliers of produce to retailer*	*E.g. transportation of purchased goods to the household by the consumer*	*E.g. energy required to microwave ready meal* Note: Could be significant for some products – screen for materiality (see Section 5.2.2)	*E.g. composting of purchased product by consumer* Note: Could be significant for some products – screen for materiality. Some food waste occurring in supply chain will already be accounted for within embodied emissions factors for Category 1 (purchased goods). See Section 7.6 for further details
Upstream		Downstream		

Table 6 – Scope 3 categories which are recommended to be included **as a minimum** for different food & drink businesses (cont.)

Restaurants, takeaways, pubs, hotels & breweries [2]

1. Purchased goods and services	4. Upstream transportation and distribution	5. Waste generation in operations	9. Downstream transportation and distribution	11. Use of sold products	14. Franchises
E.g. fresh ingredients Note: This represents the largest source of Scope 3 emissions with the exception of franchisors, where most Scope 3 emissions are accounted for in Category 24 (franchises)	*E.g. transportation by suppliers of produce to pub* Note: Dependent on business model, generally of greater significance to pubs and restaurants	*E.g. prep and spoilage waste* Note: This category will not account for embodied emissions associated with wasted food, which are factored into Category 1 (purchased goods). See Section 7.6 for further details	*E.g. transportation of purchased goods by consumers* Note: Dependent on business model, generally of greater significance to pubs and restaurants	*E.g. refrigeration of brewery products by customers* Note: Dependent on business model, only brewery businesses should consider this category a minimum reporting requirement	*E.g. scope 1 and 2 emissions of franchisees* Note: This category is only suitable for the franchise business model, and how franchise emissions are dealt with depends on whether the reporting company is a franchisee or franchisor
Upstream			Downstream		

3rd party catering services (e.g. public sectors catering) [3]

1. Purchased goods and services	4. Upstream transportation and distribution	5. Waste generation in operations	7. Employee commuting	8. Upstream leased assets
E.g. fresh ingredients This represents the largest source of Scope 3 emissions	*E.g. transportation by suppliers of produce to catering facilities*	*E.g. prep and spoilage waste* Note: This category will not account for embodied emissions associated with wasted food, which are factored into Category 1 (purchased goods). See Section 7.6 for further details	*E.g. employee travel to event venue*	*E.g. energy consumed in client kitchens* Note: For a service company these emissions can be as significant as Category 1 (purchased goods).
Upstream				

Key for Table 6

Reporting on this category is essential	Reporting on this category is recommended as a minimum	Reporting on this category is recommended as a minimum, subject to any caveats stated

Data Sources & Notes

1) **SBT Value Chain Report** – Box 2, Page 16. Wholesale assumed the same as for retail.

2) **Zero Carbon Forum Roadmap** – from which any categories contributing c.10% or more to scope 3 emissions estimated for different sub-sectors have been shaded. In all cases, the categories highlighted cover >67% of the estimated scope 3 emissions for each sub-sector. Sub-sector specific guidance and required categories for pubs, bars and restaurants are also provided by **Net Zero Now**.

3) The Compass Group **Climate Report** and the **Sodexo Net Zero Report** helped to inform 3rd party catering services categories alongside expert assessment.

5.2.2 Downstream emissions

Downstream emissions are likely to be significant for some food & drink businesses – but can be challenging to quantify because of significant uncertainty and (sometimes) limited ability to influence. Examples include determining how an item is stored and cooked and whether it is eaten or thrown away - and how this food waste is then managed.

However, for some food & drink items, downstream emissions can be significant and therefore are important to consider within a screening process. There are also actions that businesses can take to reduce downstream emissions – e.g., through product design or provision of information to consumers.

The following categories of downstream emissions are likely to be significant for many food & drink businesses:

Category 9 - Downstream transportation and distribution

The minimum boundary covers scope 1 and scope 2 emissions of transportation providers, distributors and retailers that arise from vehicle use, facility operations or other activities related to distribution. It is important to note that 'downstream' transport emissions only cover downstream transport *not* purchased by reporting entity. Any purchased transport is reported under category 4 (upstream transport).

Category 11 - Use of sold products

The minimum boundary covers emissions from the direct use-phase of sold products. These emissions are associated with products that directly use energy (e.g., sold electrical products). It is optional to report "indirect" use-phase emissions that arise from how consumers use or prepare products. These emissions include energy used to cook products or fugitive emissions from refrigerating products.

Category 12 - End of life treatment of sold products

The minimum boundary covers scope 1 and scope 2 emissions of the organisations responsible for disposal or treatment of products and packaging. Some factors influencing these emissions include what kind of packaging is used, how much packaging is used, the ability for products and packaging to be treated rather than disposed of (i.e., through recycling or composting).

Category 14 – Franchises

The minimum boundary for this category is scope 1 and scope 2 emissions of franchisees that occur during operation of franchises (e.g., from energy use).

In particular, calculating emissions from category 11 (use of sold products) requires assumptions about how consumers or food service operators use products. This is termed a 'use profile'. Depending on the type of product, this will principally include assumptions regarding the type and duration of storage and the type and duration of cooking. Usage instructions (e.g., on pack) should inform use profiles. However, these are often variable, e.g., offering multiple cooking options, or giving maximum (not actual) storage lengths and may not provide insight into how a product is typically stored or cooked. The inclusion of these 'indirect' use emissions are optional under the GHG Protocol Scope 3 Standard and so are not required under this Protocol.

Further information and potential data sources to quantify emissions for each of these categories are included in Annex A.

.

Recommendation – Franchise scope 3

As scope 3 emissions are likely to be significant for food & drink franchisees, a further best practice recommendation is that the priority scope 3 categories listed in **Table 6** are included for any franchisee (as appropriate for the type of business).

Recommendation – Indirect consumer use

Indirect use-phase emissions are optional under GHG Protocol Scope 3 Standard and SBTi target-setting criteria, and don't count towards the coverage requirements for SBTi targets. As such businesses can decide whether to include these sources of emissions within their inventory based on their specific business goals.

Further guidance on quantifying emissions from franchises is available here.

5.3 Defining organisational boundaries for the scope 3 inventory

It is important to be aware that the scope of GHG reporting is defined by the GHG protocol, and that care needs to be taken to identify where and how to account for emissions linked to any subsidiaries and their operational, upstream, and downstream activities.

Rules and guidance for organisational boundaries are outlined in section 5.2 of the **GHG Protocol Scope 3 Standard**.

There are three approaches to establishing what emissions fall under scopes 1 & 2 (i.e within the organisational boundary) and scope 3 (i.e. supply chain/outside the organisational boundary) - summarised as follows:

1) Financial control

Under the financial control approach, a company accounts for 100% of the GHG emissions over which it has financial control. It does not account for GHG emissions from operations in which it owns an interest but does not have financial control.

2) Operational control

Under the operational control approach, a company accounts for 100% of the GHG emissions over which it has operational control. It does not account for GHG emissions from operations in which it owns an interest but does not have operational control.

3) Equity share

Under the equity share approach, a company accounts for GHG emissions from operations according to its share of equity in the operation. The equity share reflects economic interest, which is the extent of rights a company has to the risks and rewards flowing from an operation.

5.4 Boundaries for category 1 – purchased good and services

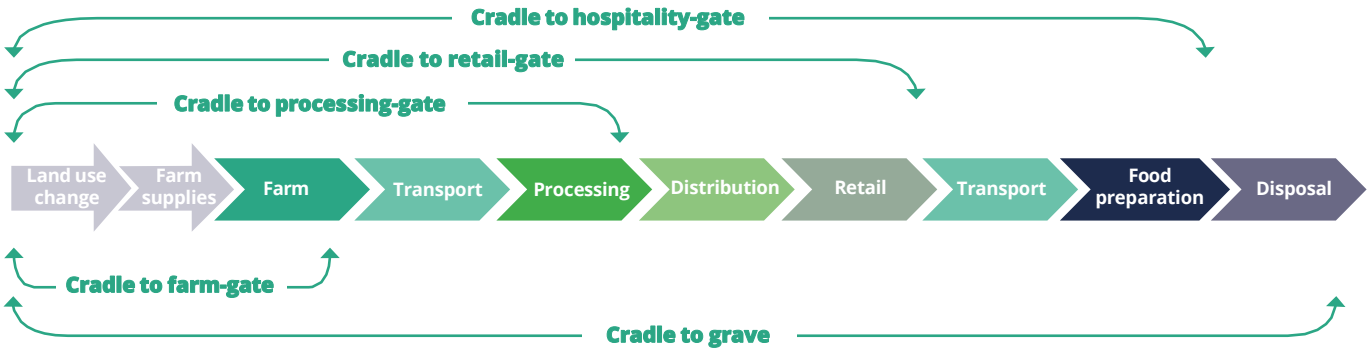
The GHG Protocol Scope 3 Standard defines purchased goods and services as: "Extraction, production and transportation of goods and services purchased or acquired by the reporting company in the reporting year, not otherwise included in categories 2-8."

Requirement – Purchased goods minimum boundary

The minimum boundary for category 1 purchased goods and services is that all upstream (cradle-to-gate) emissions shall be included.

'Cradle-to-gate emissions' include all emissions sources that occur across the life cycle of purchased products, from the point of material acquisition through to when the intermediate product leaves the reporting company's gate. This excludes onward transport, final product use and end-of-life. The 'gate' will differ depending on where the reporting company sits in the value chain. An illustration of this is shown in **Figure 4**.

Figure 4: Cradle-to-gate emissions profiles for different types of business in the food & drink sector. See **Figure 2** for a detailed breakdown for specific businesses.



Section 6.4 explains in more detail the data sources available to represent cradle-to-gate emissions for food & drink purchases.

5.4.1 Land sector emissions & removals

One of the most significant sources of emissions – and potential CO_2 removals – occurs as a result of land management and land use change within the supply chains of food and drink businesses. For example, emissions from the application of fertilisers to soils and enteric emissions from ruminants.

Emissions from both land management and land use change are required within the minimum boundary for purchased goods, under the GHG Protocol Scope 3 Standard. These emissions are now frequently included within the product LCAs that are recommended for use by food and drink businesses when quantifying scope 3 purchased goods. A summary of which types of land management and land use change emissions are included in published product footprint assessments for key UK products can be found in the WRAP emission factor **database** (tab "emissions lsr assessment"). They are also a core element of calculation tools used to produce farm or crop-level carbon footprints (see **Section 6.4**). A new Defra-funded report comparing commonly used farm carbon calculators will be published under their project "**Harmonisation of Carbon Accounting Calculators for Agriculture**" project number SCF0129.

Given the importance and unique characteristics of the land sector, this guidance provides consistent interpretations to address several key accounting and reporting uncertainties (see **Table 7** below). The interpretations in this guidance are based on the draft Land Sector and Removals Guidance (LSRG) developed by the GHG Protocol. The draft was released in 2023 for piloting and consultation, and a final version is anticipated to be released in the second half of 2024. It covers the following topics:

- **Land emissions**: Accounting for and reporting GHG emissions from agriculture, forestry, other land use, and land-use change
- **Carbon removals**: Accounting for and reporting of CO_2 removals and storage – for example in soils and agroforestry (see **Section 5.4.2**)
- **Biogenic products**: Accounting for and reporting of emissions and carbon removals from the production and consumption of biogenic products, such as bioenergy and forestry products.).

Please note, the GHGP LSRG also addresses the accounting and reporting of emissions and removals not relevant to the food and drink sector (for example accounting for carbon removals in long life biogenic products such as timber). This Protocol only addresses elements of the GHGP LSRG that are of significant relevance to food and drink businesses.

Finally, alongside the GHGP LSRG, The SBTi has published more specific guidance on setting science-based targets in land-intensive sectors (called Forest, Land and Agriculture (FLAG) sectors by SBTi). For further information on FLAG targets and their implications, refer to **Section 7**.

Biogenic CO_2 emissions

Central to land sector greenhouse gas accounting and

reporting is the concept of biogenic emissions and removals. Biogenic greenhouse gas emissions are emissions resulting from combustion, biodegradation, or other losses from biogenic sources (e.g., agricultural land, bio-based products, and livestock) to the atmosphere. Biogenic CO_2 removals are CO_2 removals resulting from atmospheric CO_2 transferred via biological sinks to storage in biogenic carbon pools e.g., soils.

The accounting and reporting approach for biogenic greenhouse gases varies depending on the source and type of gas. This is because biogenic CO_2 is treated differently from fossil CO_2 under some contexts (e.g., CO_2 from burning of biodiesel is not equated to fossil CO_2 emissions when combusted as biodiesel CO_2 was recently sequestered from the atmosphere in the production of crops). Examples of approaches are summarised in **Table 7** below with signposts to subsections where land sector emissions and removals are discussed in more detail. Under the draft GHGP LSRG companies are required to report these emissions and removals separately (see **Section 8.1** in this protocol for reporting recommendations and requirements).

Table 7: Types of biogenic CO_2 emissions and removals and their accounting in the land sector

Category	Sub-category	Example	Accounting approach	Reporting	See Section in this document
Emissions (Non-land)	Stationary and mobile combustion, process & fugitive emissions	Fossil CO_2 from diesel use; refrigerant losses	Gross flux of emissions to atmosphere. This is already covered by GHGP Corporate Standard and Scope 3 Standard	In relevant GHG scope e.g., scope 3, Purchased Goods	5.5.1
Emissions (land)	Land use change emissions	CO_2 emitted through conversion of forest to pasture	Net carbon stock change of land	In relevant GHG scope e.g., scope 3, Purchased Goods	5.4.2
	Land management CO_2 emissions	CO_2 emitted through cultivating peat soils in cropland	Net carbon stock change of land	In relevant GHG scope e.g., scope 3, Purchased Goods	5.5
	Land management non-CO_2 emissions	Soil N_2O emissions from fertiliser application on cropland	Gross flux of emissions to atmosphere	In relevant GHG scope e.g., scope 3, Purchased Goods	5.5.1
Removals	Land management net CO_2 removals	CO_2 stored in trees in agroforestry system	Net carbon stock change of land	In relevant GHG scope e.g., scope 3, Purchased Goods	5.5.2
Other	Gross biogenic product CO_2 emissions	CO_2 emitted through combustion of biodiesel in truck	Gross flux of emissions to atmosphere	Report outside of GHG scopes (i.e., it is reported but not inside of scope 1, 2 & 3). This is subject to consultation under GHGP LSRG	5.4.1

5.4.2 Land use change emissions

Definition and significance of land use change emissions

Land use change (LUC) emissions are biogenic greenhouse gas emissions resulting from changes in land use. For example, carbon stock losses from the conversion of forest or cropland; the conversion of native grasslands to intensively managed pasturelands; or the conversion of peatlands to croplands (GHG Protocol, 2023).

LUC emissions are highly relevant to agri-food value chains. Recent analysis published in Nature Food estimated that these emissions contribute one third of total food system greenhouse gas emissions (Crippa et al, 2021). Some product carbon footprint studies have calculated that the emissions footprint of crops, such as soybeans, can be more than 10x higher than those crops produced on land not recently converted from forest (e.g., Blonk, 2020). Increasing the accuracy and relevance of LUC emissions calculations is therefore highly desirable for credible target-setting and claiming of scope 3 greenhouse gas "reductions".

Under the GHG Protocol Scope 3 Standard emissions from both land management and LUC must be included in purchased goods emissions. These emissions sources are a core element of the forthcoming GHG Protocol Land Sector Removals Guidance (GHGP LSRG). In addition, the SBTi requires that all relevant emissions from LUC are included within science-based GHG targets. It is worth noting that LUC emissions are different from changes in biogenic CO_2 from land management (e.g., the effect of farming practices on soil carbon stocks in existing cropland). This section focuses on LUC accounting, not land management accounting. The broader topic of biogenic CO_2 accounting is also summarised in **Section 5.4.1**.

LUC accounting is one of the most complex areas of greenhouse gas accounting due to the lack of traceability in raw material supply chains and the data-intensive nature of LUC emissions calculations. It is important to note that due to these complexities, it is rare for food and drink businesses to calculate LUC emissions from primary agricultural production and deforestation data. Instead, businesses will likely use LUC emissions data embedded in supplier-specific emissions factors (assuming it is of sufficient quality) – or draw upon the growing number of commercial LUC datasets and tools that calculate LUC impacts using remote sensing, crop production and trade data.

This section covers some of the key concepts of LUC accounting that companies should be aware of – and sets out options for calculating them as part of scope 3 inventories. For those interested in more detail on the theory underpinning LUC calculations please refer to the draft GHGP LSRG (Part 1 and 2). This section has been informed by a guide published in November 2022 by the Accountability Framework, SBTi and GHG Protocol on aligning corporate accounting of deforestation- and conversion-free supply chains and land use change emissions.

Introduction to LUC accounting

Before discussing practical calculation options, it is important to understand some basic concepts and methods commonly used in LUC accounting. These are:

- Direct land use change (dLUC) versus indirect land use change (iLUC))
- Statistical land use change (sLUC)
- The 20-year assessment period, use of "discounting", and allocation to products

Key concept 1: Direct versus indirect land use change

There are two types of land use change: direct land use change and indirect land use change. Direct LUC is where crops or livestock are produced on land that was recently converted – whether for timber, grazing or crop production. Indirect LUC (iLUC) is where a company's demand for a crop results in an expansion of that crop's land use on existing farmland, but in so doing displaces other production which causes land conversion outside of the company's value chain. Although measures of iLUC provide a more complete assessment of the land impacts of a company's sourcing decisions, quantifying iLUC emissions requires the use of complex models with high levels of uncertainty and variation, and there are no readily available sources of emission factors for iLUC for agricultural products at the time of publication. Therefore, it is recommended that iLUC is not included in a company's scope 3 inventory. Under the GHGP LSRG, direct LUC is the preferred method for including land use change emissions in a scope 3 inventory.

Key concept 2: Statistical land use change

Calculating direct LUC requires some level of historic farm-level land use and production data. However, this level of data is not commonly available within supply chains, especially in commodities that pose the greatest deforestation and land conversion risk such as cocoa, coffee, oil palm, soy, rubber, timber/paper, and beef

cattle (forest-risk commodities).[1, 2]

An alternative to using dLUC data is to use statistical land use change methods – an approach also allowed within the draft GHGP LSRG. This approach has been one of the most used LUC methods to date and came to prominence in 2008 when it was included in product carbon footprinting specification PAS2050. Since then, similar methods have been adopted by the EU Product Environmental Footprint initiative and it underpins LUC impacts of products and processes in commonly used life cycle assessment (LCA) datasets such as Agribalyse, Ecoinvent, and Global Feed LCA Institute (GFLI).

In simple terms, sLUC methods use jurisdictional land conversion, land carbon stock and crop production data to create an 'average' LUC emissions factor associated with the production of a crop or livestock product in a specific geographic area (e.g., cocoa from Ivory Coast, soybeans from Brazil). sLUC is most commonly calculated at a national level –, although sub-national sLUC can be calculated (e.g., soybeans from Mato Grosso). There are different approaches to allocating LUC emissions to crops, which are explained below.

sLUC is sometimes used as a proxy for dLUC, however, it often contains a mixture of dLUC and iLUC associated with a crop in a region. For this reason, sLUC data are not strictly comparable with dLUC data. The final version of the GHGP LSRG is likely to provide guidance on how companies can migrate from using average sLUC data to dLUC data in their inventories.

Key concept 3: The 20-year assessment period and use of "discounting" and "allocation"

Regardless of whether companies are using dLUC or sLUC data, there are some key methodological decisions concerning how to allocate LUC emissions to the crops and livestock products that are produced on the land after a LUC event.

A common convention is that LUC emissions are distributed over a 20-year assessment period. This means that if a LUC event occurs within a business's operations or value chain within the past 20 years the reporting business gets allocated a share of emissions from that LUC event, as opposed to all the emissions being allocated to the first crop grown on the land post-conversion). Beyond this 20-year window, historic land use change emissions are effectively ignored from a carbon accounting perspective. The 20-year assessment period convention has particular relevance in the context of using deforestation- and conversion-free (DCF) certification schemes (see section below).

There are, however, different options for allocating how to allocate LUC emissions over time and to products. The judgement on what approach to use has a major impact on the LUC emissions values attributed to products produced on converted land. The two key decisions are:

Discounting: Should LUC emissions be allocated equally across each year in the 20-year assessment period after the LUC event (equal discounting) or be allocated more to years near the LUC event (linear discounting) (i.e., what is the "discounting" method that should be used – see **Figure 5** below for the two options).

Allocation: How should LUC emissions be allocated to crops and livestock products that are produced on land post-conversion? There are several options here and approaches also depend on whether dLUC or sLUC is being used. For sLUC the main option is whether to allocate on the basis of area occupied by crops in a region ("shared responsibility approach") or on the basis of which crops have expanded production more in a region ("product expansion approach"). The rationale of the latter is that cropland expansion is driving LUC so crops demanding more land should get attributed a greater share of land use change emissions.

Within the final GHGP LSRG, it is likely that linear discounting will be required or preferred (as it is required under SBTi FLAG). It is also likely that either shared responsibility or product expansion allocation options will be allowed (as long as these are transparently reported). SBTi FLAG targets use product expansion methods – as do datasets built from the methods outlined in PAS2050-1.

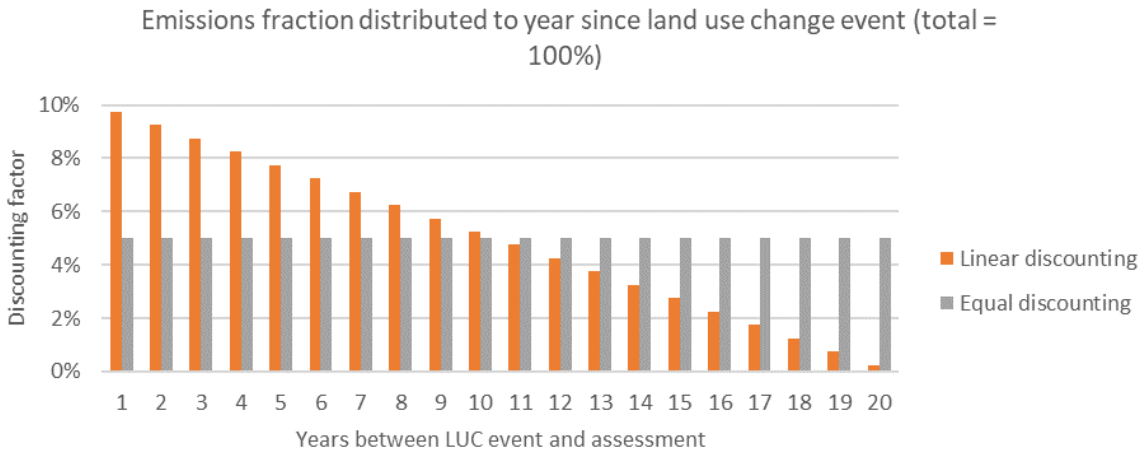
It is important to know how data sources such as supplier-specific carbon footprints and secondary emissions factor datasets approach these two key methodological options. Maintaining methodological consistency over time and within a scope 3 inventory is important if comparisons over time are to be reliable. Unfortunately, many published product footprints and LCAs are likely to use equal discounting, and so it will take time for data sources and inventories to adjust to this approach.

Recommendation

For now, it is recommended within this Protocol that businesses should use linear discounting and product expansion allocation approaches where possible.

[1] These commodities are covered by the EU Deforestation Regulation (EUDR)

Figure 5: Equal versus linear discounted allocation of land use change emissions to years[3]



Risks to be aware of when using LUC data in scope 3 target-setting.

It is important to be aware of two aspects of LUC accounting that could pose risks to the credibility of future emissions reduction claims.

Due to the high spatial variability of LUC in some countries (e.g., Brazil), a country-level 'average' sLUC emissions factor could significantly under- or overstate actual LUC emissions. For example, Ecoinvent – a major source of life cycle data – recently adopted a regional dLUC model for Brazilian crops based on **Donke et al (2020)**. This resulted in a 42% reduction in the footprint of soybeans in their dataset as a result of more conservative LUC emissions being estimated.

If base year LUC emissions are calculated using a country-level sLUC emissions factor and businesses then "clean" their supply chain (i.e., switch supply to verified conversion free sources) a claim of a reduction could be criticised on two fronts:

1. If using country-level average sLUC significantly overstates base year LUC emissions, cleaning a supply chain will deliver a greater 'reduction' in emissions in the target year than should be attributed to the business. Such is the significance of LUC in some supply chains, this could go a long way to meeting a business's scope 3 FLAG target. Although the issue of under-/over- estimating emissions is a general challenge in scope 3 inventories, the materiality of LUC emissions makes it of particular concern if country averages are used.

2. Even if the business can report zero land use change emissions in the target year, if this has been achieved through changing sourcing to low-risk producers then it is likely no 'real' reduction in emissions has occurred at a sectoral level. Instead, those 'dirty' producers are supplying product to alternate customers and markets.

The first criticism can be mitigated through the use of sub-national sLUC data or supplier-specific dLUC data. While many LUC impacts in studies and databases are calculated using country-level averages at the moment, it is expected that more sub-national and supply chain - specific traceability data will become available, as a result of new due diligence legislation. Criticism could also be mitigated through transparency on LUC methods and limitations.

The second criticism is a general challenge with all inventory-based GHG accounting methods.[4] As such, the issue is something to be aware of when developing a LUC emissions reduction strategy. That is to say, the strategy should not only ensure your supply chain is DCF but should also support sector-level activities that deliver conversion reductions beyond your value chain – for example, through policy advocacy, climate finance, and sector collaboration.

[3] Based on data in GHGP LSRG (Draft) Part 2 Table 17.4

[4] Corporate scope 3 accounting uses an 'inventory'-based method that generally does not look at sector-level changes in emissions that may or may not result from carbon reduction interventions by the reporting company. This is opposed to "intervention" or "project-based" accounting, which does.

WRAP recommends further work in the UK to explore potential to identify sub-national dLUC datasets and tools that can be used by UK businesses to improve the accuracy and relevance of LUC calculations that will enable credible GHG reduction reporting.

Summary of LUC calculation approaches

Given the challenges and limitations above, this section sets out the current options for calculating LUC emissions by food and drink businesses (e.g., retailers, wholesalers, food manufacturers and food service) – see **Table 8**. **Table 9** shows a hierarchy for guiding businesses on what is the most appropriate LUC method to use given a company's data availability. Based on the draft GHGP LSRG it is assumed that dLUC based on supply chain - specific data is the most preferred option – whereas sLUC based on country-level data is least preferred, but an acceptable place to start. Companies should use a calculation approach that delivers the most consistent and relevant GHG inventory. It is expected that the granularity and relevance of these emissions calculations will improve over time as supply chain data quality improves. From a materiality perspective it is recommended that businesses focus on key forest-risk commodities first.

Table 8: Current LUC data sources for food & drink businesses

Data source	Food & drink business calculation example	Comment on method
A: LUC emissions included in product carbon footprint using emissions factors from generic database or industry research.	Value for $kgCO_2e$/kg of chocolate bar from LCA database, combined with data on tonnes of chocolate bar purchased by business.	Many commonly used LCA databases include LUC emissions in their results. This means that where generic data are used for key ingredients, this will include potentially significant levels of LUC emissions. It is impossible or sometimes very difficult to understand underlying LUC contributions and assumptions – unless the source is very well documented and/or there is access to the underlying data models. Please note, where data on LUC are available, they are included - and separately reported - in the Emission Factor Database for Food & Drink products published on WRAP's website.
2: Commodity LUC emissions included in product carbon footprint provided by supplier.	As above, but uses "supplier-specific" product emissions factor containing LUC emissions	There will be a variety of LUC data quality in these circumstances – ranging from supplier analyses that use generic sLUC assumptions (i.e., country or industry average), to analyses that are highly supply chain relevant (i.e., include sub-national or farm-specific dLUC data that is representative of the reporting business's supply chain). If provided with carbon footprint data, the basis of LUC emissions should be clearly described.
3: Commodity LUC emissions calculated by reporting company-based commodity sourcing and certification data	Tonnes of soy sourced from Mato Grosso, Brazil in 2022. Company sourcing data is combined with sLUC or dLUC data from third-party datasets.	This approach is an option when no supply-chain specific LUC data is included in product footprint data used to calculate scope 3 emissions, and yet the reporting business wishes to include an estimate of LUC for forest -risk commodities. This approach requires that a company has consistent and complete data on directly and indirectly used commodities (i.e., tonnages, sourcing locations – preferably sub-national – and certification status). This commodity data is combined with an appropriate third-party LUC dataset/tool to estimate LUC emissions. Quantifying quantities of indirect commodity usage (e.g., soy in animal feed) can be challenging but is possible through cross-sector supplier engagement initiatives such as the **Soy Transparency Coalition**.

LUC hierarchy and calculation examples

Based on the latest draft of the GHP LSRG it is assumed that preference is given for direct land use change emissions calculations that relates to land management unit or sub-regional averages, regardless of whether this data is in emissions factors provided by suppliers or calculated by reporting company separately using sourcing and LUC emissions factors. As with all emissions calculations, activity data years should match emissions data years as far as possible. It is worth noting that LUC figures in generic LCA databases or in poorly documented supplier emissions factors are likely to be the worst option i.e., based on unknown/non relevant crop sourcing assumptions.

Table 9: Hierarchy of data sources for LUC accounting

Ranking	Spatial scale & LUC type	Description	Activity data examples
1	Farm-specific dLUC	LUC calculated based on historic production and land conversion data specific to sample of farms in supply chain	1000 tonnes of soybeans from producer group
2	Sub-national level dLUC	Regional sourcing data combined with third-party dLUC factors for regions	1,000 tonnes of soybeans from Mato Grosso
3	Sub-national level sLUC	Regional sourcing data combined with third-party sLUC factors for regions	1,000 tonnes of soybeans from Mato Grosso
4	National level dLUC	National-level sourcing data combined with third-party dLUC factors for regions	1,000 tonnes of soybeans from Brazil
5	National level sLUC	National-level sourcing data combined with third-party sLUC factors for regions	1,000 tonnes of soybeans from Brazil
6	Unknown / Non-relevant	LUC based on unknown or non-relevant sourcing assumptions e.g., embedded in generic LCA database	1000 tonnes of soybeans

LUC estimation example

If estimating LUC at regional or country-level using commodity usage and sourcing data, the calculation steps below can be used. In the example 1000 tonnes of soymeal are sourced from Argentina in 2021 for the production of chicken. Data on soymeal usage can be based on supplier disclosures of soymeal purchasing – or calculated using conversion factors estimating soy usage per kg of chicken produced. The calculation example below estimates approximately 3,000 tCO_2e emissions were associated with 1000 tonnes of soymeal use. This method is a simplified approach to the sort of calculation that would be undertaken in a full LCA.

Table 10: Calculation steps for estimating country-level LUC emissions for Argentinian soy.

Step	Calculation description	Calculation	Notes
A	Convert 1000 tonnes of soymeal quantity to soybean equivalent	1,000t / 0.79 = 1,389 tonnes of soybean equivalent	Soybean conversion (0.79) based on **RTRS soy calculator methods**
B	Convert soybean tonnage to growing area	1,389t / 2.81 t/ha = 494Ha of land use	Yield based on country and year-specific average yield data for soy from **FAOSTAT**
C	Convert land area to LUC emissions attributed to soybean production using third party emissions factor or tool	494ha * 12 tCO_2e/ha/year = 5,932tCO_2e LUC	Country-level crop LUC emissions factors can be sourced from industry research and or commercial datasets/tools. They can also be calculated from first principles using methods such as those described in PAS02050-1:2012. The choice of LUC factor will have a major impact on results. A consistent approach to LUC factor data sources should be used across commodities and countries.
D	Allocate a share of calculated soybean LUC emissions to soybean meal based on economic value of co-products	5,932 * 52% = 3,084 tCO_2e for LUC	Here it is assumed that soybean meal represents 52% of soybean processing co-product financial values (i.e., compared to soybean oil and other co-products). This is based on assumptions in **RTRS soy calculator methods**). Final results will be sensitive to co-product value assumptions so consistency in sources and approach are needed, where possible.

Treatment of certification in LUC analyses

One of the principal mechanisms for retail, manufacturer, and service sector businesses to tackle deforestation and land conversion is through the use of 'certification' schemes. These schemes take multiple forms and are frequently commodity-specific, e.g., the RTRS standard for soy. Unfortunately, the certification of a forest-risk commodity does not necessarily eliminate LUC emissions from the footprint of the product in question. In addition, the practical guidance in this area is limited and now will not be addressed as part of the GHGP LSRG finalisation in 2024.[5] Some of the key characteristics of certification schemes and how they relate to GHG accounting under the Land Sector and Removals Guidance are summarised in **Table 11** below. **Table 12** shows two examples of commonly used certification schemes for soy and palm.

Table 11: Characteristics of certification schemes that are relevant to LUC GHG accounting.

Characteristic of certification scheme	Description	Relevance to GHG accounting
Chain of custody model	Sustainability standards typically use one of four chain of custody (CoC) models. "Identity Preserved" and "Segregated" models do not allow mixing of certified materials and non-certified materials and so there is a physical link between the final product and certified production. The "mass balance" model allows blending with non-certified material so does not ensure physical traceability to specific land management units. The "certificate" or "book and claim" model is not strictly a chain of custody model; it is a trading system intended to reward responsible production, with no physical link to certified product. For more details on chain of custody models refer to ISEAL's guidance on this topic.[6]	In the draft GHGP LSRG it was proposed that only certification schemes with physical links to production be eligible for demonstrating zero LUC emissions. However, this is likely to be removed in the final version with further consultation on market-based mechanisms addressed by broader GHG Protocol standards review in 2024/25.
Scope of LUC covered	Different standards may include/exclude certain forms of land use change. For example, legal deforestation is allowed under some schemes. Certain habitat-types may also be excluded under their definitions. A good source of benchmarking data on soy voluntary standards is the Profundo "Benchmark of soy standards".	According to GHGP LSRG *all* forms of land use change must be included in an assessment of LUC emissions – regardless of habitat type, legality, etc.
Cut-off date	Certifications that address deforestation and land conversion will set a 'cut-off date' before which land conversion must not have occurred on the land on which the commodity was grown. These cut-off dates vary by sustainability standard and are often within the last 5-10 years. See examples in Table below.	According to GHGP LSRG, emissions from LUC events that occurred in the 20 years prior to the reporting year must be included in a corporate inventory. For example, if the GHG reporting year is 2023, then a share of emissions from any LUC since 2003 must be included. This means that to be *zero* LUC emissions a commodity must be covered by a certification scheme that has a cut-off date of at least 20 years ago.

[5] Instead, the use of 'market -based' mechanisms such as certification will be addressed within a much broader GHG Protocol update. This process won't be concluded until 2025. https://ghgprotocol.org/ghg-protocol-standards-and-guidance-update-process-0

[6] ISEAL (2016) ISEAL Guidance: Chain of custody models and definitions https://www.isealalliance.org/get-involved/resources/iseal-guidance-chain-custody-models-and-definitions

Table 12: Chain of custody, scope, and cut-off dates of example certification schemes

Characteristic of certification scheme	Roundtable on Responsible Soy (RTRS) certification (Soy)	Roundtable on Sustainable Palm Oil (RSPO) certification (Palm)
Available chain of custody model options	Segregated, Mass Balance, or Certificates	Identity Preserved, Segregated, Mass Balance or Certificates
Scope: Covers all relevant forms of land use change?	Yes	Yes
Deforestation cut-off date	31st Dec 2015 for legal and illegal deforestation (the RTRS also has a 2008 cut-off date for illegal deforestation in line with the Amazon Soy Moratorium.)	November 2018
Usage in an inventory	Any RTRS soy bought after 31st December 2035 under the segregated CoC model may be included within a company's GHG inventory with zero LUC emissions. Before 31st December 2035, or under any other CoC model, LUC emissions for RTRS soy shall be calculated using the sLUC or dLUC approach outlined earlier in this section.	Any RSPO palm bought after November 2038 under the identity preserved of segregated CoC models may be included within a company's GHG inventory with zero LUC emissions. Before November 2038, or under any other CoC model, LUC emissions for RSPO palm shall be calculated using the sLUC or dLUC approach outlined earlier in this section.

As illustrated above, the cut-off dates of the major certification schemes for forest -risk commodities fall within the 20-year assessment period, and as such certification schemes can only provide partial assurance that no LUC has occurred within the period. For example, for a 2023 scope 3 inventory, the 2016 RTRS cut-off date covers 7 years of the required 20-year assessment period. Credible methods for adjusting LUC emissions for partial coverage of the 20-year assessment period with certification have not been identified.

Requirement – LUC inclusion

Emissions associated with LUC shall be included when quantifying scope 3 category 1 - purchased goods.

Requirement – Use of certification

Certified commodities can only claim to have zero LUC emissions using the certification scheme alone if it has the following characteristics: It has a cut-off date that is more than 20 years before the reporting year (i.e., 2003 for a 2023 inventory); It uses segregated or identify preserved chain of custody models; It addresses all forms of conversion – including both legal and illegal.

Recommendation – Discounting approach

Until GHGP LSRG is finalised business should use equal discounting approach for LUC as this is most likely to be consistent with existing supplier and secondary data used in scope 3 inventories. Businesses should migrate to linear discounting when GHGP LSRG is finalised in 2024 if this is the recommendation of that standard.

Requirement – LUC methods disclosure

LUC emissions shall be reported separately. The basis for these emissions calculations shall be reported: the scope of commodities and LUC covered; the calculation approach; the spatial granularity of the analysis; if and how results have been adjusted to reflect the use of certification.

Requirement – LUC reduction claims in target year

Although businesses can start estimating LUC emissions with country-level sLUC emissions factors, they should not use this data for assessing LUC emissions reductions in their FLAG target year. This should be achieved through the use of more accurate sub-national or land management unit-level sourcing and dLUC data.

Recommendation – Commodities to prioritise

Recommendation: Businesses should prioritise efforts in quantifying emissions linked to LUC for the following commodities: cocoa, coffee, oil palm, soy, rubber, timber/paper, and beef cattle.

In developing requirements for LUC emissions accounting for this protocol we have aligned with principles set out in Accountability Framework Initiative guidance on Deforestation and Conversion Free (DCF) corporate accounting i.e. that volumes may generally be considered DCF if they have been certified according to a standard whose criteria prohibit deforestation and conversion after a stated cutoff date and when using a chain of custody model that allows products to be linked to the site on which they were produced.

5.5 Land management emissions

In addition to land use change emissions, the GHG Protocol requires reporting of so-called 'land management' emissions. Land management emissions relate to emissions from land that has not been converted between land use types in the reporting year. In agriculture land management emissions will principally relate to emissions from existing cropland and grassland.

Land management emissions cover the following two types of emission: net CO_2 emissions from land management; and non-CO_2 greenhouse gas emissions from land management.

Net CO_2 emissions from land management is the net carbon stock change from above- and below-ground carbon pools on managed lands. In a farming context, this is principally driven by CO_2 emissions from soil management (i.e., through degradation of soils or cultivation of peat soils).
NB If land use change or management results in net carbon removals, then this is accounted for in a separate accounting category "land management net removals". See **Section 5.5.2** describing the recommendations and requirements for calculating and reporting on removals.

Non-CO_2 emissions from land management covers all other agricultural emissions such methane (CH4) emissions from livestock, nitrous oxide (N_2O) emissions from applying fertilisers and methane emissions from rice growing. These non-CO_2 emissions are already commonly included in farm carbon calculators and life cycle assessments. When selecting emissions factors or using data farm carbon calculators it is important to ensure that they include all key sources on non-CO_2 gases.

The GHGP LSRG draft categorises non-CO_2 land management emissions as follows:

- Enteric emissions from livestock (CH4)
- Manure management (CH4 and N_2O)
- Managed soil emissions e.g., fertilisers (N_20)
- Rice cultivation (CH4)
- Biomass burning (N_2O & CH4)
- Reservoirs (CH4)

5.5.1 Non-land emissions

It is important to note that energy and industry emissions that occur on farm or in a farm's supply chain are classified as 'non-land' emissions. The main sources of these emissions are the production and transport of farm inputs e.g., fertilisers, pesticides, fuels, equipment, etc. Non-land emissions also cover greenhouse gas emissions on fuel combustion on farms.
Finally, it is worth noting that there is some divergence between what the SBTi classifies as a 'FLAG' emission and how the GHGP LSRG defines 'Land' emissions. Under the GHGP LSRG, 'Land' emissions exclude energy and industry emissions associated with farming e.g., machinery use, fertilizer manufacture. Under SBTi FLAG it is recommended that some of these 'non-land' emissions are included in FLAG targets – however this is not currently a strict requirement as it is appreciated that emissions factor data constraints make disaggregating emissions to this level of granularity not feasible.

Table 13: Example farm emissions and removals

Emission source	Accounting category	Companies that own or control lands	Companies with land management impacts in their value chain
Enteric fermentation	Land management non-CO_2 emissions	Scope 1	Scope 3
Manure management	Land management non-CO_2 emissions	Scope 1	Scope 3
Biomass carbon stock reductions e.g., degradation of forest	Land management net CO_2 emission	Scope 1	Scope 3
Soil carbon stock reductions (e.g., cultivation of peat soils)	Land management net CO_2 emission	Scope 1	Scope 3
On-site fuel and energy use	Non-land emissions	Scope 1	Scope 3
Fertiliser and inputs embodied emissions	Non-land emissions	Scope 3	Scope 3

5.5.2 Carbon removals

Introduction to removals

Since food and drink businesses rely on agriculture and other land-based sectors, the primary carbon pool of interest is biogenic – namely, carbon stored in soils and in plant biomass e.g., trees. Biogenic carbon removals, in the terminology of the GHG Protocol Land Sector & Removals Guidance (GHGP LSRG), occur when the net result of CO_2 fluxes to and from the atmosphere result in more CO_2 ending up retained in a terrestrial pool of carbon (i.e., there is a carbon stock change). Carbon stored in food products themselves can be ignored as they are only temporary.

The GHG Protocol Land Sector and Removals Guidance (LSRG) is establishing sector-agnostic GHG accounting and reporting requirements for carbon removals. The SBTi FLAG methods provide additional requirements on how land sector business include removals in science-based targets.

The SBTi allows companies to net removals from emissions when businesses develop FLAG targets, as long as accounting and reporting used is aligned to the GHGP LSRG. The SBTi methodology for near term targets does not allow companies to use removals to abate "non-FLAG" emissions (e.g., to balance energy and industry that occur post farm-gate). See **Section 7.1** for more detail on setting and tracking a FLAG target.

A critical point to note is that quantifying and reporting carbon removals is optional under the current draft of the GHGP LSRG. However, meeting FLAG targets without including removals will be challenging for food business, given the SBTi expectation that removals play an important role in overall land-sector GHG abatement.

Carbon removals criteria

It is in the interest of the whole food sector for downstream food businesses to account for these removals in scope 3 reporting in a credible and defensible manner so as to not discredit this important aspect of net emissions from the food sector. The draft GHGP LSRG sets out a series of criteria that removals must meet, to ensure rigour and accuracy. These include:

- Ongoing storage monitoring: The need to provide evidence that carbon removals are remaining stored (i.e., not reversed and lost to atmosphere)
- Traceability: The reporting company has traceability to the removal reported.
- Primary data: Companies use empirical data to quantify carbon removals specific to their value chain (e.g., soil sampling, remote sensing, etc)
- Reversals accounting: Companies report losses – including if they lose the ability to monitor a previously reported removal.

The issue of traceability, in particular, is being heavily debated as a part of the GHGP LSRG drafting process. Many stakeholders are advocating that the traceability

restrictions be loosened to encourage greater investment in this emerging climate mitigation space (while applying guardrails to ensure integrity). One of the proposed approaches would allow companies to claim removals that occur at a less granular level e.g., "supply shed" or regional levels.

Data collection

Whether a stricter or looser definition of traceability is adopted, companies will likely still need to establish greater levels of primary data than is currently the norm. Approaches based only on collecting activity data and applying generic sequestration factors are very unlikely to be permitted. In practical terms this means that companies will not be able to use carbon removals estimates from farm GHG models (where there is no validation of estimates) or using default carbon removals values embedded in LCA or emissions factor databases or published studies. This means that engaging suppliers (and potentially companies further down the supply chain) will be essential to collecting the data needed to account for removals.

The most rigorous, and preferred, of the allowed methods is based on directly measuring removals where they occur on the land – for example, with soil sampling on a sample of farms within the value chain. Other allowable methods include remote sensing- and model-based approaches, but in the current draft of the LSRG these approaches still require periodic calibration and verification using direct measurements (supplier/primary data). In short, companies should be aware that the monitoring, reporting, and verification requirements associated with carbon removals will increase.

Double counting of carbon removals

Double counting occurs if the same volume of removals is claimed by more than one company. In some instances, double-counting is legitimate – but in others it is to be avoided.

Double counting to avoid is where two downstream companies claim more removals than are embodied in the products they purchase. For example, if a farm splits the sale of all of its harvest of one crop to two customers (i.e., each receive 50% of the crop and the embodied removals), double counting could happen if one or both of those customers claim more than 50% of the total pool of removals.

A related example of where double counting is to be avoided is where carbon markets interact with supply chains where removals are being reported. The GHG Protocol requires that all carbon credits sold outside of the value chain must be excluded from scope 1, 2 and 3 inventories – meaning they cannot be used as abatement for a science-based target. The risk for double counting arises if companies are claiming any fraction of removals that have been sold by the originator as credits. When credits are sold, only one entity can use the removals they represent. The originator of the credits, and by extension, every company downstream can no longer account for those removals.

Finally, it is important to note that in voluntary scope 3 reporting some double-counting of removals is legitimate – for example a dairy farm reports removals associated with the production of a litre of milk to a processor, who can report those removals associated with the milk. Likewise, a retailer buying that litre of milk could also report those removals associated with that litre of milk.

5.6 Other land metrics

Under the draft GHP LSRG it has been proposed that other non-emissions metrics will need to be reported by companies wishing to conform to the guidance e.g., "land occupation" in hectares.

This protocol is not recommending companies report these other metrics for now, but rather keep a watching brief on this issue and focus on scope 3 GHG inventory improvements, while the LSRG is finalised.

Requirement – Removals methods disclosure

If companies report carbon removals in their GHG inventory they shall disclose the level of traceability, primary data and approach to monitoring being used.

Requirement – Generic sequestration factors

Companies shall not use generic sequestration factors (i.e., those found in LCA databases, industry average data) to report removals in their GHG inventory those found in LCA databases, industry average data) to report removals in their GHG inventory.

Recommendation – Removals criteria

Companies should align with the principles for removals accounting outlined above when including carbon removals in corporate GHG inventory reporting. This includes the recommendation to use primary empirical data, have traceability and sufficient monitoring is in place to ensure that removals are not reversed.

Section 6

Steps 5 and 6 – Collect data and allocate emissions (category 1– purchased goods and services)

Our initial screening was based on total spend data. As such we worked with a 20:80 approach and identified the largest supplier transactions which could take us to cover at least 80% of our total cost of goods sold (COGS). After identifying these transactions, we converted the COGS to volume data by multiplying the total units of product sold by assumptions of the average volume (kg or l) by each unit of product, depending on the type of product. These assumptions were provided by the relevant category buyers and category technical managers.

- **Tesco**

This section outlines how to collect data and allocate emissions for purchased food & drink goods, in accordance with steps 5 and 6 of the GHG Protocol Scope 3 Standard.

The GHG Protocol Scope 3 Standard does not include any specific requirements relating to data sources, other than the boundary requirement that all upstream (cradle-to-gate) emissions must be included. **These Protocols provides further consistency, relevance, and transparency by defining specific recommendations for food & drink businesses relating to data coverage and quality.**

A summary of requirements and recommendations is as follows:

Requirement

The minimum boundary for category 1 purchased goods is that all upstream (cradle-to-gate) emissions shall be included.

Recommendation

It is important to focus effort on continuous improvement in the quality of purchased goods activity data. As a best practice guideline, aim for weight or volume data (as opposed to spend-based data) to be collected for purchases representing at least 80% of emissions identified during screening. See **Section 6.2** for more information on screening and **Section 6.3** for more information on activity data.

Recommendation

Where publicly reporting, a summary of activity data sources, an assessment of data quality, and a summary of proposed steps to obtain better quality data should be provided alongside the inventory.

Recommendation

It is important to focus effort on continuous improvement in the quality of embodied emissions data for purchased goods. As a best practice guideline, aim for embodied emissions data meeting the threshold of 'good quality' (a total score across all data quality indicator scores of 10 or lower) for purchases representing at least 80% of emissions identified during screening. See **Section 6.2** for more information on screening; **Section 6.4** for more information on embodied emissions data; and the appendices of WRAP's Emission Factor Inclusion and Adjustment Guidance for more information on data quality scoring.

Recommendation

Where publicly reporting, a summary of embodied emission data sources, findings from data quality assessment, and proposed steps to obtain better quality data should be provided alongside the inventory.

Non-production-related procurement (goods not for resale)

As this document is specific to the food & drink sector, the guidance in this section focuses primarily on the purchase of food & drink goods and does not provide detailed steer on measuring emissions for other, non-production-related, procurement needed to enable operations, such as office supplies & equipment, PPE, etc. (often called indirect procurement, or procurement of goods not for resale).

Non-production-related procurement may also be significant for some companies and should be considered within the screening step described below. Many food & drink businesses have reported that emissions linked to non-production-related

procurement are not significant, but if they are they shall be included, with reference to the following information sources:

- **GHG Protocol Scope 3 Standard, Chapter 7** - provides further guidance on data and allocation of emissions for non-production-related procurement of goods and services.
- A recommended source of emission factors for secondary and tertiary packaging materials* or other purchases (e.g., refrigerants, office supplies, electrical equipment, clothing) is the latest **UK Government conversion factors for GHG reporting**.

*Note 1: Primary packaging is typically included as part of food & drink purchased goods (i.e. goods for resale). **Box 3** and **Section 6.4** outline the need to ensure that data sources used for food & drink purchases (activity data and embodied emission factors) are consistent in their inclusion of packaging, and how to check for this.

*Note 2: UK Government emission factors for packaging materials currently require businesses to know the recycled vs non-recycled content split for any individual material type (see 'Material Use' tab in the conversion factor database).

6.1 Types of data and quantification steps

Good quality data for food & drink purchases is the foundation of effective scope 3 measurement for the food & drink sector, and is the basis of sound target setting and tracking emissions reductions over time.

Two types of data are needed: 'activity data'; and 'embodied emission data'.

- **Activity data** - this refers to how much of a product is purchased. Purchase volumes can be in the form of either spend or mass/volume data. The appropriate use of each is outlined in **Section 6.3**.
- **Embodied emissions data** – this refers to the values that are used to convert activity data (purchase volumes) into GHG emission values (total GHG emissions linked to purchases). 'Embodied emissions' refer to the amount of GHGs emitted in the production of a given quantity of product or ingredient purchased (e.g., CO_2e per kg chicken). Further information on embodied emissions data is included in **Section 6.4** and **Annex E**

Recommended steps for data collection are as follows:

- Undertake screening to identify the most significant emission sources within category 1 purchased goods (**Section 6.2**);
- Collate and improve activity data quality over time (**Section 6.2**, **6.3**); and
- Collate and improve embodied emissions data quality over time (**Section 6.4** and **Annex E**).

6.2 Screening to identify the most significant emission sources within category 1 purchased goods and services

Screening of the scope 3 emissions inventory is an important first recommended step to identify the most significant emission sources within a company's category 1 purchased goods.

This recommended screening step reflects the fact that good data quality emissions inventories come at a cost – both in time and resources - and that good quality activity and emission factor data is not always readily accessible.

The screening process aims to use the most easily available data to develop an initial 'screening inventory' for purchased goods and services. This initial inventory can then be used to direct efforts to improve data quality on the most significant purchased goods. This is likely to be through a process of continual improvement, initially to create an emissions inventory that is good enough for its purpose, rather than perfect.

Box 2: Developing a Screening Inventory

Creating a screening inventory helps companies to focus their efforts toward GHG measurement and reduction on the most material products purchased. Developing a screening inventory requires the company to identify **activity data** (e.g., spend or weight of a purchased good) and **embodied emission factors** (GHG emissions per unit of spend, weight, etc.)

Depending on the type of products purchased by the reporting company, its GHG reduction ambitions and stakeholder expectations, companies may opt for a simplified, or more involved, screening inventory. However, the method is likely to incorporate the following steps, which offer guidance for screening using spend based activity data, which is likely to be the most suitable for those starting out:

1. **Define the period for measurement:** This should typically be 12 months, and where feasible should align to periods used for financial and other non-financial information reporting.
2. **Collate procurement spend data:** Collect spend data for all goods procured within the defined measurement period. Typically, this data can be consolidated from a central procurement platform, or via engagement with the company's procurement function.
3. **Conduct spend data analysis:** Through analysis of the spend data, identify the most significant purchasing categories, together summing to at least 80% of the total spend on purchased goods. Additionally, evaluate categories within the remaining 20% that contribute more than 1% of total spend to consider their potential GHG intensity, and the likelihood of being material to the company's total scope 3 inventory. Any categories representing over 1% of total spend may be material to the company's total emissions. Whilst 80% represents a minimum, where feasible companies should strive to achieve coverage of 95% or more of total spend as a good practice benchmark.
4. **Identify and apply suitable emission factors:** to create an emissions inventory, identify the most relevant source of emission factors for the categories of products collated within spend data. Data sources include: Defra Table 13 'Indirect emissions from the supply chain', which is free to access here, or Exiobase which is commonly used database available for purchase.
5. **Apply suitable emissions factors:** Use the emission factors identified, to translate spend data collated in steps 2) and 3) into GHG emissions – matching purchasing categories to emission factor descriptions. Then sum to generate a total.
6. **Fill data gaps:** For the remaining spend data (i.e., the 5-20% not included in steps 2) and 3)), emissions should be estimated as accurately as possible. This could either be by using an emission factor which is broadly appropriate to the nature of the products, or by extrapolating the total up to 100% (according to the proportion of spend not included).

Reporting companies that operate several businesses may wish to undertake this exercise in-depth for a single business (appropriate where multiple businesses operate in similar markets or buy similar products), or at the corporate level (appropriate where the portfolio of businesses are expected to purchase a wide variety of products).

Where companies have access to good quality weight-based activity data, this can be used as an alternative to spend based data, offering more accurate measurement, with better comparability over time. Alternatively, a hybrid approach using both spend and weight-based activity data can be applied, depending on availability of activity data for different products. For food & drink purchased goods, useful sources for quick emissions factors using weight-based activity data for the high-level screening process include:

- WRAP's food & drink emission factor database, encompasses data on a range of food & ingredient items.
- UK Government conversion factors for packaging and other inputs

Case Studies: Screening Inventory

Barfoots developed a screening inventory following the process outlined in the protocol.
Period – Following Barfoots established annual accounting procedures data was available following the end of the calendar year for the preceding year. 2021 data for a 12-month period was available for this project. Data systems were created to ensure that calculations could be replicated with further annual data when available.
Spend data – This was available from a central procurement platform. Weight-based data was also readily available for produce. In order to improve the accuracy of country of origin and transport type data was also accessed. This was used to refine the produce emission factors using information specific to the organisation.
Spend analysis – Coverage of more than 95% of total spend was achieved.
Emission factors – WRAP (Produce) and DEFRA (Transport) published emission factors were accessed and used for screening.
Data gaps – Where emission factors were not available these were estimated as accurately as possible following the conservativeness principle (GHG Protocol Land Sector and Removals Guidelines).
Key Learnings
High quality volume data and emission factors was found to be available for broad groupings of the produce sourced and produced by the organisation. It was identified during the screening process that more a more accurate assessment could be made by combining the produce data with business specific transport data that was available within existing business reporting.

- **Barfoots**

For each category included in our scope 3 emissions inventory, we held internal workshops to plan responsibilities for data collection. As some categories, such as upstream and downstream logistics and distribution, include the same staff, these were combined into one workshop.
At the start of the workshop, we explained the aims of the project, and the timescales. Using the guidance, we talked through each category, identifying what data was required, and what data was available. We reviewed the format of the data, identifying where data was in a format that was easy to use, but also where data was not easy to use. An example of this is where some ingredients are bought in kgs, but some are in units. We therefore had to understand what a unit consisted of, to convert to a weight.
Ownership of data collection was assigned, and a data collection template issued to capture the necessary volume and financial related data, for initial screening.
The workshops also acted as an upskilling opportunity for our colleagues, as baselining GHG emissions, net zero and Science Based Targets were new concepts for a lot of people.

- **Albert Bartlett**

It is very important to engage with suppliers early in the screening process to obtain as much primary data as possible, to build an accurate emissions inventory, reflective of what is actually happening in your supply chain.

- **Dunbia**

To complete our initial screening, we used an expenditure report provided by our finance department, to calculate our scope 3 footprint using spend-based methodology. This allowed us to identify our largest emission categories and focus on these going forward to engage with our suppliers to drive improvements in quality of data.

- **Avara Foods**

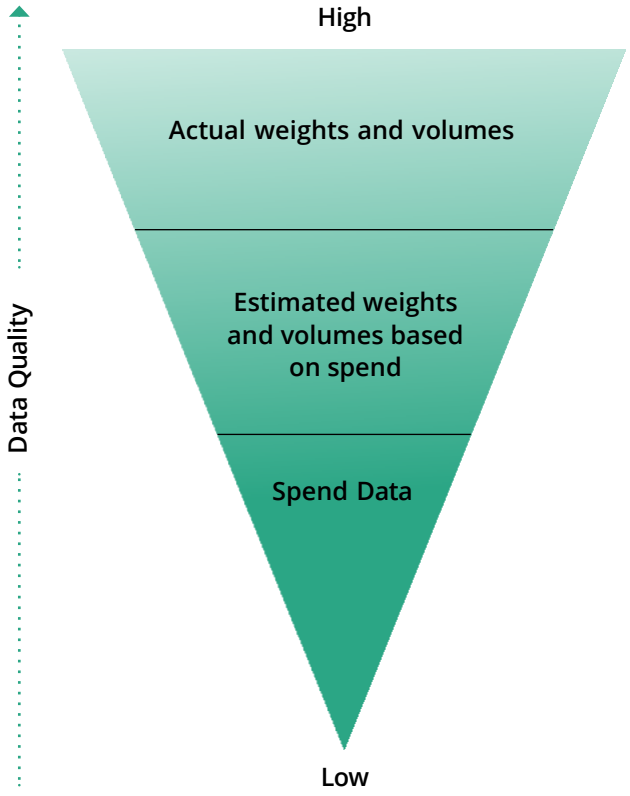
6.3 Collate activity data (volume of purchases)

Purchased goods activity data is one of the key data sources (along with embodied emission factors), needed for the development of a scope 3 emissions inventory. Activity data refers to the quantity of products / ingredients, etc. that your organisation has purchased within the reporting period. Activity data can be either spend-based, or relate to weights, volumes or unit numbers.

The screening step outlined above suggests using the most accessible activity data available to help focus efforts. However, for reporting and monitoring purposes, the robustness of the activity data needs to be considered further to ensure that the scope 3 inventory is representative and meets the principles outlined in Section 4.

Given the significance of purchased goods within any food & drink scope 3 emissions inventory, the following have been added as recommendations for food & drink businesses, particularly when publicly reporting:

Figure 6: Data quality hierarchy for activity data



Recommendation

It is important to focus effort on continuous improvement in the quality of purchased goods activity data. As a best practice guideline, aim for weight or volume data (as opposed to spend-based data) to be collected for purchases representing at least 80% of emissions identified during screening.

Recommendation

Where publicly reporting, a summary of activity data sources, an assessment of data quality and a summary of proposed steps to obtain better quality data should be provided alongside the inventory.

Figure 6 sets out a data quality hierarchy for activity data. This is not a set order in which to collect data, there is no need to begin data collection at spend data if weight and volume data is already readily available. Figure 6 is designed purely to illustrate the quality of data and how improvements to activity data can be made.

Spend data are often easier to obtain (although they can incur a charge from certain sources of licensed data) and are therefore useful for developing an initial screening inventory for those organisations without easily obtainable product weight data. However, they are typically not well suited to developing a representative scope 3 emissions inventory because:

- Monetary unit values of a product / purchase change over time due to market influences (e.g. inflation) that are not linked to changes in GHG emissions intensity. This is a particularly significant weakness in using spend data when making year-on-year comparisons.
- Spend-based emission factors are typically not sufficiently disaggregated into individual product categories to enable the required degree of accuracy within an inventory. In comparison, emissions factors that can be used with weight-based activity data are much more granular, for example being specific to geography, production practice, relevant life cycle stages, etc. for that product.

Because of these limitations, spend-based activity data are generally considered to be of 'low quality'.

Spend-based data can serve as a useful first step for screening (described earlier in **Box 2**) if no other data are available. But the long-term goal should be to work towards collecting weight or volume-based data.

Box 3 provides further information on collecting and recording weight or volume-based data for food & drink purchases.

The challenges of accessing robust weight or volume-based purchasing data for food & drink businesses should not be underestimated and so it is important that the process for data collection and measurement can evolve and improve over time. Given these challenges and evolving landscape, transparency is important. In particular, when publicly reporting, an assessment of data quality and a summary of proposed steps to obtain better quality data should be provided alongside the inventory

Box 3: Collecting and recording weight or volume-based data

Using weight or volume activity data will result in a more representative scope 3 emissions inventory. The following points should be considered when capturing appropriate weight or volume-based activity data for the reporting year. The process can also be refined over time as access to data improves.

1. **Identify the most appropriate source of activity data within your organisation.** This might come from procurement systems, financial accounting systems, supplier management systems, central distribution systems, etc.
2. **Not all companies will record weight-based activity data for purchases**. Where this does not exist, a methodology should be developed and documented to allow for repeatable measurement each year and across the company, that allows the conversion of activity data (for example the number of units purchased) into weight-based activity data. For example, using product specs, physically weighing products or reviewing other sources of information (such as supplier invoices) to identify weight or volume information. For common products you can establish an average conversion, what is the average weight of the product you buy / how much do you get per spend unit? In some cases, professional judgement may also have to be used.
3. **Consider the appropriate level of granularity for each product category**. For example, it may be useful to start by considering beef, rather than identify the different cuts of beef, or cheese, rather than identifying different types of cheese.
4. **Weight-based activity data should match the life-cycle stages included within the emissions factor**. For example, product packaging should be included within the weight data if the emissions factor includes the impacts of packaging but should be excluded if it does not. If the functional unit of the emissions factor is the ingredient, rather than the product itself, weight data should be excluded (see **Section 6.4** for further information on emission factors).
5. **The origin of food & drink products is important when calculating emissions inventories**. Where the business operates in different geographies and therefore has different supply chains, it is helpful to record activity data for products purchased in different regions separately so that geographically appropriate emissions factors can be applied, where available (see **Section 6.4** and **Annex E** for further information on emission factors).
6. **Capture product specific details will support the application of more accurate emissions factors** – such as whether products are farmed using intensive or extensive farming systems, product origin and estimates of upstream transport distance (see **Section 6.4** and **Annex E** for further information on emission factors).
7. **A calculation methodology should be developed that should document all aspects of the calculation activity data**. This should include the data sources within your organisation for all product types, how any calculations are undertaken to convert available unit or spend data into weight-based data, and data quality checks that are undertaken, when activity data is included in relation to a reporting year (for example if sales data is used as a source of activity data then consideration should be given to including stock data and any wasted products to ensure a complete inventory of purchases is included).

Barfoots were able to use their ERP procurement system to access the data required for the project. Some processing of the data was required to standardise the activity data. This was carried out according to established procedures which are used for extra-financial (technical and commercial) reporting. This standardisation was predominantly conversion of unit or volume to weight.
Records – Although records are maintained in the business there is some inconsistency in this. For the purposes of developing a consistent calculation approach it was necessary to do some data conversion where volume activity data is recorded rather than weight-based data. Where this was necessary activity data (sweetcorn cobs) was converted to weight-based activity data using an established conversion factor method.
Granularity – Produce is grouped to type for reporting purposes using established methods. These groupings represent distinct value chains within the business and the this provided a useful application of existing accounting practices for this project.
Packaging – In the existing company data packaging was either not included in produce weight, or sufficiently granular data was available to exclude from analysis.
Origin – Geographically appropriate emission factors were applied to produce. Data quality was assessed following the GHG Protocol standard to identify the applicability of emission factors and identify data gaps.
Product specific data – The transport element of the produce emission factor was split from produce factor and geographic data applied to transport factors to increase granularity of data. Following the initial development of the scope 3 inventory it was identified that splitting produce from upstream transport was more consistent with the GHG Protocol.
Calculation methodology – A data model was created to provide documentation and facilitate data checks. Using this approach has contributed to the transparency of our methods, allowing auditing and data verification to be carried out. This also has the benefit of being easy to update with company data and where changes are made to external data sources such as emission factors.

- **Barfoots**

Where activity data was not in the right format, we used product specifications, or requested the information from suppliers.

- **Albert Bartlett**

Activity-based (weight and volume based) data is relatively straight-forward to collect when looking at purchased goods, as quantities can be used, however, this is more complicated when looking at services provided. This is where it is important to form a close relationship with suppliers, as they are the experts within their own area and will understand how to measure their impact most accurately. We have been working closely with our suppliers in these key categories to provide accurate data and encourage them to calculate their own carbon footprints.

- **Avara Foods**

After obtaining the estimated volume of product sold, we worked on determining product compositions and sourcing regions. This enabled us to estimate the footprint associated with fresh product and prepared product SKUs which sometimes encompass ingredients sourced from a wide range of sourcing areas. These assumptions were also provided by the relevant commercial and technical teams. Based on this modelling, we estimated the footprint associated with our top 30 sourcing ingredients, all of them agricultural. Some of these ingredients are direct sourcing – such as animal protein, fresh produce, etc., - and others are indirect sourcing – such as palm oil, wheat, and soy.
To improve the data that we use we are working on two main fronts:
(i) scaling up our on-farm data collection efforts through our TSFGs (right now all of our fresh milk, and a sizeable proportion of our beef, lamb and fresh produce supply chains are providing carbon data, and we know how to do the same for pork, poultry & eggs, aquaculture),
(ii) building a centralised tool where commercial categories can easily access the associated footprint of their products by SKU based on secondary information and primary information coming from the TSFGs.

- **Tesco**

6.4 Collate embodied emissions data and assess data quality

In the context of scope 3 purchased goods accounting, embodied emissions data refers to the emission factors that are used to convert activity data (purchase weight or volumes) into GHG emissions data (GHG emissions linked to purchases). The term 'Embodied emissions' refers to the amount of GHGs emitted in the production of a given quantity of product or ingredient purchased (e.g., CO_2e per kg chicken) – across all life cycle stages from primary production on farm to the relevant point of purchase.

Identifying and obtaining good quality embodied emissions data for food & drink products and ingredients can be a significant challenge but is a critical focus for companies operating in this sector given the dominance of this emissions source within their overall scope 3 inventory.

6.4.1 Important considerations when using embodied emissions data

Focusing effort on the purchases identified as the most significant during screening, it is important to consider the following when using embodied emissions data.

Representativeness – The purpose of using embodied emissions data (e.g., published emission factors) is to convert activity data (purchase weight / volume) into an estimate of the GHG emissions linked to producing these purchases. As such, it is important that any emission factors used are an accurate representation of the product / ingredient purchased and its supply chain.
In reality, this is very difficult (and in many cases currently impossible), as food & drink supply chains are extremely complex, subject to variability (e.g., due to weather conditions) and there is a lack of available data. However, care should be taken to ensure that the data sources used are as representative as possible – for example, the geographies sourced from, production practices used, etc.

- The data quality assessment framework outlined in **Section 6.4.3** should be used to judge the representativeness of different data sources. Further guidance on its use can be found in **Annex E**.
- **Annex B** also includes a list of things to check when reviewing embodied emissions data.

Consistency of boundaries – The emission factors used must incorporate all of the relevant life cycle stages for purchased goods. Which stages to include depends on the point in the value chain the reporting company is situated. **Figure 7** shows a simplified example of common life cycle stages, and the different 'cradle- to-gate' terminologies used when grouping life cycle stages within emission factors databases. Care should be taken to make sure that the emission factor covers all stages up until the point of purchase.

- Using emissions factors or calculation tools that can be split up by stage is crucial for accounting for land-based emissions and removals. The SBTi requires that companies with significant emissions from land management and land use change set a FLAG (forest, land and agriculture) target, which is totally separate from a company's energy and industry target. As a result, emissions from any stage of production involving significant FLAG emissions must be accounted for and reported separately**.**
- The Land Sector and Removals Guidance dictates how FLAG emissions and removals are quantified. A major requirement from the guidance is that companies must account for and report any CO_2 removals separately from emissions. In addition, all components of land use change and land management must also be separately accounted for and reported.

Potential issues arise when data sources bundle FLAG emissions, non-FLAG emissions, land use change emissions and removals into average emissions factors. Because the LSRG's requirements for quantifying removals and land use change are very precise, it is important to be able to split out these components and calculate them separately. Care should be taken when selecting emissions factors – factors that don't allow users to isolate the lifecycle stage and emissions source may conflate some of the footprint elements that must be accounted for and reported separately.

In some instances, a company may also choose to separately account for some individual lifecycle stages. For example, if the company has more specific data from their tier 1 suppliers on processing emissions, or more specific data on packaging or transportation[4]

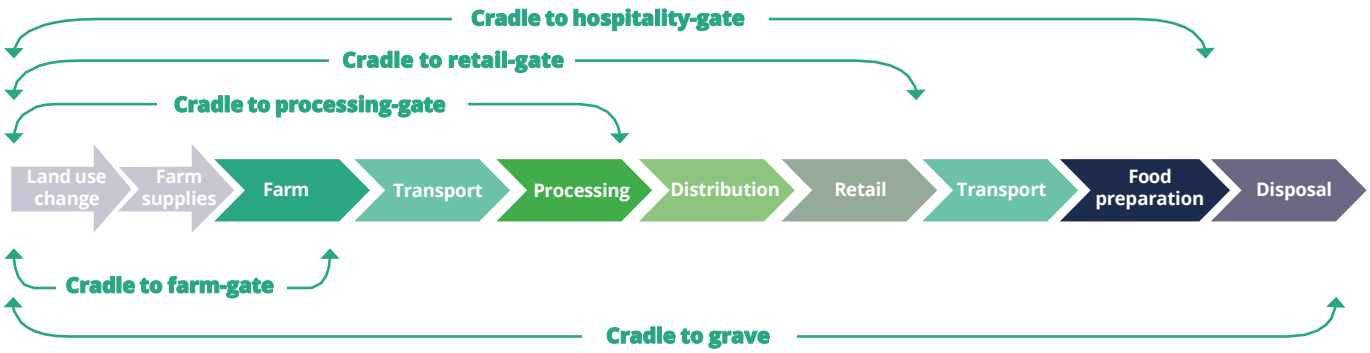
- In WRAP's food & drink emission factor database – published alongside this document emissions linked to individual life cycle stages are separately listed wherever they are available, along with an assessment of each emission factor against the accounting categories laid out in the GHG Protocol Land Sector and Removals Guidance.
- This enables companies to check whether the appropriate life cycle stages are included and also to supplement more specific data for some stages (e.g., transport, packaging, processing) where appropriate.

For further information on this type of 'Hybrid approach' refer to **Chapter 7** of the **GHG Protocol Scope 3 Standard**.

Having individual life cycle stages separately listed also enables companies to differentiate between agriculture/land use and other emissions – required for setting a specific FLAG (forest, land and agriculture) in accordance with new **SBTi FLAG guidance** (see **Section 7.1**).

In March 2024, a new release of WRAP's emission factor database is expected, which will include a more detailed and explicit breakdown of emissions by Land Sector and Removals Guidance category, further supporting reporting requirements. We anticipate this being a document that regularly updated and updates will be notified via Courtauld membership.

Figure 7: Life cycle stages included within different cradle-to-gate values (e.g. within **WRAP's food & drink emission factor database**). See **Figure 2** for a detailed breakdown for specific businesses



- **Comparability of datasets – e.g. consistency of methodologies and tools** – Any embodied emissions data used would ideally have been quantified using the same methodology – following specific rules for methodological choices, such as quantification of land-use change and carbon removals, or the approach used to allocate emissions to different outputs (described in Chapter 8 of the GHG Protocol Scope 3 Standard). In **WRAP's food & drink emission factor database** we have undertaken a top-level review of data quality and summarised some of the key methodological choices, but urge caution in making any direct comparisons. In March 2024 a new release of WRAP emission factor database is expected. This will include data calculated through HESTIA for priority products, vastly improving the comparability of embodied emission data up to the farm gate. **Annex B** also includes a list of other things to check when reviewing embodied emissions data, and **Annex E** provides more detailed guidance on selecting the most appropriate emission factor for a given activity.

There is widespread inconsistency in the methodologies and underlying data sources used within published emission factor datasets; as well as in tools that are commonly used within the supply chain to quantify farm-level emissions[5]. This means that in most instances, embodied emissions data from different sources are unlikely to be directly comparable and can't be used interchangeably. As such, companies should not seek to use this type of data to compare the emissions profile between two suppliers, for example. Defra has recently undertaken a project seeking to diagnose the scale, causes and potential ways to resolve inconsistency across farm-level carbon footprinting tools. The implementation of project findings will be conducted in in 2024 and beyond. Meanwhile, data should be used primarily as a means to identify where to focus reduction efforts and to track progress over time. Tracking progress over time is less likely to be subject to inconsistency where the same methodology, footprinting tools, etc. are used year on year.

To address some of the major methodological inconsistencies, standard LCA/product carbon footprinting methodologies have been developed (e.g. the **GHG Protocol Product Life Cycle Accounting and Reporting Standard**, **PAS 2050** and the **EU Product Environmental Footprint (PEF)** scheme). In some sectors, 'product category rules' have also been developed (or are in development), which further aid consistency and these should be used where available.

  - The European PEF scheme has developed a series of category rules (Product Environmental Footprint Category Rules (**PEFCRs**)) for products such as beer, wine, dairy, pasta and animal feed.
  - Efforts are underway to generate a consistent list of product category rules, but these are currently relatively limited for food & drink items. Available product category rules can be sourced from the **International EPD System**.

- The ability to track emissions reductions over time – For many companies, the most important first step will be to develop a scope 3 inventory for purchased goods – e.g., to understand the biggest emissions sources and focus effort; or to develop a base year for a GHG reduction target. For this purpose, the use of secondary emission factors from published datasets (see **Table 14**) is likely

be the easiest available data source. However, it is important to be aware that this source of embodied emissions data is unlikely to be useful for tracking progress in reducing emissions, as the data are not updated over time or designed with this use in mind. The key use of these emission factors is in the initial screening process. Tracking emissions reduction over time is critical for a number of reasons, e.g., to know if management actions are having the right effect, to identify and report progress against targets, etc. For this purpose, it is likely that other data sources (as listed in Table 14) will be needed.

Annex E provides additional support to improve tracking over time using a combination of secondary embodied emissions data and known interventions.

A number of initiatives and work programmes are actively working to address the need for access to consistent and comparable data along food & drink supply chains, in the UK and globally. It is important that food & drink businesses support the ongoing development of these, and encourage the development of harmonised approaches:

- **HESTIA (Harmonised Environmental Storage and Tracking of the Impacts of Agriculture)** – HESTIA is an open-source data platform that consolidates and harmonises product and production practice data from studies worldwide and presents this in a standardised way against multiple environmental indicators. By March 202, WRAP's emission factor database will include data from HESTIA to enable more consistent data usage.
- **Sector-specific initiatives** – A number of sector bodies are working toward compiling sector- level average data – aiming towards having the ability to have more representative embodied emissions data and the ability to show year-on- year (or periodic) changes. For example, **Bord Bia/Origin Green reported values for Irish beef & milk**, Dairy UK (via **the Dairy Roadmap**), **Teasgasc** environmental performance calculations for the Irish sheep sector **Freshfel** (the EU fresh produce industry body), **Eggbase** (developers of a detailed poultry and eggs specific footprinting tool). As these develop, they will be incorporated into WRAP's food & drink emission factor database.
- **WBSCD Pathfinder Framework** and **Partnership for Carbon Transparency** (PACT) – this is a global initiative that provides guidance on the calculation data across value chains (aligned with both the GHG Protocol and **EU PEF scheme**). This includes required elements for data exchange between supply chain partners. Alongside the methodological framework (**Pathfinder Framework**), WBCSD has also launched the **Partnership for Carbon Transparency (PACT)**, which is intended to enable companies to share standardised Product Carbon Footprint (PCF) data via any chosen technology solution confidentially and securely and hence create transparency across supply chains. At the time of drafting, the frameworks are at an early stage of development and piloting and further work is required to understand their relevance to the food and drink sector, but they could provide an important mechanism for consistent data exchange along global supply chains.
- **DEFRA Food Data Transparency Partnership (FDTP)** – The FDTP is a UK government initiative to improve the availability, quality and consistency of environmental data, at both the product and organisational level. The partnership aims to provide policy recommendations to enable consistent environmental labelling of food products and scope 3 reporting of food and drink companies, among other objectives.
- National environmental labelling initiatives, including **IGD**, **Eco-Score** and **Wageningen University** – Over recent years there has been a proliferation of private eco-labels providing on-pack environmental information. In order to standardise approaches a number of national initiatives are attempting to provide aligned methodologies. While these methodologies pertain to product-level accounting rather than corporate accounting, often the same or similar information is needed and used to compile corporate inventories.
- **OECD Food Chain Analysis Network (FCAN)** – The FCAN is an OECD expert group convening academics, industry and governments to study initiatives to measure and communicate the environmental impacts of food products.

Endnotes

3 Some of the data sources listed in WRAP's food & drink emission factor database include land-use change emissions. Another source of data for land-use change emissions is the **Blonk Direct**

Land Use Change Assessment Tool.

4 Please also note that there may be potential for double-counting of transport emissions, when transport from a tier 1 supplier site is included both within an emission factor for the purchased good AND included in category 4 – upstream transportation (see **Annex A**). In most instances this will not lead to a significant overestimate, but it is something to be aware of. Some emission factor dataset will enable the final transport step to be removed to avoid this double-counting

5 **https://www.nfuonline.com/archive?treeid=140961**

Case Studies

To understand the embodied emission data, we used secondary emission factors and available industry information regarding emission sources of our main product lines. We have also used this information to determine our main decarbonisation initiatives for each product. For example, for beef, we have used the available emission factors from Defra for UK beef and from Bord Bia for Irish beef, our two main sourcing areas. We have also used secondary industry information from organisations such as CIEL to determine what share of the overall beef footprint stems from fertiliser use, methane resulting from ruminant activity, slurry, feed, etc.

- **Tesco**

It is very important to carry out due diligence on emission factors before deciding to include them in the calculation of a business' scope 3 inventory. The methodology, scope, and credibility of the LCA studies should be reviewed and considered. We created a table which summarizes some key differences in the emissions factors available in the WRAP Protocol database (see full case study). The range in value of emissions factors is broad, and would, if applied to the calculation of an organizations' inventory, yield substantially different results for UK beef and lamb products.

- **Dunbia**

An emissions factor quality matrix, based on the GHG Protocol Standard was developed to assess emissions quality and identify areas for improvement. An example of this is to increase the number of growers conducting carbon footprint calculations to increase the accuracy of the emissions factor.

- **Albert Bartlett**

Approach – Produce emission factors considered to be fair or better. There is scope to improve this with more specific factors which could be applied due to the granularity of activity data available to the organisation, i.e., supplier/grower specific data.
Key Learnings - Following initial calculation of embodied emission data using cradle to processing gate emission factors it was identified that the travel element of this emission factor was not representative. Changes were made to the data model to allow an emission factor for the form of transport (DEFRA) and the distance travelled to be included in the assessment.
Data quality improvement - Estimated produce emission factors were applied to products which were likely to be significant to the inventory. These included baby sweetcorn and sweet potato.

Sweet Potato - Although an emission factor was available for Sweet Potato this was derived from data on a small data set from a different growing area than the produce in our supply chain. We adjusted this emission factor to align with similar produce in the same growing conditions.

Babycorn – We were not able to use a reliable emission factor for babycorn but anticipated that as the production of this crop is input intensive it would be relevant to our scope 3 inventory. We used the principle of conservativeness and applied an estimated emission factor for another high input horticultural crop.

A further data quality improvement that has been identified but not yet carried out is to refine the air freight emission factor to include passenger flight data as this is the predominant form of air transport used and is available for use. Improvements to the produce emission factors have been discussed and work to improve these according to best practice identified in the protocol is in progress.

- **Barfoots (2023)**

6.4.2 Recommended data sources for UK food & drink businesses

Table 14 lists the different types of embodied emissions factors that could be used to estimate emissions for food & drink products / ingredient purchases and recommendations for when they should be used.

As a general principle the hierarchy for data choice in **Table 14** is from 1 (primary emission factor – most preferred) to 5 (spend-based secondary emission factor - least preferred). However, this does not always apply, and when making choices between the sources of embodied emissions data listed in **Table 14**, it is important to pay particular attention to data quality. There may be instances where the best quality data currently available is from industry or secondary sources, as opposed to primary sources. In any case, the embodied emissions data with the highest overall data quality score, as scored against WRAP's data quality framework outlined in **Section 6.4.3**, should be used. Further guidance on the use of WRAP's data quality framework and how to choose between multiple emission factors can be found in **Annex E**.

A **data quality assessment** should be undertaken to ensure that the data used to quantify emissions linked to purchased goods with the scope 3 inventory are as representative as possible. Specifically, the data quality scoring framework outlined in **Section 6.4.3** can be used to generate a data quality score for different embodied emission data sources. Using this framework, a combined 'data quality score' can be generated for each embodied emission factor used in the scope 3 inventory by summing the scores for each of the 5 data quality indicators. 'Good quality' would be indicated as a total score (across all categories) of 10 or lower.

The objective of a data quality assessment is to ensure that the data used to quantify emissions linked to purchased goods with the scope 3 inventory are as representative as possible. Too great a reliance on poor quality data within an inventory reduces the accuracy of emissions reporting and can be misleading. Poor quality data that are not representative of a company's purchases / supply chains can also lead to incorrect prioritisation, poor decision making and ultimately affect a company's ability to reduce scope 3 emissions. As such, a recommended threshold for data quality has been included, as a guideline of best practice and to apply in particular to instances where the scope 3 inventory is to be publicly reported.

Recommendation

It is important to focus effort on continuous improvement in the quality of embodied emissions data for purchased goods. As a best practice guideline, aim for embodied emissions data meeting the threshold of 'good quality' (a total score across all data quality indicator scores of 10 or lower) for purchases representing at least 80% of emissions identified during screening.

Recommendation

Where publicly reporting, a summary of embodied emission data sources, findings from data quality assessment and proposed steps to obtain better quality data should be provided alongside the inventory.

Recommendation

The emission factor with the highest quality data score, as scored against WRAP's data quality framework in Annex E should be used.

A data quality assessment is also helpful in identifying areas in which further data collection efforts should be focused. **Given the volumes and challenges of data collection and limited good quality secondary datasets available for food & drink products and ingredients, it is inevitable that data of varying quality will exist within an inventory, particularly in the shorter term. The objective should be that companies should strive to improve data quality over time for high-volume or high-impact purchases.** One of the benefits of the screening process described in **Section 6.2** is to enable resources to focus on improving the quality of the most significant emissions sources. **Annex E** should be used to provide greater clarity and consistency when scoring data quality and to help continuously improve an inventory's data quality.

Note: Where steps have been taken to improve data quality in support of reporting against a GHG emissions reduction target, it may be necessary to undertake a re-baselining exercise (see **Section 7.3**).

Table 14 – Types of embodied emissions factors for food & drink products/ingredients*

Embodied emission data source	Description	Recommended use cases and other considerations
1. Product carbon footprint (PCF) specific to the item purchased **(primary emission factor)**	Product-level cradle-to-gate GHG data e.g. provided by a supplier or determined via an LCA study – relating specifically to the product or ingredient purchased and its supply chain/s.	• Recommended where sourcing from a dedicated supply chain – and where screening identified as a significant emission source. • To meet data quality requirements product carbon footprints shall be quantified in accordance with an appropriate product footprinting standard (e.g. **EU PEF**, **PAS2050**, **GHG Protocol Product Standard**), or ideally, specific product category rules, where developed (e.g. **PEFCR**, **International EPD system**). • **WRAP has developed a questionnaire to use when requesting product carbon footprint data from suppliers, including important clarification questions to ask**. • **Annex B** also includes a list of things to check when receiving data from suppliers.
2. Industry approved emission factor **(industry emission factor)**	Product-level cradle-to-gate GHG reference value published by an industry body as representative of 'average supply' for a product or ingredient from a specific geography. For example - **Bord Bia/ Origin Green year-on-year reported values for Irish beef & milk**.	• Recommended where this is likely to be the best available data source e.g. if not sourcing from a dedicated supply chain – or if suppliers are unable to provide data of sufficient quality. • To meet data quality requirements the industry approved emission factor shall be quantified in accordance with an appropriate product footprinting standard (e.g. **EU PEF**, **PAS2050**, **GHG Protocol Product Standard**), or ideally, specific product category rules, where developed (e.g. **PEFCR**, **International EPD system**). • Industry average values could be helpful to use when tracking progress – and in the shorter term may be more reliable than primary data sources if they have not been validated or cover only a small part of the supplier population. • A number of sector bodies are considering compiling this kind of sector-level average data (see section above). As these develop, they will be incorporated into WRAP's food & drink emission factor database.
3. Emission factor from published database **(secondary emission factor)**	Product-level cradle-to-gate GHG reference values published by a 3rd party. This includes open-source databases such as **WRAP's food & drink emission factor database**.	• In general, should only be used where neither of the above are available, or of the same quality of a secondary emission factor. • May be applicable for some purchases – e.g. global commodity purchases where neither of the above are likely to be available. • Emission factors from published data sources are unlikely to be helpful to use when tracking progress in reducing scope 3 emissions, as data sources are typically old and infrequently

Table 14 – Types of embodied emissions factors for food & drink products/ingredients (continued)

Embodied emission data source	Description	Recommended use cases and other considerations
	A number of proprietary databases are also available – such as **Ecoinvent**, **Gabi**, **World Food Database**, **Eggbase** etc.*	updated in a consistent way (so any year-on-year reductions will not be visible). Some data sources may be developed in the future that change this – e.g., HESTIA (described above). • In the short term, WRAP's food & drink emission factor database encompasses data on a range of food & ingredient items. This consolidates data from a number of free-to-access published datasets, such as Poore & Nemecek, Agribalyse, GLFI and other publications. These can be used by food & drink businesses in the absence of other data sources. • **Annex B** includes a list of things to check when choosing emission factors from published databases.
4. Proxy indicators	For some products / ingredients, there are a small number of critical data points that are important determinants of the relative GHG emissions intensity.	• For example, for tomatoes, a small handful of variables will determine >80% of resulting GHG emissions: % grown in heated systems; energy / tonne; % renewable energy used; and the km travelled when transported by road. • For products / ingredients where this applies, there is potential to develop simple Excel-based calculators that could be used to adjust 'default' secondary emission factors accordingly. Over time, these could be incorporated into WRAP's food & drink emission factor database to enable users to generate a customised emission factor – based on changes in critical data points (proxy indicators) as opposed to requiring a full product carbon footprint from suppliers. • **WRAP has developed and tested product-specific questions for a range of food & drink products / ingredients: beef, lamb, pork, poultry, warm water prawns, cheese, bananas, coffee, tomatoes and wine**.
5. Spend-based emission factors	[See Sections **6.2** and **6.3**]	• Only recommended for filling data gaps as unlikely to be a good representation of emissions linked to food & drink purchases (see **Section 6.3** for reasons).

* Additionally, a recommended data source for packaging materials or other purchases (e.g. refrigerants, office supplies) is the latest UK Government conversion factors for GHG reporting, accessible **here**. UK Government emission factors for packaging materials currently require businesses to know the recycled vs non-recycled content split for any individual material type (see 'Material Use' tab in the conversion factor database. WRAP will be developing a new methodology to combine the UK Government packaging emissions factors with other datasets that contain an estimate of the recycled content of different packaging materials.

6.4.3 Data Quality Scoring Framework to assess data quality for scope 3 purchased goods embodied emission factors

The data quality scoring framework presented in **Table 15** has been developed to be consistent with the data quality indicators set out in the **GHG Protocol Scope 3 Standard** (outlined in Table 14).

It provides a semi-quantitative framework against which embodied emission factors can be assessed to determine whether the required data quality threshold for public reporting has been met. As technological and geographic representativeness can be more subjective, greater guidance for scoring these indicators can be found in **Annex E**.

Table 15 – GHG Protocol Data Quality Indicators from the **GHG protocol Scope 3 Standard**

Indicator	Description
Technological representativeness	The degree to which the data set reflects the actual technology(ies) used
Temporal representativeness	The degree to which the data set reflects the actual time (e.g., year) or age of the activity
Geographical representativeness	The degree to which the data set reflects the actual geographic location of the activity (e.g., country or site)
Completeness	The degree to which the data is statistically representative of the relevant activity. Completeness includes the percentage of locations for which data is available and used out of the total number that relate to a specific activity. Completeness also addresses seasonal and other normal fluctuations in data.
Reliability	The degree to which the sources, data collection method and verification procedures[6] used to obtain the data are dependable.

Endnotes

6 Adapted from B.P. Weidema and M.S. Wesnaes, "Data quality management for life cycle inventories – an example of using data quality indicators," Journal of Cleaner Production 4 no. 3-4 (1996): 167-174.

Table 16 – Data Quality Scoring Framework to assess data quality for scope 3 purchased goods embodied emission factors

Descriptor	Score	Technology	Time	Geography	Completeness	Responsibility
Very good	1	Emission factor represents the same production method / technology (e.g. greenhouse production heated using natural gas)	Data age less than 3 years	Emission factor represents the same processing / production site (e.g. the specific farm where the product is sourced from)	Highly complete - all appropriate life cycle stages and GHGs are covered. Either all relevant production sites are covered, or if sampling has occurred then sampling is an excellent representation of the relevant production sites. Sampling is an excellent representation of sites when all **three** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the EF is being used in.	Emission factor is from a peer-reviewed meta-analysis, systematic review, umbrella analysis or equivalent, or it is quantified in accordance with a published **sector-specific** standard (e.g. PEFCR, PAS 2050 Category Rule, GHG Protocol Sector Guidance) and verified by a third party, or it is an aggregation of multiple of the above. Methodology reporting is explicit and detailed. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.
Good	2	Emission factor represents a similar production method / technology	Data age 3-5 years	Emission factor represents a processing / production site from the same geographical area (e.g. UK production for a UK-sourced product)	Mostly complete - All appropriate life cycle stages and GHGs included in models and reporting. Data sampling promises good representation of the relevant production sites. Sampling is a good representation of sites when **two** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the EF is being used in.	Emission factor is from a peer-reviewed journal paper, or it comes from a meta-analysis verified by a third party, or it is quantified in accordance with a published product footprinting standard (e.g. PEF, PAS2050, GHG Protocol Product Standard) and verified by a third party, or it is an aggregation of multiple of the above. Methodology reporting is explicit and detailed. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.

Table 16 – Data Quality Scoring Framework to assess data quality for scope 3 purchased goods embodied emission factors (cont.)

Descriptor	Score	Technology	Time	Geography	Completeness	Responsibility
Fair	3	Emission factor represents a different production method / technology - but technological variability is expected to be low	Data age 5-10 years	Emission factor represents a geographical area which could have different production characteristics (e.g. European production) - but geographical variability is expected to be low	Generally complete - All appropriate life cycle stages and GHGs included in models, but not reporting. sampling of data promises reasonable representation of the relevant production sites. Sampling is a reasonable representation of sites when **one** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the EF is bein used in.	Emission factor comes from a meta-analysis, or it is quantified in accordance with a published product footprinting standard and/or sector-specific rules - but not verified by a third party. Methodology reporting is of limited detail. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.
Poor	4	Emission factor represents a different production method / technology - and technological variability is expected to be high	Data age more than 10 years	Emission factor represents a geographical area which could have different production characteristics (e.g. global average value) - and geographical variability is expected to be high	Some life cycle stages and GHGs not included, or uncertainty remains as to whether they were included. Data covers a small sample of overall activities and is unlikely to be representative of the relevant production sites. Sampling is unlikely to be representative of sites when **none** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the EF is being used in.	Calculation method for emission factor is not described in source publication; or not reported to be in line with a standard methodology, or it is an aggregation of multiple of the above. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.

Table 16 – Data Quality Scoring Framework to assess data quality for scope 3 purchased goods embodied emission factors (cont.)

Descriptor	Score	Technology	Time	Geography	Completeness	Responsibility
Unsuitable	5	Technological representativeness of emission factor is unknown	[n/a - no threshold]	Geographical representativeness of emission factor is unknown	Completeness of emission factor is unknown	Source is unknown, or it is an aggregation of multiple unknown sources. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.

Section 7

Step 7 – Set a target and track emissions and reductions over time

This section covers step 7 of the GHG Protocol Scope 3 Standard, and also refers to the **SBTi Net Zero Standard and associated SBTi Criteria and Recommendations**, the new **SBTi guidance** for setting Forest, Land and Agriculture (FLAG) targets, the **WWF Basket Metric Blueprint for Action** and the **Food Loss and Waste Protocol guidance**.

The GHG Protocol Scope 3 Standard requires companies to take the following steps when tracking scope 3 emissions over time:

1. Choose a base year and determine base year emissions;
2. Set scope 3 reduction goals;
3. Recalculate base year emissions (if necessary); and
4. Account for scope 3 emissions and reductions over time

This document provides best practice recommendations to support consistent approaches to establishing targets and tracking emissions and reductions over time – and defers to SBTi requirements wherever they apply.

7.1 Setting a GHG reduction target

General information on setting a GHG reduction target for scope 3 emissions is set out in the GHG Protocol Scope 3 Standard, chapter 9.

For target setting, the requirements established by the Science Based Target Initiative (SBTi) are important - in particular the Net Zero Standard and FLAG (Forest Land and Agriculture) guidance.

Recommendation

Requirements established by the Science Based Target Initiative (SBTi), in particular, the Net Zero Standard and FLAG (Forest Land and Agriculture) guidance should be followed when setting a GHG reduction target.

- The SBTi near-term target guidance requires that a company has undertaken a complete scope 3 screening exercise, which can be used to determine scope 3 thresholds for target setting. This is the same as the screening step described in **Section 5.2** of this document.
- The same boundaries need to be applied for target setting as for the scope 3 inventory development (see **Section 5** for boundary considerations for food & drink businesses).
- The SBTi Net Zero Standard establishes two timeframes for targets:

Case Studies

One of the biggest challenges in setting Science Based Targets (SBTs) is predicting the future landscape. There are some emerging technologies, such as hydrogen, that could lead to significant decarbonisation opportunities. However, these are still in early deployment and require significant investments to roll out at a national level. Our plan is to set our SBTs in the near future, which will include a supplier and customer engagement target. This target will be identifying suppliers that have committed to, or are willing to commit to setting science-based targets within the next five years. The engagement with suppliers has been generally positive, as they recognise collective action is important for our supply chain to achieve net zero.

- **Albert Bartlett**

ABP were supported by a consultant to develop reduction targets for scope 3 emissions and explored ways to set targets that are consistent with the requirements of the SBTi, working with ABP's key internal stakeholders and suppliers. One of the first steps was to run a science-based target workshop with key internal stakeholders and supplier representatives at ABP's offices. The workshop covered:
1) In-depth exploration of ABP's scope 3 footprint and key drivers within the beef supply chain.
2) Deep dive of the SBTi's scope 3 target requirements and assessing what is likely to be deemed ambitious.
3) Discussion with ABP stakeholders to explore scope 3 reduction opportunities and estimated scale.
4) Discuss the key areas where ABP can influence its supply chain emissions, and areas outside of ABP's direct control, which may also have an influence on ABP's supply chain emissions.

- **ABP**

Table 17: SBTi Target Requirements

Timescale	Timescale	Reduction target	Coverage of scope 3 emissions targets
Near term science-based targets.	5-10 years from submission	GHG mitigation targets in line with 1.5°C pathways	Where scope 3 emissions are at least 40% of total company emissions (scope 1, 2, and 3 emissions), at least two-thirds (67%) of scope 3 emissions must be covered.
Long term science-based targets.	By 2050 or sooner	Reaching net zero at the global or sector level in eligible 1.5°C pathways.	90% of scope 3 emissions.

The **SBTi guidance for setting Forest, Land and Agriculture (FLAG) targets** requires separate additional emissions targets to be set for 'FLAG emissions' by companies that meet specific criteria defined in Table 1 of the **SBTi FLAG guidance**. Generally, companies are covered by these criteria if any of the following apply. **In most instances this will include all food & drink sector businesses**:

1. They fall under an SBTi FLAG designated sector by having land intensive activities in their value chain;
2. More than 20% of their financial revenues come from forests, land or agriculture; or
3. More than 20% of overall GHG emissions relating to their activities are FLAG related.

The scope of emissions covered under these FLAG targets in the draft guidelines is broad, including -"CO_2 emissions associated with land use change (LUC) (i.e. biomass and soil carbon losses from deforestation and forest degradation, conversion of coastal wetlands and peatland burning) and emissions from land management (i.e. N_2O and CH_4 from enteric fermentation, biomass burning, nutrient management, fertilizer use, and manure management; and - CO_2 emissions from machinery and fertilizer manufacture)".

Note - Specific guidance on Land Use Change and other biogenic GHG emissions in scope 3 accounting within the SBTi FLAG draft guidance is discussed earlier in Sections 5.5.1 to 5.5.3.

For companies where emissions from land-based activities are significant, which includes companies within the food & drink sector, and in particular companies with SBTs, the new FLAG guidance is significant and should be monitored closely. The latest information can be found here.

SBTi FLAG requirements, as currently defined, are summarised as follows:

- The FLAG target must cover at least 67% of FLAG-related scope 3 emissions and the non-FLAG targets must cover at least 67% of non-FLAG related scope 3 emissions.

  Note – This requirement will be met if the boundary requirements set out in **Section 5** are followed. For food & drink companies, FLAG emissions will be covered within category 1 – purchased goods.

- A company's FLAG-specific target would cover the portion of their emissions that are related to the land sector, including, but not limited to, emissions from forestry, deforestation, and agricultural production up to the farm gate (see **Figure 7** for an illustration of where this boundary occurs). It wouldn't cover energy related emissions from processing stages.

- Reductions made against the FLAG targets cannot be used to meet non-FLAG targets and vice versa.

Setting a FLAG target therefore means that emissions from agriculture and forestry need to be quantified separately from post-farm gate emissions for all purchased goods & services.

In addition, emissions from agriculture should be split into the key GHGP LSRG categories of: Non-Land, Land management, Land use change and Removals. As far as is possible country-specific emissions factors for the production key commodities should also be used.

However, given the acknowledged difficulties of obtaining high-quality food and drink **emission factors with these emissions breakdowns (see Section 6.4),** businesses should seek to align as far as data availability allows – and be transparent on where assumptions have had to be made to separate out land sector emissions.

Other notable SBTI requirements that apply to companies with significant FLAG emissions, in particular:

- FLAG targets are expected to include both emission reductions and removals (whereas other sectors are not permitted to include removals when achieving SBTi approved targets). See **Section 5.5.2** for further information on quantifying carbon removals.
- Companies must publish a no deforestation policy that aligns with wording set-out in FLAG guidance ("[Company X] commits to no deforestation across its primary deforestation linked commodities, with a target date of [no later than December 31, 2025]."

Other initiatives that provide steer on GHG reduction targets:

The **British Retail Consortium Climate Action Roadmap** establishes the need for net zero emissions by 2040 for all products sold in the UK. This is also reflected in the **WWF Basket Metric**, which sets the following minimum expectations and targets:

A number of other sector targets with supporting roadmaps and guidance include:

- **WRAP's Courtauld Commitment 2030** – which includes a target for a 50% absolute reduction in GHG emissions associated with food & drink consumed in the UK by 2030 (against a 2015 base year). N B - This is a collective industry target (not a target for individual businesses) – and a pathway of action to meet this target is also available **here**.
- **Food & drink Federation's Achieving Net Zero Handbook** - provides practical guidance for food & drink manufacturers towards an objective of achieving net zero emissions by 2040.
- **Zero Carbon Hospitality & Brewing Roadmap** - outlines net zero ambitions, target years, milestones, and pathways for businesses operating in this sector.
- **Net Zero Now (hospitality sector)** – outlines a route to net zero for SMEs in the hospitality sector, with sector-specific definitions of net zero and target requirements.
- **Wholesale sector Net Zero roadmap** outlines a net zero trajectory for wholesalers, with strategy guidance and practical actions.
- Other sector-specific examples include the **Dairy Roadmap** and **UK Cattle Sustainability Platform**.

Table 18: Target Setting Considerations

Minimum expectations	a. Set and publicly communicate a science-based target aligned to a 1.5-degree pathway for all scopes. b. Commit to net zero by 2040 or sooner - in line with the BRC Roadmap – with long-term science-based targets to reach net zero value chain GHGs emissions. c. Develop and publicly communicate action plans to achieve short term targets (2-4 years) and publicly report progress.
Target	a. Specify the baseline year (ideally as recent as possible). b. Absolute targets are the preferred measure for reduction. c. Supplier reporting should be inclusive and contain all their suppliers, for own label and branded suppliers.

7.2 Choosing a scope 3 base year

Establishing a base year is a critical part of being able to set GHG emissions targets and to measure reductions.

Recommendation

To set a base year compliant with SBTi, GHG Protocol and WWF Basket Metric requirements, the points and recommendations outlined in **Table 19** should be considered.

Table 19 – Considerations when choosing a base year for a GHG target

Scope 3 emissions data should be accurate and verifiable. An effective scope 3 base year should be based on a representative emissions inventory that will enable consistent and meaningful comparisons over time.	**Section 6.4.3** of this document provides guidance on data and data quality assessment for category 1 purchased goods. It also advises on a data quality threshold - which could be used as a guideline to judge sufficiently high quality for establishing a base year. **It is recommended that data used to establish the base year should meet the data quality requirements of 'good quality' as set out in Section 6 of this document.**
Base year emissions should be representative of a company's typical GHG profile. This requires good quality data that represents as closely as possible the actual emissions profile for that business and its supply chains. It also requires consideration of how those emissions might be subject to expected variation year-on-year (e.g., due to weather conditions). A further key point is that years that are likely to be anomalous should also be identified and considered when setting a baseline.	Representativeness is an important attribute of good data quality, so the recommendation above also applies here. Most companies select a single year as their base year. However – **in some instances and where feasible it may be more appropriate to choose an average of annual emissions over several consecutive years if this would provide a more representative baseline**. For example, the **GHG protocol agricultural guidance** recommends a baseline period, not a base year: "Oftentimes, individual years will not serve as representative base periods. In such cases, companies should average GHG flux data from multiple, consecutive years to form a more representative base period. For example, a three-year base period is often sufficient to smooth over inter-annual variability. If a base year has already been set for non-agricultural emissions, then a multi-year base period can be centred on that year. (p43)". Where business as normal is interrupted, for example, due to COVID, the company should consider appropriate steps to make ensure that the base year is representative of a 'typical trading year'. This might for example include estimating what additional products might have been purchased or additional waste been generated based on previous years or trends, if the interruption had not occurred, or using the most recent 'representative' year.

The base year must be no earlier than 2015 (as recent as possible to comply with the WWF Basket Metric).

Note – **Making decisions on when to establish a base year should not hinder the start of a scope 3 inventory development or delivery of any value chain emissions reduction activities**. An iterative approach is recommended – particularly for food & drink businesses, for whom data on scope 3 category 1 purchased goods is likely to be poor in the short term and subject to change over time as data availability and quality improves (see also **Section 7.3** on re-baselining). It should also be noted that for companies committing to the SBTi targets, the forthcoming GHG Protocol Land Sector and Removals Guidance will establish the guidelines for the calculation of FLAG base year emissions [See **Section 5.4.1** and **Sections 5.4 and 5.5** for more information on the GHG Protocol Land Sector and Removals Guidance].

7.3 Base year emissions recalculation

When setting a base year, the GHG Protocol Scope 3 Standard requires that companies shall also develop a base year emissions recalculation policy and clearly articulate the basis and context for any recalculations.

To maintain consistency of reported scope 3 emissions when tracking progress against targets, companies must recalculate base year emissions when significant changes in company structure or inventory methodology occur.

SBTi requirements deem the following scenarios as significant enough to require a recalculation of targets. These criteria are also recommended as a means to guide a base year emissions recalculation policy:

- Significant changes* in company structure and activities (e.g. acquisitions, divestitures, mergers, insourcing or outsourcing, shifts in product or service offerings) that would affect the company's scope 3 inventory boundary.

  Note - This refers to permanent changes rather than shocks due to unforeseen factors such as Covid disruptions.

- Significant changes* in the categories or activities included in the scope 3 inventory.
- Significant changes* in data used to quantify the inventory (e.g., the discovery of significant errors, or changes in the types of activity data or embodied emissions data used). Support for recalculating base year emissions and choosing the most appropriate data for a base year, due to significant changes in embodied emissions data can be found in **Annex E**, and should be followed.

  Note - Any changes in emission factor or activity data that reflect real changes in emissions (e.g. changes in purchasing, supplier emissions reductions) do not trigger a recalculation.

  * The GHG Protocol does not specify a threshold for significance – it suggests that companies define in their recalculation policy what level of change in emissions should trigger a recalculation. The SBTi has commonly used a rule of thumb that the threshold for a 'significant change' is one that alters base year emissions by at least 5%.

SBTi also requires that targets are reviewed and, if necessary, recalculated and revalidated as a minimum every 5 years - even if none of the recalculation criteria are triggered. This would therefore be an appropriate minimum timescale for recalculation of base year emissions – unless triggered earlier by one of the scenarios above.

This periodic recalculation of the base year is considered best practice; however, recalculating a base year can present some practical challenges. A lack of data or having low quality data is one common issue. In general, companies should aim to gather more and better data as GHG accounting becomes a more regular process. How improved data could potentially affect the base year is something companies should consider when writing their recalculation policies. Support for how to recalculate base year inventories when data quality or data sources change can be found in **Annex E.**.

Recommendation

In accordance with SBTi requirements, base year emissions must be recalculated as a minimum every 5 years, unless triggered earlier by one of the recalculation criteria outlined above.

7.4 Measuring GHG reductions

The GHG Protocol sets out two ways of approaching the measuring and monitoring of GHG reductions. Each offers a different lens with which to measure reductions. The project method is typically employed to measure reductions that occur outside of a company's organisational boundaries – for example to quantify the reduction in embodied emissions for a purchased good. Inventory accounting is carried out annually to report on reductions across all scope 3 activities included within the scope 3 boundaries that have been established.

The project method requires a high degree of transparency, traceability, and granular emission measurement and modelling through supply chains to use. **Annex ELink** provides a way to adjust existing embodied emissions data to reflect changes as a result of supply chain interventions. While it does not have the same robustness as undertaking a full assessment using the project method in the GHG Protocol for Project Accounting, it can be a useful starting point to support emission reduction projects.

Note - For food & drink businesses this must meet the boundary requirements described in **Section 5**.

Table 20 – Summary of methods to measure GHG reductions.

Method	Description	Relevant standard
Inventory method	Quantifies GHG reductions by comparing changes in the company's actual scope 3 emissions inventory over time relative to a base year.	GHG Protocol Scope 3 Standard
Project method	Quantifies GHG reductions by assessing impacts from individual GHG mitigation projects relative to a baseline. Includes changes in emissions beyond a company's value chain and operations.	GHG Protocol for Project Accounting

7.4.1 Measuring progress against a target

To measure progress against an SBTi-aligned target, a company shall report on its scope 3 inventory, and use the inventory method to report the reductions that have occurred.

As noted in **Section 7.4.2**, the same data used to calculate reductions using the project method for specific interventions can be used in scope 3 inventories. Support for using such data can be found in **Annex E**, where requirements and recommendations for the use of adjustment factors to account for interventions can be found.

As mentioned in **Section 7.1**, if a FLAG target has been set, a company's scope 3 inventory must be split into FLAG and non-FLAG emissions to report progress against both FLAG and non-FLAG targets.

By following the recommended/required reporting framework set out in Section 8, and by calculating in accordance with this guidance and relevant GHG Protocol standards and guidance, you will be able to report progress against FLAG and non-FLAG targets.

The following **cannot** be used when measuring progress towards science-based targets in accordance with the SBTi Net Zero Standard:

- **Carbon credits/offsets**: The use of carbon credits / offsets external to a company's value chain must not be counted as emission reductions toward the progress of companies' near-term science-based targets.

  Note – This is different to measuring and accounting for carbon removals that occur within the company's value (see **Section 5.5.2** for more detail). The SBTi FLAG guidance allows GHG targets for those companies in the forestry, land use and agriculture (FLAG) sector - including food & drink businesses - to include carbon removals within their value chain to achieve their science-based targets (see **Section 7.1**).

- **Avoided emissions**: Avoided emissions relate to reductions in GHG emissions that fall outside of the company's inventory boundary but result from the actions or activities of the company. These emissions reductions can impact different scope 3 categories. An example includes interventions that might reduce demand for food in a different value chain, such as donating food to a redistribution charity (see **Section 7.6**). Food redistribution, whilst mitigating the need to produce additional food in a different part of the food and drink sector, does not reduce an organisation's footprint. The product was still produced and handled in the same way as any other product, it just ended up in a different output stream. Emissions may be saved in the wider economy, and this is a valid piece of narrative, but the individual organisation's footprint will not be reduced.

Avoided emissions are calculated using 'project accounting' methods, which are described below.

- In accordance with GHG Protocol requirements, avoided emissions cannot be included within a scope 3 inventory – but may be helpful to include within supporting narrative.
- Avoided emissions also do not count toward science-based targets.

7.4.2 Inventory method

Developing a scope 3 inventory refers to the quantification of GHG emissions associated with the activities of a company – as described through the body of this document, including defining boundaries (**Section 5**) and collecting data (**Section 6**).
The inventory method of calculating GHG reductions uses changes in the scope 3 emissions inventory over time:

Current year scope 3 emissions inventory − **Base year scope 3 emissions inventory** = **Change in emissions**

Case Studies

We source our food from circa 1,700 suppliers, but 70% of our purchased goods comes from large, branded suppliers, over which we have minimal influence, but we are at least reassured that these organisations already have decarbonisation ambitions and programmes. The baseline measurement programme has shown that our top 100 suppliers supply 70% of our food, so this enables us to prioritise communications, engagement, data capture and overall effort.

- **Bidfood**

We have identified where we can adapt our financial system to include weights, and carbon emissions data. Bringing the system up to a standard where it produces volume and carbon data will require significant resources, but once in place, will make calculation easier.

Albert Bartlett

ABP has worked closely with suppliers and third parties linked to the Agriculture sector in order to identify and demonstrate initiatives which can help reduce emissions associated with the company's supply chain, some of these initiatives include developing and distributing best practices relating to farming activities to the supplier base, and also offering monetary incentives to suppliers for the development of more sustainably bred cattle. All initiatives, and associated reductions, are carefully calculated, collated and verified in order to ensure that the company is measuring its scope 3 inventory correctly.

- **ABP**

7.4.3 Project method

Project accounting estimates the total emissions increases or decreases associated with an intervention (e.g., carbon reduction investment). It examines changes in emissions in a business's operations and value chain but also the wider economy. It compares a 'business as usual' scenario (baseline) against emissions after the intervention. Similar methods are used in carbon markets projects to calculate total tradable credits associated with a carbon project.

The GHG Protocol Scope 3 Standard states that companies may use the project method to undertake detailed assessments of actual reductions from discrete scope 3 GHG mitigation projects, in addition to reporting comprehensive scope 3 GHG emissions using the inventory method.

It is best practice to use project accounting to ensure interventions are delivering emissions reductions when taking into account beyond value chain effects, however it is not common practice at the moment to do this as the methodologies and data needs are more complex than scope 3 inventory accounting. To support greater uptake of interventions by being able to reflect the effect within a scope 3 inventory, **Annex E** provides a methodology for adjusting emission factors based on known interventions within a business' supply chain.

Requirement

To avoid double counting (see **Section 7.5**), project-based reductions shall be reported separately from the company's scope 1, scope 2, and scope 3 emissions – for example in the supporting narrative. A hypothetical example of how this might apply in practice is outlined in **Figure 8 below**.

7.5 Addressing double counting of emissions reductions

Double counting - or double claiming - occurs when two or more companies claim ownership for a single GHG reduction within the same scope. Particular attention should be given to avoiding the double counting of emissions reductions. For example, if reductions are made by supplier A, then those reductions cannot be claimed in full by 2 downstream companies. Each downstream company can only claim reductions relevant to their activity data (i.e., their purchase volumes).

Challenges regarding double counting have not yet been fully resolved within scope 3 emissions measurement and reporting. This is particularly the case because few businesses are at the stage of collecting primary data from suppliers to demonstrate year-on-year reductions. The following recommendation, and information in Table 21 and Figure 8, are provided as initial steer.

Recommendation

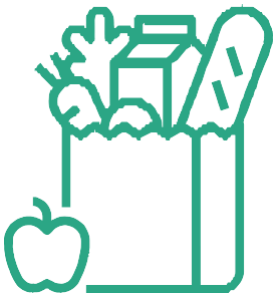
To ensure transparency and avoid misinterpretation of data, companies should identify any potential double counting of reductions when making claims about scope 3 reductions – and include this in the supporting narrative. For example, a company may claim that it is working jointly with partners to reduce emissions, rather than taking exclusive credit for scope 3 reductions.

Table 21 provides examples of potential double counting scenarios and actions needed in response. A hypothetical example of scenario 2), where 2 companies account for the same improved goods purchased, is also outlined in **Figure 8**.

Table 21 – Examples of potential double counting scenarios

Scenario	Example	Implication
1. Overlap between a company's scope 3 inventory and a supplier's scope 1 or 2 inventory	A company purchases products from a supplier. The company invests in or influences energy efficiency improvements that reduce emissions in the operations of the supplier. The company includes the benefits of that intervention in their scope 3 inventory, and the supplier incorporates the intervention into their scope 1 inventory.	**This form of double counting does NOT require any action** since it is logical that a company's scope 1 and 2 emissions will be within the scope 3 emissions of all other companies in their value chain.
2. Two companies account for the same improved goods or services	One company invests in improvements that reduce emissions in the operations of a given supplier and accounts for the improvement associated with the amount of goods purchased from them (e.g., by using a lower primary emission factor provided by the supplier). A second company also buys from that same supplier and also accounts for the lower impact goods purchased.	**These forms of double counting are. important to be aware of.** The risk of multiple claims on the same emissions reductions can be mitigated by implementing a robust mass-based measurement system so that each company only counts the improvement linked to the goods they source, and the supplier does not 'sell' the already-claimed improvement to additional customers (either directly, or in the form of credits). **In practice, this may be challenging, however, and so transparency about potential risks of double-counting reductions is important.**
3. Emission reductions from a supply chain intervention are also issued as carbon credits	A supplier includes reductions from an intervention into their emissions inventory and this is reflected in the product carbon footprint value provided by the supplier to its customers (i.e. the primary emission factor provided by the supplier). At the same time, the supplier also issues carbon credits arising from the reduced emissions from that same intervention; and these are purchased by another company as evidence of reducing their net emissions.	

Figure 8: Hypothetical example where 2 companies account for the same improved goods purchased



Tomato Supplier

Supplier A produces 500 tonnes of tomatoes annually.

In the base year, tomato supplier calculates the carbon footprint of tomatoes sold (in accordance with requirements in **Table 6**) and provides a primary emission factor of 2 tonnes CO_2 e/tonne tomatoes.

Supplier A implements an initiative supported exclusively by Purchaser X in the base year that leads to 100 tonnes of CO_2e reduction in year 1 (e.g., quantified using the project method described earlier) .

Supplier A also introduces other interventions in year 1 that reduce emissions.

All interventions together reduce the product footprint to 1.5kg CO_2e/kg tomatoes sold in base-year +1. Supplier A does not sell any carbon credits from any of the reductions.

Purchaser X

Purchaser X purchases 50% of the tomatoes from supplier A in base year +1

Purchaser X included tomatoes from Supplier A in its base year scope 3 inventory using an emission factor of 2t CO_2e/t

In base year +1 purchaser X will account for 250 tonnes of tomatoes from Supplier A using an emissions factor of 1.5t CO_2e/t in their scope 3 emissions inventory in base year +1. This results in a total of 125 tCO_2e reduction (=250 t * (2 - 1.5)t CO_2e/t) between base year and base year +1.

Purchaser X can additionally state in their reporting narrative that they have specifically supported an initiative with supplier A that has led to a reduction of 100 tonnes of CO_2e.

Purchaser Y

Purchaser Y purchases 50% of the tomatoes from Supplier A in base year +1

Purchasers Y included tomatoes from Supplier A in its base year scope 3 inventory using an emissions factor of 2t CO_2 e/t

In base year +1 purchaser X will account for 250 tonnes of tomatoes from Supplier A using an emissions factor of 1.5t CO_2e/t in their scope 3 emissions inventory in base year +1. This results in a total of 125 tCO_2 reduction (=250 t * (2 - 1.5)t CO_2e/t) between base year and base year +1.

Purchaser Y cannot make any narrative claim related to the reductions.

7.6 Quantifying reductions in scope 3 emissions from reducing food losses and waste

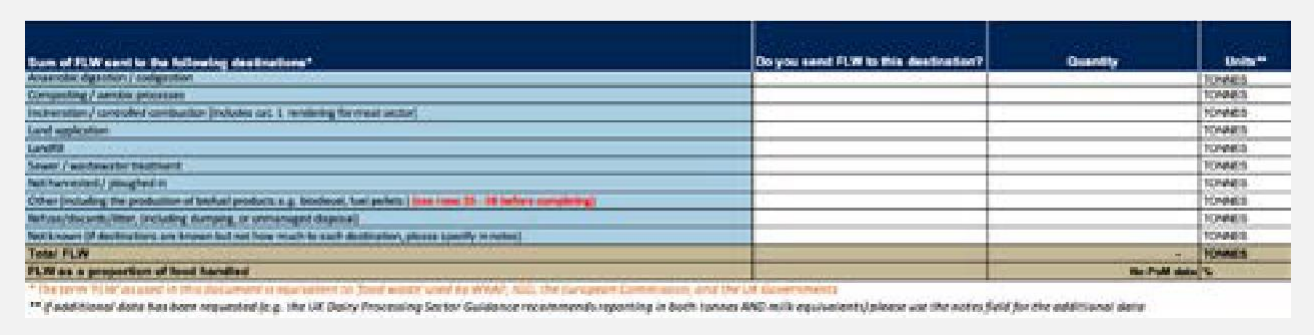
Increasing numbers of food & drink businesses have set targets to reduce food waste and are measuring their operational food waste using the common measurement approaches defined within the **Food Waste Reduction Roadmap.**

Annual reductions in food waste that have been quantified using this approach can also be used to demonstrate reductions in a scope 3 inventory in the following ways.

A) Reduction in emissions linked to waste treatment (scope 3 - category 5)

Annex A describes how UK Government GHG Conversion Factors for Company Reporting can be used alongside food waste data to calculate emissions linked to food waste management. In simple terms:

- Use the annual tonnage of food waste reported to different destinations (example screenshot from common food waste reporting template)



Sum of FLW sent to the following destinations*	Do you send FLW to this destination?	Quantity	Units**
Anaerobic digestion / codigestion			TONNES
Composting / aerobic processes			TONNES
Incineration / controlled combustion (includes acc. t. rendering for meat sector)			TONNES
Land application			TONNES
Landfill			TONNES
Sewer / wastewater treatment			TONNES
Not harvested / ploughed in			TONNES
Other (including the production of biofuel products e.g. biodiesel, fuel pellet) [see rows 33 - 38 before completing]			TONNES
Refuse/discards/litter (including dumping, or unmanaged disposal)			TONNES
Not known (if destinations are known but not how much to each destination, please specify in notes)			TONNES
Total FLW		-	TONNES
FLW as a proportion of food handled			No FLW data %

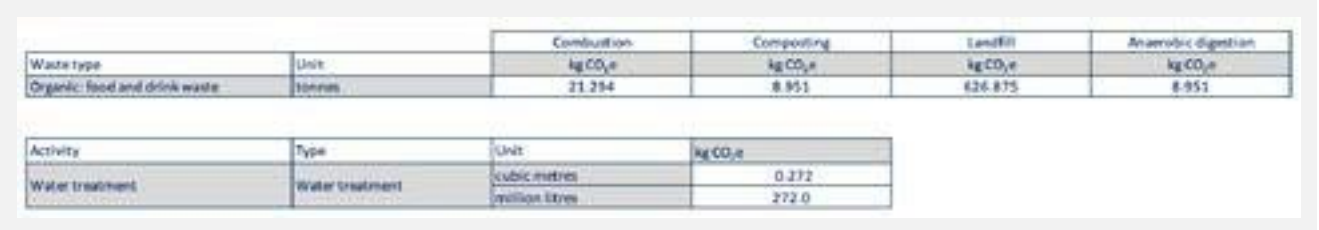
* The term FLW assessed in this document is equivalent to 'food waste' used by WRAP, ISO, the European Commission, and the UK Governments

** If additional data has been requested (e.g. the UK Dairy Processing Sector Guidance recommends reporting in both tonnes AND milk equivalent) please use the notes field for the additional data

Source:

WRAP 2020 – **Food Surplus and Waste Data Capture Sheet**

- Multiply by the respective conversion factors within the **UK Government GHG Conversion Factors for Company Reporting**: 'Waste disposal' and 'Wastewater treatment' tabs (example screenshot from 2021 database provided below). To accurately account for disposal emissions, it is important to understand if the food waste is mixed or separated, and to know the final treatment method (e.g., landfill or composting).



		Combustion	Composting	Landfill	Anaerobic digestion
Waste type	Unit	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e
Organic: food and drink waste	tonnes	21.294	8.951	626.875	8.951

Activity	Type	Unit	kg CO_2e
Water treatment	Water treatment	cubic metres	0.272
		million litres	272.0

- When repeating annually, year-on-year changes will be reflected in the inventory.

B) Reduction in emissions linked to purchased goods (scope 3 - category 1)

In many instances reducing food waste will also reduce the quantity of purchased goods for an organisation – as reducing waste means that the same quantity of outputs can be produced with fewer inputs. These reductions will therefore appear as a reduction directly within category 1 - purchased goods (quantified as described in **Section 6**) - and should not be separately quantified again, to avoid double counting.

Note – The Food Loss and Waste Protocol guidance on **Connecting Food Loss and Waste to Greenhouse Gas Emission** (summarised in **Box 4** below) describes an alternative approach to separately quantifying the benefits of food waste reduction initiatives. This can be useful for other forms of communication but is not recommended for use when quantifying and reporting scope 3 emissions because of the significant potential for double counting of these reductions alongside reductions in category 1 purchased goods.

C) Reduction in emissions linked to food surplus redistribution for human consumption, or for other industry use

Diverting surplus food to people in need is an important action that can address food insecurity and contribute to resource conservation, as well as meeting food waste reduction targets. An alternative avenue for reducing food waste is to sell food that would be considered waste to another industry where it can be used, for example as animal feed.

The following points are important to consider when quantifying emissions reductions linked to food surplus redistribution.

- If the food would have otherwise been sent for waste treatment, donation for human consumption or alternative industry use, this can result in emission reductions linked to waste treatment (scope 3 - category 5) - as described in example A) above.
- Example B) is unlikely to apply, as food donations and industry usage of food waste do not necessarily reduce a company's food *purchases* and as such do not reduce a company's scope 3 GHG emissions from category 1 purchased goods.
- Food donations and industry usage of food waste may result in 'avoided emissions' if the donated food/utilised food waste reduces demand for similar food elsewhere produced. This may be the case if, for example, those receiving food redistribution would have otherwise purchased food, or had food purchased for them. These avoided emissions fall outside of the company's inventory boundary, and so cannot be included within a scope 3 inventory (see **Section 7.4**) – but may be helpful to include within supporting narrative alongside the inventory. The quantity of avoided emissions could be estimated by multiplying quantities of different food types redistributed by corresponding emission factors (e.g. from **WRAP's food & drink emission factor database**).
- The Food Loss and Waste Protocol guidance on **Connecting Food Loss and Waste to Greenhouse Gas Emissions** can be used for other forms of communication to explain system-level emission reductions that may occur as a result of avoided emissions.
- In some cases, food redistribution feeds those who would have otherwise not eaten were it not for the redistribution. This has substantial social benefits which could be included in the supporting narrative, though it makes it more difficult to claim that emissions have been avoided.

Note – Whilst reporting of avoided emissions is only allowed as a separate narrative, this may change in future.

D) Reduction in emissions linked to reductions in sold product wastage

- Emissions linked to the management of food waste arising in households, or by consumers out of home, are included within scope 3 category 12 - end-of-life treatment of sold products.
- **Annex A** describes how these emissions can be quantified by developing an 'end-of-life profile', including assumptions regarding how much of the product is typically wasted and the waste management methods employed.

- When food & drink businesses implement actions to reduce consumer food waste – e.g. by extending shelf life or adopting **best practice for on-pack labelling** – the resulting reduction in emissions can be quantified by making changes to the end of life profile. For example, estimates / approximations can be made regarding the resulting change in wastage rate, using tools such as **WRAP's Household Simulation Model**. This could then be used to adjust the default % wastage rate provided in **Annex A, Figure 8** – with resulting changes in emissions for scope 3 category 12.
- As noted, in **Section 5.2.2**, where actions are taken to reduce emissions from a company's sold products, any claims of resulting emissions reductions must be reported separately from the company's scope 3 inventory, in line with GHG Protocol requirements and because of the significant uncertainties involved.

Further Information

Box 4: **Food Loss and Waste Protocol - Connecting Food Loss and Waste to Greenhouse Gas Emissions: Guidance for Companies**

The Food Loss and Waste Protocol have published guidance on Connecting Food Loss and Waste to Greenhouse Gas Emissions. This outlines in further detail:

- **How to calculate the GHG emissions associated with Food Waste**: the basic steps and calculations for estimating the GHG emissions associated with food waste and/or its reduction. Also included is an overview of various third-party tools available for estimating the GHG emissions associated with food waste.
- **How to determine the contribution of Food Waste to a GHG inventory**: recommendations for how a company can determine the contribution of food waste in the various parts of a GHG inventory.
- **How to communicate about the GHG benefits of Food Waste reductions**: recommendations on how to make general statements that link food waste reduction efforts with associated reductions in GHG emissions, as well as how to communicate about the contribution of food waste to a corporate GHG inventory and related GHG reduction targets.

Section 8

Steps 8 and 9 – Reporting and Assurance

8.1 Reporting

The GHG Protocol Scope 3 Standard states that "a credible GHG emissions report presents information based on the principles of relevance, accuracy, completeness, consistency, and transparency. It should be based on the best data available and be transparent about its limitations". The LSRG principles of conservativeness and permanence should also considered.

Chapter 11 of the GHG Protocol Scope 3 Standard sets out the information required to include when publicly reporting, as well as optional information to include when applicable.

Table 22 summarises recommendations for food & drink businesses when publicly reporting a scope 3 emissions inventory, in conformance with the GHG Protocol, as well as the requirements and recommendations within this document.

Recommendation

When publicly reporting a scope 3 emissions inventory, the information outlined in **Table 22** should be included.

Recommendation

When reporting, businesses should state that their scope 3 inventory values have been quantified in conformance with the requirements of these food & drink sector protocols.

Public reporting of a scope 3 emissions inventory is not specifically required, nor is there any specific requirement regarding the frequency of reporting (e.g., annual reporting). However, important to note for companies that have set GHG reduction targets in conformance with the Science-Based Targets Initiative, the SBTi Net Zero Standard requires that the company shall publicly report its company-wide GHG emissions inventory and progress against published targets on an annual basis. Additionally, companies with FLAG (forestry, land-use, and agriculture) targets will be required to report these FLAG emissions and reductions separately (see **Section 7.1**).

When reporting the company's GHG emissions inventory and reductions, a detailed internal review is carried out followed by the Board. This internal report is populated with verified data from both suppliers, associated third parties and internal data collection streams. It is also imperative that the best available emission factors are utilized when calculating the current state of the emissions inventory.

- **ABP**

Table 22 – Scope 3 inventory reporting recommendations for food & drink businesses

What to include	GHG Protocol Scope 3 Standard requirements and other recommendations for food & drink businesses within this document
Description of the scope 3 inventory boundary and justification of any exclusions	It shall be made clear which scope 3 categories and activities are included in the inventory; and which categories or activities have been excluded from the inventory. Justification of any exclusions shall also be included in the report – for example with reference to the materiality of activities outlined in **Section 5.2**. Scope 3 data shall be reported for a 12-month period aligned to other company GHG emissions reporting. The reporting timeframe shall be made clear in the report.
Emissions, reported separately by scope 3 category	For each scope 3 category, total emissions of GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, and SF6) shall be reported in metric tons of CO_2 equivalent, excluding carbon removals, and independent of any GHG trades, such as purchases of offsets. For Purchased Goods & Services (and any other relevant Scope 3 category) the following shall/should be reported separately, if relevant: Total land use change shall also be reported separately. Total carbon removals shall also by included separately. Total land management and non-land emissions from agriculture should be reported.
Description of data sources and data quality	For each scope 3 category, a description of the data sources, assumptions and uncertainties used shall be provided. Additionally, for category 1 purchased goods: • A summary of findings from data quality assessment and proposed steps to address poor data quality. • The % of activity data and embodied emissions data considered to be 'good quality' (as defined in **Section 6.3** and **Section 6.4**). • Land use change and carbon removals methodologies and data sources, as outlined in **Section 5**
When reporting on emissions reductions	Alongside year-on-year changes in the scope 3 inventories, companies may wish to include a supporting narrative on: emissions reductions achieved through supply chain interventions (e.g., quantified using the project method with suppliers, or actions taken to reduce emissions from the company's sold products); and any potential avoided emissions, such as through food waste prevention actions. Any potential risks of double counting should also be included (see **Section 7.5**).
Assurance	The type of assurance performed, the relevant competencies of the assurance provider(s), and the opinion issued by the assurance provider.

8.2 Assurance

GHG Protocol Scope 3 Standard defines assurance as "the level of confidence that the scope 3 inventory is complete, accurate, consistent, transparent, relevant, and without material misstatements".

The GHG Protocol Scope 3 Standard recommends that obtaining assurance for a scope 3 inventory is valuable for reporting companies (and for other stakeholders when making decisions using the inventory results). However, assurance is not a requirement.

While the situation will be unique for every company and every assurance body, the assurance process generally involves:

a. Select a third-party assurance provider – identify a reputable provider that has experience with similar companies.
b. Prepare for assurance – at the direction of the provider, organise and share the relevant data, brief staff on procedures and open lines of communication.
c. Engage in assurance – the provider will review all relevant data, data sources and methods; be prepared to regularly answer questions that the provider may have.
d. Receive assurance statement – once the provider completes the assurance process, they will issue a statement assessing the accuracy, completeness, and reliability of the inventory.

Continuous improvement – use insights generated through the assurance process to improve the quality and accuracy of data sources, methods, and the resulting footprint.

The practice of obtaining third-party assurance on emissions inventories is increasingly common. Similarly, at the regional and national level, regulatory bodies are increasingly recommending or requiring assurance. With markets trending towards the verification of metrics via third-party assurance, organisations should be aware of the benefits, challenges and processes involved.

Third-party assurance can enhance the confidence of both the company and its stakeholders in the accuracy of its emissions inventories. Furthermore, it mitigates the risk of presenting data that is inaccurate, incomplete, or unreliable, thereby undermining the credibility of target progress. Companies in jurisdictions where disclosing emissions is (or soon will be) mandatory should be particularly mindful of reporting inventories without performing robust error checking.

However, the role of assurance is to confirm that data calculations align with the criteria specified by the reporting standards, not to improve the quality or specificity of the data itself. Data with assurance may not necessarily be more specific than unassured data. Improving the quality and specificity of data over time is a best practice that should be done alongside assurance (point E in the outline of the assurance process above).

Of particular concern to smaller businesses is the added resource burden brought on by assurance. Hiring a third-party assurance provider can involve substantial costs and time investments, potentially limiting resources for mitigation activities, for example. The potential trade-offs that can come with allocating resources to conduct assurance should be considered.

There are different types of assurance, that an organisation can choose: reasonable or limited assurance (see Table 23). Reasonable assurance demands a greater understanding of the organisations, calculation methods and data sourcing; limited assurance relies more heavily on representations and has a lower level of scrutiny.

It is also important to be aware that the ability to provide assurance may sometimes be limited. Scope 3 accounting inherently involves making assumptions and relying on a mixture of data sources of varying quality. The emissions sources being reported on are also often removed from the reporting company's control. As such, there may be limited ability to provide sufficient evidence on emissions sources as part of the assurance process. This means that there may be a need to change the level of assurance or a need to rely on the assurance statement of another assurer. For example, using the assurance statement provided by a supplier.

When deciding whether to pursue third-party assurance alongside the type of assurance necessary and auditor, a company might then consider:

i) the nature of the initiative they are participating in or reporting against;

ii) the size of their business and the relative cost of to assure their results;

iii) the nature of the claim being made.

The SBTi underline that the leading practices relating to assurance are:

- Obtain limited assurance initially, and reasonable assurance over time.
- Obtain assurance of base year data (for base year dependent targets.
- Obtain assurance of target year data (for all target types).

However, these may not be applicable to every organisation and should be treated in context.

Further detail on obtaining assurance for a scope 3 inventory is available in Chapter 10 of the GHG Protocol Scope 3 Standard, including guidance on assessing competencies of assurers; the assurance process and timings; and what should be included in an assurance statement.

Table 23 – Key types of assurance

Term	Description	Description
Reasonable assurance	One of the two types of assurance a company can get. This type of assurance is more extensive and many companies opt for this level when undertaking their first assurance exercise.	This type of assurance results in a positive opinion "In our opinion the reporting company's assertion of their scope 3 emissions by category, as reported in the inventory report, is fairly stated, in all material respects, and is in conformance with the GHG Protocol Scope 3 Standard.
Limited assurance	One of the two types of assurance a company can get. As the name suggests this is the less extensive of the two types of assurance.	This type of assurance results in a negative opinion "Based on our review, we are not aware of any material modifications that should be made to the company's assertion that their scope 3 inventory is in conformance with the requirements of the GHG Protocol Scope 3 Standard."
First party assurance	Person(s) from within the reporting company but independent of the GHG inventory process conducts internal assurance.	This type of assurance remains independent via different lines of reporting.
Third party assurance	Person(s) from an organization independent of the scope 3 inventory process conduct third party assurance.	This type of assurance remains independent via different business entities from the reporting company.

Annex A

Wider scope 3 category descriptions and data sources

Complete definitions and minimum boundaries for scope 3 categories are provided in the **GHG Protocol Scope 3 Standard**, Table 5.4.

This Annex provides a summary of each of the categories and sources of data to inform calculations for UK food & drink businesses. **Table 26** also provides additional steer on where different types of transportation and distribution emissions should be reported. Transportation and distribution activities occur at multiple points in the value chain and - depending on where these occur and the relationship with the reporting company - should be reported under a variety of possible scope 3 categories, or even as scope 1 emissions.

Please note - this summary does not aim to be exhaustive and for further detail on reporting other scope 3 categories users should refer to the GHG Protocol Scope 3 Standard.

Purchased goods and services (category 1)

See **Section 6** for detailed guidance on the measurement approach.

Capital goods (category 2)

What does this relate to?	This category includes all upstream emissions from the production of capital goods purchased or acquired by the reporting company in the reporting year. Capital goods are final products that have an extended life and are used by the company to manufacture a product, provide a service, or sell, store, and deliver merchandise. In financial accounting, capital goods are treated as fixed assets or as a plant, property, and equipment (PP&E). Examples of capital goods include equipment, machinery, buildings, facilities, and vehicles.
Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions* (version 1.0), pp.36-37.
Example emission sources	• **Manufacturing or food processor:** embodied carbon in industrial refrigeration units; manufacturing equipment, packaging machines. • **Retailer:** embodied carbon in delivery vehicles; refrigeration units, store fixtures and fittings. • **Hospitality and food service:** embodied carbon in kitchen appliances, vehicles, office and venue furnishings.

Fuel - and energy - related emissions not included in scope 1 or scope 2 (category 3)

What does this relate to?

This category includes:

- **Upstream ('well-to-tank') emissions of purchased fuels:** this includes the emissions associated with extraction, processing and transportation of fuels used by the reporting company.
- **Upstream emissions of purchased electricity:** this includes emissions associated with extraction, processing, and transportation of fuels used by power generators, proportionate to the amount of electricity, steam, heating, or cooling purchased by the reporting company.
- **Transmission & distribution (T&D) losses:** corresponding to the production emissions of purchased energy (electricity, steam, heating, or cooling) lost during transmission, i.e. the difference between the gross energy output and the net energy received.
- **Generation of purchased electricity that is sold to end users:** emissions associated with the generation of electricity that is purchased by the reporting company and resold. to an end user.

Sources for support with measurement

- GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.38-48.
- **UK Government** GHG Conversion Factors for Company Reporting:
  - This provides emission factors for well-to-tank emissions, T&D losses, and some aspects of upstream emissions from purchased electricity (where these emissions are not captured within scope 3, or scope 3 categories 8 or 13).
  - These emission factors can be used alongside company data on volume or fuel used, or distance travelled.
  - Further guidance on their applicability and use can be found within the most recent published version of the conversion factors

Example emission sources

- **Manufacturing or food processor:** T&D losses calculated as a proportion of total electricity purchased.
- **Retailer:** well-to-tank emissions relating to the fuel consumed within own-operated vehicle fleet (delivery vans etc.)
- **Hospitality and food service:** as for manufacturers, food processors or retailers.

Upstream transportation and distribution (category 4)

What does this relate to?	**This category includes transportation of products from tier 1 suppliers to the reporting company but not transportation upstream of tier 1 suppliers, as this is captured within category 1**. This should additionally include third-party transportation purchased by the reporting company, as well as emissions arising from storage of purchased products or finished goods in third-party operated distribution centres / warehouses. For further detail regarding the attribution of emissions arising from transportation and distribution at different stages of the value chain, see **Table 26**.

Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.49-71.
	• **UK Government GHG Conversion Factors for Company Reporting**:
	  ◦ Where the reporting company identifies this to be a material category for its scope 3 emissions inventory, 'freighting goods' emission factors published by the UK Government can be used.
	  ◦ Where possible, companies should work with suppliers and logistics providers to collect accurate data on the type and volume of fuel used or distance travelled. If this is not feasible, reasonable estimates for distance travelled can be applied.
	  ◦ The reporting company should take care to avoid double counting between this category, and downstream transportation and distribution (category 9) if that category is being reported.
	  ◦ Further guidance on their applicability and use can be found within the most recent published version of the conversion factors.

Example emission sources	• **Manufacturing or food processor:** third-party transport of ingredients to a factory, or of product from a factory to the customer **(where paid for by the manufacturer)**. • **Retailer:** transport of products between distribution centres, or from distribution centres to stores, where provided by a third-party haulier. • **Hospitality and food service:** as above, or emissions associated with the electricity and heating consumption required for third-party contracted warehousing. • **3rd party catering services:** freight transport of items and foodstuffs to an event venue **(where paid for by the catering service).**

Waste generated in operations (category 5)

What does this relate to?	This category includes emissions from third-party disposal, handling and treatment of waste that is generated in the reporting company's owned or controlled operations during the reporting year. This category includes emissions from the disposal of both solid waste and wastewater.

Sources for support with measurement	• **UK Government GHG Conversion Factors for Company Reporting 'Waste disposal' and 'Water Treatment' Sections:**
	  ◦ This provides emission factors for food waste or other waste materials sent to different waste treatment routes, or to recycling / recovery.
	  ◦ These emission factors can be used alongside company data on volumes of material sent to different destinations.
	  ◦ An example calculation approach is also provided - compliant with the GHG Protocol Scope 3 Standard.
	• **WRAP Food Waste Reduction Roadmap**:
	  ◦ This provides guidance on how to measure food waste and a common reporting template for food & drink businesses to use. The information captured in this reporting template can be used directly in the calculations described above.
	• **Food Loss and Waste Protocol - Connecting Food Loss and Waste to GHG Emissions-Guidance for Companies:**
	  ◦ This provides more detailed guidance on quantifying GHG emissions linked to food waste, and food waste reduction initiatives.
	  ◦ **Note – Section 7.6** of this accounting principles document sets out rules for accounting GHG emissions reductions linked to food waste reduction and notes some limitations on what can be reported within a scope 3 inventory versus supporting narrative

Example emission sources	• **Manufacturer / food processor / retailer / HaFS:** Emissions resulting from the collection and disposal of food waste. • **3rd party catering services:** as above, and emissions resulting from the collection and disposal of waste resulting from booths, stands, build at a venue, where responsible for waste removal. • Emissions associated with other waste management services – e.g. recycling collections, residual waste collections. • Emissions associated with the treatment of wastewater on sites, where provided by third parties.

Business travel (category 6)

What does this relate to?	This category includes emissions from the transportation of employees for business-related activities in vehicles owned or operated by third parties such as aircraft and trains, not including employee travel to and from work (accounted for in scope 3; category 7) or leased vehicles (which if not accounted for in scope 1 or 2, fall under scope 3; category 8). Optionally, reporting companies may report on emissions from business travellers staying in accommodation such as hotels within this category.

Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.81-86.
	• **UK Government** GHG Conversion Factors for Company Reporting:
	  ◦ For business travel, (including land, sea and air travel, and hotel stays) emission factors are provided for the purposes of scope 3 emissions reporting.
	  ◦ These include granular emissions factors broken down by type of transport, in addition to average factors where details of travel are unknown.
	  ◦ For scope 3 reporting, companies should use the 'business travel' emission factors included within the published database, and not 'passenger vehicle' or 'delivery' vehicle factors, which are developed for scope 1 emissions reporting.
	  ◦ Further guidance on their applicability and use can be found within the most recent published version of the conversion factors.

Example emission sources	• **Manufacturer / food processor / retailer / HaFS:** emissions associated with travel to visit suppliers via third party-owned means of transport (e.g. air, rail)

Employee commuting (category 7)

What does this relate to?	This category includes emissions from the transportation of employees between their homes and their worksites unless already captured within scope 1 (e.g., employees using company vehicles and operating from their homes). Optionally, reporting companies may report on indirect emissions from employees working remotely from home ('teleworking') within this category.

Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.87-93.
	• **UK Government** GHG Conversion Factors for Company Reporting:
	  ◦ Business travel emission factors can be applied for calculating employee commuting emissions. These typically rely on an estimate of the average distance commuted by employees, per type of transport, multiplied by the total number of employees.
	  ◦ Given the reliance on estimates for calculation of these emissions, key features of the methodology used and the level of certainty should be disclosed transparently in reporting.
	  ◦ For reporting of emissions relating to employees working from home, estimates of the average amount of energy (electricity, gas and other fuel sources as applicable) should be made, and relevant government conversation factors should be applied. Estimations of energy use should only account for a reasonable proportion of total energy use associated with work (i.e. should not include all domestic emissions).
	  ◦ Further guidance on their applicability and use can be found within the most recent published version of the conversion factors.

Example emission sources	• **Manufacturer / food processor / retailer / HaFS:** emissions associated with employees travelling to work (whether by car or public transport). • **3rd party catering services:** as above, and emissions associated with employees travelling to event venue to provide catering services.

•

Upstream leased assets (category 8)

What does this relate to?	This category includes emissions associated with the reporting company's operation of leased assets that are not already captured within scope 1 or scope 2. This will depend on the reporting boundaries applied by the reporting company (e.g., financial control vs operational control).

Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.94-101.
	• **UK Government** **GHG Conversion Factors for Company Reporting**:
	  ◦ For leased vehicles, and electricity associated with leased buildings / leased space, emission factors are provided for scope 3 reporting, where the company's operational boundary does not include these within scope 1 or 2 reporting.
	  ◦ Further guidance on their applicability and use can be found within the most recent published version of the conversion factors.

Example emission sources	• **Manufacturer / food processor / retailer / HaFS:** where a company uses a financial control reporting boundary, leased assets (e.g., retail space) may be outside of the company's financial control and therefore operational emissions are excluded from scope 1 and 2 reporting. In this instance, these emissions should be reported to this category.

Downstream transportation and distribution (category 9)

What does this relate to?	This category includes emissions from transportation and distribution of products sold by the reporting company in the reporting year between the reporting company's operations and the end consumer, in vehicles and facilities not owned or controlled by the reporting company. **This should exclude logistics services contracted by the reporting company itself, which should be reported under category 4.** This category includes emissions from retail and storage (if downstream of the reporting company and not included with scope 1 and 2). For companies that own or operate retail facilities, this category may include emissions from customers travelling to and from retail stores.

Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.102-105.
	• **UK Government** **GHG Conversion Factors for Company Reporting**:
	  ◦ Where the reporting company identifies this to be a material category for its scope 3 emissions inventory, 'freighting goods' emission factors published by the UK Government can be used.
	  ◦ Ideally, companies should work with downstream stakeholders and partners to collect accurate data on the fuel used or distance travelled. If this is not feasible, reasonable estimates for distance travelled can be applied.
	  ◦ The reporting company should take care to avoid double counting between this category, and upstream transportation and distribution (category 4) if that category is being reported.
	  ◦ Further guidance on their applicability and use can be within the most recent published version of the conversion factors.

Example emission sources	• **Manufacturing or food processor:** transportation of products to downstream factories and on to retailers (**where paid for by the customer)**. • **Retailer:** this could include emissions associated with customers travelling to and from retail stores. **Hospitality and food service:** unlikely to be material for hospitality providers where products are consumed at the site of purchase. For food services companies, this could include downstream distribution activities if purchased by customers or franchisees.

Processing of sold products (category 10)

What does this relate to?	This category includes emissions from the processing of sold intermediate products by third parties (e.g., manufacturers) subsequent to their sale by the reporting company to customers.
Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.106-112.
Example emission sources	• **Manufacturer or food processor:** for producers supplying into the prepared foods supply chain, this could include the emissions associated with additional processing of products prior to their sale to end consumers. For example, sugar sold as an intermediary product to be further processed into consumer goods such as cake.

Use of sold products (category 11)

What does this relate to?	This category includes emissions from the use of products sold by the reporting company in the reporting year. This includes the direct use-phase emissions of sold products over their expected lifetime for products that directly consume energy or emit GHGs during their use. For food & drink products this does not apply – but they may indirectly consume energy – e.g., for refrigeration or cooking. **These indirect use-phase emissions are optional to include within the GHG Protocol Scope 3 Standard but can be highly material and therefore this should be considered on the basis of materiality.**
Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.113-124. • Calculating emissions from category 11 requires assumptions about how consumers (or HaFS operators) use products. This is termed a 'use profile'. Dependent on the type of product this will principally include assumptions regarding: i. How the product is stored (e.g., refrigerated, frozen) and for how long; and ii. How the product is cooked (e.g., using gas or electric oven / gas or electric hob/ microwave and for how long. • Usage instructions (e.g., on pack) should inform use profiles (e.g., storage mode, cooking mode and duration). However, these are often variable (e.g., offering multiple cooking options, or given maximum storage lengths), and may not provide insight into how a product is typically stored or cooked. • **Given the potential significance of indirect use-phase emissions and the potential for significant variability, WRAP will investigate the need to develop a set of default 'use profiles' for key food & drink items during the piloting of this Version 1 measurement & reporting protocols document.** • Having determined a use profiles some national-level data sources are available on appliance use and energy consumption for appliances: ◦ **BEIS ECUK - Energy consumption for food-related appliances** ◦ **Energy follow up survey (EFUS) – domestic appliances, cooking and cooling equipment** ◦ **Given the potential significance of indirect use-phase emissions and the potential for significant variability, WRAP will investigate the need to develop a cooking & storage calculator for food & drink items (e.g., based on these data sources) during the piloting of this Version 1 measurement & reporting protocols document**
Example emission sources	• **Manufacturing / food processor/breweries:** this could include emissions associated with refrigeration or cooking of the products sold, by end consumers (e.g., individual customers / hospitality businesses.)

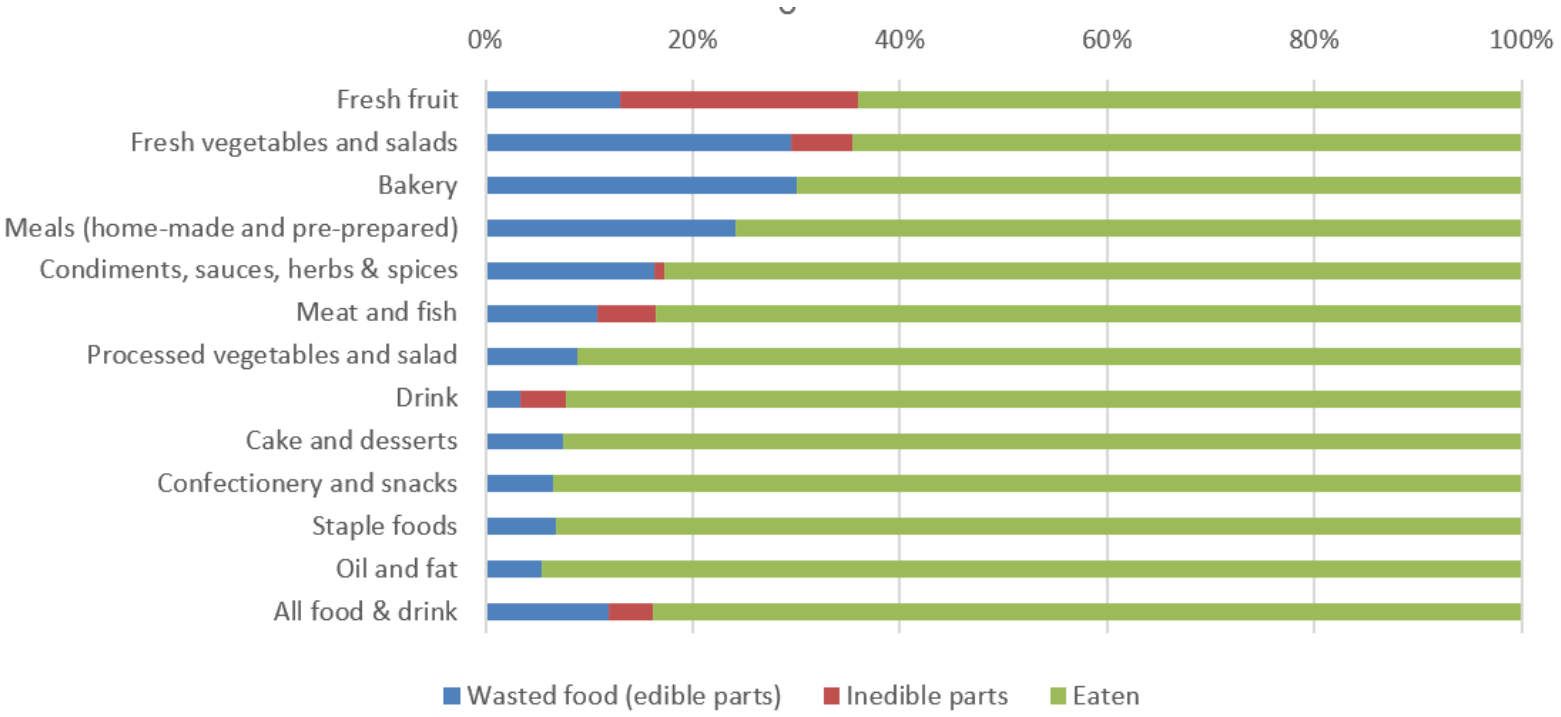
End-of-life treatment of sold products (category 12)

What does this relate to?	This category includes emissions from the waste disposal and treatment of products sold (during the reporting year) by the reporting company at the end of their life.
Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.113-124 • Calculating emissions from category 12 requires assumptions about the typical fate of a product and its packaging at the end of its useful life. This is termed an 'end-of-life profile'. This will principally include assumptions regarding: i. How much of the product and packaging is typically discarded (as opposed to being consumed or reused). ii. The waste management methods employed for each type of material discarded (e.g., food / drink vs packaging materials). • WRAP's most recent statistics regarding UK wastage rates for different types of food & drink items at home and in different out-of-home settings (plate waste) are provided in **Table 24** and **Figure 9**. These values can be used to inform part i) of the end-of life profile. • WRAP's most recent statistics regarding UK waste management routes for food & packaging materials are provided in **Table 25**. These values can be used to inform part of the end-of-life profile. • Having determined end-of-life profiles (% wastage and management route for different product & packaging types) these can be multiplied by quantities of products sold to determine the total volume of different materials to different waste management routes. • UK Government GHG Conversion Factors for Company Reporting: 'Waste disposal' and 'Water Treatment' Sections provides emission factors for food waste or other waste materials sent to different waste management routes. These emission factors can be used as a last step to translate waste volumes into a GHG emissions estimate.
Example emission sources	• **All:** emissions associated with consumer food and packaging waste (inc. composting and food waste going to landfill). • **HaFS and 3rd party catering services:** emissions associated with plate waste, disposable containers and cutlery waste, and waste from takeaway and home deliveries. • **Manufacturer or food processor:** for intermediate products sold, the emissions associated with the disposal for the intermediate product at the end of its life, not the final product.

Investments (category 15)

What does this relate to?	This includes emissions arising from the operation of the entities or projects in which the reporting company invests (i.e., financed emissions). These emissions will typically represent the sum of the scope 1 and 2 emissions of all the reporting company's investments. There may be some limited instances in which emissions arising from investments are already captured within the reporting company's scope 1 and 2 emissions inventories (e.g., where companies apply an equity-share approach and have made equity investments). In these cases, these emissions should not be reported as scope 3, to avoid double counting.
Sources for support with measurement	• GHG Protocol: *Technical Guidance for Calculating Scope 3 Emissions (version 1.0)*, pp.136-152. • **The Global GHG Accounting & Reporting Standard for the Financial Industry** sets out specific guidance for reporting on scope 3 category 15 emissions, based on principles of the GHG Protocol. This includes guidance on reporting emissions associated with business loans, project finance and commercial real estate, in addition to other investment categories.
Example emission sources	• **All:** where equity investments or joint ventures are formed, and the reporting company applies and 'operational control' reporting boundary, but does not have management control over the invested activities, the scope 1 and 2 emissions arising from these activities should be reported in this category.

Figure 9: Approximate UK wastage rates for different types of food & drink items at home



(Figure 9). Proportion of purchases wasted by weight for different food groups, showing edibility of the waste (2021/22)

Table 24 – Approximate UK food wastage rates in different out-of-home settings

HaFS subsector	% waste of purchases*	APPROXIMATE breakdown*	
		Combined back of house food waste (prep & spoilage)	Plate waste
Pubs	**22%**	63%	38%
Restaurants	**23%**	74%	26%
Hotels	**19%**	74%	26%
QSR	**8%**	54%	46%
Healthcare	**18%**	64%	36%
Education	**17%**	64%	36%
Staff	**3%**	64%	36%
Services	**28%**	64%	36%
Leisure	**25%**	54%	46%

Source: WRAP ***** *Please note – these values are based on a small sample size and are very uncertain approximations only. In particular, observed values for plate waste are reported to be much higher, and the values do not include buffets/ overproduction. It is recommended that businesses take efforts to measure food waste and generate more accurate values. Resources to help businesses do so are available here:* ***https://guardiansofgrub.com/***

Table 25 – Approximate UK waste management routes for **food materials** wasted at home and in out-of-home settings

Sector	Landfill	Incineration / energy recovery	Recycling (AD, compost)	Sewer
Household	9-12%	55-58%	[17%]	15
Hospitality and food service[2]	26	57	17	Not known
Retail	Not known[3]	%	%	Not known

Sources:

1. WRAP 2023 – **Household Food and Drink Waste in the United Kingdom 2021-22**
2. WRAP 2023 – **Food Surplus and Waste in the UK - Key Facts – updated November 2023**
3. WRAP 2021 – **Modelling for UK Food System GHG Emissions**

Notes:

- Of which, up to 1/5th (or 3% of household food waste) being composted at home.
- Hospitality is particularly uncertain due to no estimates for sewer waste, which could be quite substantial – such as for pubs or bars. The amount recycled may also have increased since it was last measured. The split between recovery and disposal for residual waste from HaFS has been assumed to be the same as for household residual waste.
- Information from Courtauld 2030 signatories suggests that almost all (97%) is recycled via anaerobic digestion, with remaining food waste (3%) being sent for recovery via thermal treatment. This suggest that landfill and sewage waste is likely to be quite small.

Table 26 – Reporting categories for transportation and distribution emissions

Transportation and distribution activity in the value chain	Scope and category of emissions
Transportation and distribution in **vehicles owned or controlled by the reporting company**.	Scope 1 (for fuel use) or Scope 2 (electricity use).
Transportation and distribution of purchased products, **upstream of the reporting company's tier 1 suppliers** (e.g., transportation between a company's tier 2 and tier 1 suppliers).	Scope 3, category 1 (Purchased goods and services) since emissions from transportation will be included in the cradle-to-gate emissions of purchased products.
Transportation and distribution of products **purchased by the reporting company** (i.e. paid for by the reporting company), **between a company's tier 1 suppliers and its own operation**s in vehicles not owned or controlled by the reporting company. **All third-party transportation and distribution services purchased by the reporting company (either directly or through an intermediary) are included here.**	Scope 3, category 4 (Upstream transportation and distribution).
Transportation and distribution of products sold by the reporting company, **not paid for by the reporting company**. This includes each of the stages, post the reporting company's operations, involved in getting the product to the end user. i.e., all transport and emissions associated with the retail and storage of the product (in vehicles and facilities not owned or controlled by the reporting company).	Scope 3, category 9 (Downstream transportation and distribution).
Transportation and distribution in **vehicles leased by and operated by the reporting company** (not already included in scope 1).	Scope 3, category 8 (Upstream leased assets).
Transportation of fuels and energy consumed ("well-to-tank" emissions) by the reporting company.	Scope 3, category 3 (Fuel- and energy-related emissions not included in scope 1 or scope 2).
Embodied **emissions associated with the production of vehicles** (e.g., ships, trucks, planes) purchased or acquired by the reporting company.	Account for the upstream emissions associated with manufacturing vehicles in scope 3, category 2 (Capital goods).

Annex B

Purchased goods embodied emission factor data checklist

The purpose of using embodied emissions data (e.g., published emission factors or primary emission factors from suppliers) is to convert activity data (purchase weight/volume) into an estimate of the GHG emissions linked to producing these purchases. As such, it is important that any emission factors used are an accurate representation of the product/ingredient purchased and its supply chain. In reality, this is very difficult (and in many cases currently impossible), as food & drink supply chains are extremely complex, subject to variability (e.g., due to weather conditions) and there is a lack of available data. However, care should be taken to ensure that the data sources used are as representative as possible.

Section 6.4.3 outlines a data quality assessment framework which can be used to rate the quality of data behind the calculation of an emission factor. **WRAP's food & drink emission factor database** also partially utilises this data quality scoring framework to rate the emission factors it includes. Beyond this data quality framework, some useful points to consider when selecting emission factors from published databases, or when checking data received from suppliers, are listed in **Table 27**. Annex E can provide further guidance on applying the data quality framework to determine the most appropriate emission factor if having to select between multiple or determine whether one provided by a supplier is suitable to replace a secondary emission factor.

Table 27 – Purchased goods embodied emission factor data checklist

Causes of data variability or inaccuracy	Questions to ask / checklist
Functional unit	What unit of the product does the emission factor represent – e.g. emissions per kg carcase weight, or per kg live weight, or per kg bone-free meat, or per kg protein? Does this match with the product purchased?
Completeness (System Boundaries)	Have all life cycle stages from the farm up until the point of purchase been included (including e.g. feed for livestock). **Figure 7** in **Section 6.4** can be used as a reference. Where there are omissions are they quantifiable (e.g. by reference to a similar dataset)? How significant is the data gap likely to be?
Production system	What type of production system does the emission factor represent – e.g. conventional versus organic; heated versus unheated? Does this match with the product purchased?
Sample size	What proportion of the supply base has been included within the dataset? Are these an appropriate representation for all suppliers, or could there be a high degree of variability across different suppliers, production types, farm practices or technologies used; or major geographical differences?
Methodology - General	Has the emission factor / product carbon footprint been quantified in accordance with agreed international standards? What tools have been used for farm-level emissions, and what methods are these based on? To meet data quality requirements, embodied emissions shall be quantified in accordance with an appropriate product footprinting standard (e.g. **EU PEF**, **PAS2050**, **GHG Protocol Product Standard**), or ideally, specific product category rules, where developed (e.g. **PEFCR**, **International EPD system**).

Table 27 – Purchased goods embodied emission factor data checklist (continued)

Causes of data variability or inaccuracy	Questions to ask / checklist
General errors	Has a thorough process of quality assurance been undertaken to reduce errors?
Methodology – Co-product allocation	In many cases, emissions from a multi-output process (e.g. processing of soyabeans into soyabean meal and soyabean oil) need to be allocated between those outputs. Different data sources for emission factors may do this based on economic value, mass, other properties (e.g. protein content) or other methods to deal with this issue. This area can be complex to understand, although guidance is included in the **GHG Protocol Product Standard (chapter 9)**. In general, co-product allocation by economic value is most commonly adopted. **As much as possible, companies should use emission factors with a consistent method for co-product allocation throughout.**
Methodology – Land-use Change	Land-use change in scope 3 accounting is discussed in . How emissions from land-use change are calculated and subsequently included in product level emission factors can be extremely variable. The forthcoming **GHG Protocol Land Sector and Removals Guidance** will aim to standardise how land-use change emissions are measured. Until that guidance is finalised, it is important food businesses are aware of whether emissions from land-use change are included in any emission factor they use. **Emissions from both land use and land-use change are required within the minimum boundary for purchased goods, as set out by the GHG Protocol Scope 3 Standard. Where possible use emission factors that account for land-use change and follow an established standard that covers this area such as PAS 2050 or the GHG protocol product LCA reporting standard.**
Methodology – Biogenic CO_2	Biogenic CO_2 in scope 3 accounting is discussed in **Section 5.4.3**. The forthcoming GHG Protocol Land Sector and Removals Guidance will aim to standardise how biogenic GHGs (including CO_2, N_2O and CH_4) are including in scope 3 accounting. Until that guidance is finalised it is important food businesses are aware of whether biogenic GHGs (other than those caused by land-use change) are included in any emission factor they use. **For emission factors in the WRAP emission factor database this is not currently included, as most data sources did not account for this, or separately report these emissions. Current SBTi FLAG guidance mandates the inclusion of all biogenic GHG emissions in scope 3 accounting but such emission factors are not be available for many food products at the time of publishing.**
Methodology – Calculating GWP	There are several available methods from which a calculation of overall Global Warming Potential (GWP) of the greenhouses gases released as a result of an organisations activities. For example, there can be variation in the time period considered (e.g. GWP_{20} vs GWP_{100}) or how short lived greenhouse gases such as N_2O and CH_4 are accounted for (e.g. **GWP***). The **GHG Protocol Product Standard** mandates that "*Companies shall apply a 100-year GWP factor to GHG emissions and removals data to calculate the inventory results in units of CO_2 equivalent (CO_2 e)*". **Always use GHG emission factors that adopt the GWP_{100} method to comply with this requirement**. Specific GWP_{100} values for greenhouse gases are updated in each IPCC report. It is required that the latest GWP values are used when calculating emission factors - these are summarised by the Greenhouse Gas Protocol **here**.

Annex C

Recommended format for supplier questions relating to GHG emissions and reduction actions

1. For general questions to manufacturing suppliers – e.g. covering their GHG emission reduction targets and scope 1 & 2 emissions:

- WWF has developed a questionnaire outlining the key questions to ask, available **here**.
- Wider guidance, advice and tools to support emissions reporting are also available to help with completing this and taking steps to reduce their scope 1 and 2 emissions. Available **here**.
- The SME Climate Hub has developed the 1.5°C Supplier Engagement Guide. This is designed to aid SMEs in engaging their supply chains in the measuring and decarbonisation journey, available **here**.

Note – The guidance and questionnaires included in the links above are targeted at manufacturing suppliers and are NOT suitable for agricultural suppliers (see point 3 below).

2. For questions to suppliers relating to obtaining product carbon footprint data – e.g., for use as a purchased goods embodied emissions factor:

- In future – we anticipate that reported product carbon footprint values should be in line with the data exchange requirements set out in the **WBCSD Carbon Transparency Pathfinder framework**. However – currently, this framework is not well-suited to reporting emissions data for food & drink items.
- In the interim, WRAP has developed a questionnaire outlining key questions to ask, including useful things to check for to ensure representativeness. This includes:
  - The year to which data used to calculate the product carbon footprint relate;
  - What life cycle stages are included;
  - What methodology or calculator tool/s has been used (e.g. GHG Protocol Product Standard, PAS2050, EU PEF Category Rules);
  - How representative is the average value of the total supply base for this product? For example, is it based on a small sample of suppliers? Is there likely to be a high degree of variability across production types and geographies?
- WRAP has also developed and tested product-specific questions for a range of food & drink products/ ingredients: beef, lamb, pork, poultry, warm water prawns, cheese, bananas, coffee, tomatoes and wine.

3. When engaging agricultural suppliers

Businesses should encourage and support agricultural producers / suppliers to use carbon accounting tools to understand their on-farm emissions and aid the development of GHG reduction plans. As discussed in Section 1.1.4, on-farm carbon accounting tools are important decision support tools that are useful for benchmarking relative progress, however difficulties arise from the plethora of tools and their results, and the resource required to input into them. Defra has recently completed a project on harmonisation carbon accounting tools and will set out by 2024 how farmers will be supported to measure their emissions, but in the meantime, farmers are encouraged to find a calculator that is best suited to their business and to use it consistently to track change over time. Cross-industry efforts will be required more widely to build capacity of producers / suppliers to effectively input into and utilise carbon accounting tools.

Annex D

Summary of other standards and guidance documents

The following list provides a brief summary of the international standards referenced throughout this document, along with other key standards or guidance related to scope 3 emissions calculation and reporting along the value chain.

Environmental Reporting Guidelines

UK Government Environmental Reporting Guidelines

This document is designed to help organisations with reporting on a range of environmental matters, including energy and GHG emissions reporting (including Streamlined Energy and Carbon Reporting (SECR) guidance).

Link: Environmental Reporting Guidelines (publishing.service.gov.uk)

The Corporate Sustainability Reporting Directive (CSRD)

On 5 January 2023, the Corporate Sustainability Reporting Directive (CSRD) entered into force. This new directive modernises and strengthens the rules concerning the social and environmental information that companies have to report. A broader set of large companies, as well as listed SMEs, will now be required to report on sustainability.

The first companies will have to apply the new rules for the first time in the 2024 financial year, for reports published in 2025.

Companies subject to the CSRD will have to report according to European Sustainability Reporting Standards (ESRS). The standards were developed by the EFRAG, previously known as the European Financial Reporting Advisory Group, an independent body bringing together different stakeholders. The standards will be tailored to EU policies, while building on and contributing to international standardisation initiatives.

These reporting rules apply to large public-interest companies with more than 500 employees. This covers approximately 11 700 large companies and groups across the EU, including

- listed companies
- banks
- insurance companies
- other companies designated by national authorities as public-interest entities

Link: Corporate Sustainability Reporting Directive (CSRD)

Scope 3 measurement and reporting

GHG Protocol Corporate Value Chain (Scope 3) Standard

Provides requirements and guidance for companies to prepare and publicly report a GHG emissions inventory that includes indirect emissions resulting from value chain activities (i.e. scope 3 emissions).

Link: GHG Protocol Corporate Value Chain (Scope 3) Standard

GHG Protocol technical Guidance for calculating scope 3 emissions

In addition to the information entailed in the GHG Protocol Scope 3 Standard, this guidance includes:

- Methods for calculating GHG emissions for each of the 15 categories of scope 3 emissions;
- Guidance on selecting the appropriate calculation methods; and
- Examples to demonstrate each calculation method.

Link: **Technical Guidance for calculating Scope 3 emissions**

GHG Protocol Land Sector and Removals Guidance

The GHG Protocol *Land Sector and Removals Guidance* explains how companies should account for and report GHG emissions and removals from land management, land use change, biogenic products, carbon dioxide removal technologies, and related activities in GHG inventories, building on the *Corporate Standard* and *Scope 3 Standard*.

The guidance is currently being developed through a global, inclusive multi-stakeholder development process which began in 2020. The *Draft for Pilot Testing and Review* is now available (see documents below). The Guidance will be finalized and published in mid/late 2024.

If you would like to receive updates, please **subscribe here**.

Link: **Land Sector and Removals Guidance | GHG Protocol**

Product life cycle accounting

GHG Protocol Product Lifecycle Accounting and Reporting Standard

The GHG Protocol Product Life Cycle Accounting and Reporting Standard (referred to as the Product Standard) provides requirements and guidance for companies and other organisations to quantify and publicly report an inventory of GHG emissions and removals associated with a specific product. The primary goal of this standard is to provide a general framework for companies to make informed choices to reduce greenhouse gas emissions from the products (goods or services) they design, manufacture, sell, purchase, or use.

The GHG Protocol Scope 3 Standard and GHG Protocol Product Standard both take a value chain or life cycle approach to GHG accounting and were developed simultaneously.

Link: **Product-Life-Cycle-Accounting-Reporting-Standard_041613.pdf (ghgprotocol.org)**

PAS 2050

Publicly Available Specification (PAS) 2050 was the first consensus-based and internationally applicable standard on product carbon footprinting that has been used as the basis for the development of other standards internationally. The 2011 revision to PAS 2050 was developed through extensive consultation with international stakeholders, and in particular, through significant engagement with the wide PAS 2050 user community. PAS 2050 was introduced in 2008 (revised in 2011) with the aim of providing a consistent internationally applicable method for quantifying product carbon footprints.

Link: **PAS 2050**

EU PEF scheme documentation

The Product Environmental Footprint (PEF) is a multi-criteria measure of the environmental performance of a good or service throughout its life cycle. PEF information is produced for the overarching purpose of seeking to reduce the environmental impacts of goods and services taking into account value chain activities (from the extraction of raw materials, through production and use, to final waste management). The PEF Guide provides provides guidance on how to calculate a PEF, as well as how to develop product category-specific methodological requirements for use in Product Environmental Footprint Category Rules (PEFCRs).

Link: **PEF scheme**

WBCSD Pathfinder Framework: Methodological Guidance for the calculation and allocation of product carbon emissions

This is a global initiative that provides guidance on the calculation and exchange of product-level carbon emissions data across value chains (aligned with both the GHG Protocol and **EU PEF scheme**). This includes required elements for data exchange between supply chain partners. Alongside the methodological framework (**Pathfinder Framework**), WBCSD has also launched the **Partnership for Carbon Transparency (PACT)**, which is intended to enable companies to share standardised Product Carbon Footprint (PCF) data via any chosen technology solution confidentially and securely and hence create transparency across supply chains. *At the time of drafting, these frameworks are not currently well-suited to reporting emissions data for food & drink items, but could provide an important mechanism for consistent data exchange along global supply chains if further developed.*

Link: **Pathfinder Framework, Partnership for Carbon Transparency (PACT)**

Sector level guidance

Product category rules (product footprinting)

In some sectors, 'product category rules' have also been developed alongside the product footprinting standards described above. **These further aid consistency and should be used where available**.

- The European PEF scheme has developed a series of category rules (**PEFCRs**) for products such as beer, wine, dairy, pasta, and animal feed.
- Efforts are underway to generate a consistent list of product category rules, but these are currently relatively limited for food & drink items. Available product category rules can be sourced from the **International EPD System**.
- *PAS 2050-1:2012- Assessment of life cycle greenhouse gas emissions from horticultural products* gives supplementary requirements for the cradle-to-gate stages of GHG assessments of horticultural products undertaken in accordance with PAS 2050.

  Link: **PAS 2050-1**

GHG Protocol – Agricultural guidance

This guidance is primarily intended for primary producers and companies that seek to develop scope 1 and scope 2 inventories of their agricultural operations.

Link: **GHG Protocol - Agricultural guidance**

GRI Sector Standard for Agriculture, Aquaculture and Fishing (draft consultation period ended July 2021)

In 2019, the Global Sustainability Standards Board (GSSB), GRI's independent standard setting body, initiated a project under the Sector Program to develop a Standard for Agriculture, Aquaculture, and Fishing. The aim of this project is to identify and describe the most significant impacts and stakeholder concerns for the agriculture, aquaculture, and fishing sectors from a sustainable development perspective, which will serve as a foundation for increased transparency and more consistent reporting for organizations in the sectors. At the time of drafting the standard was in consultation phase, with expected publication in 2022.

Link: **Consultation process in 2021**

Beverage guidance

The purpose of this guidance is to provide beverage companies with supplemental guidance specific to the sector, which supports beverage companies with alignment to global GHG reporting protocols and more granular guidance to drive additional consistency, accuracy, and leadership across the sector.

Link: **Beverage Industry Greenhouse Gas Emissions Sector Guidance (Version-4.1)**

Accounting for emissions reductions through interventions

Gold Standard

This guidance aims to raise ambition by providing an approach through which value chain interventions are incentivised by enabling their recognition and inclusion in reporting towards performance targets, even in cases where direct knowledge and measurement of specific value chains is challenging.

This guidance is intended to offer supplementary guidance to the GHG Protocol Scope 3 Standard in cases where knowledge about a supply chain intervention is available but there is a gap in knowledge needed to link this intervention to a company's specific supply. It is also intended to address cases where the supply affected by an intervention is unlikely to be exactly that received by an intervening company but is from the same production market as where the intervening company sources (referred to here as a "supply-shed"), for example where tier 2 and above suppliers may be difficult to trace.

Link: **Gold Standard V1**

GHG Protocol – Estimating and Reporting Avoided Emissions

This paper outlines a neutral framework for estimating and disclosing both positive and negative impacts of products and provides recommendations for companies to improve the credibility and consistency of their claims. Using a review of current practices in comparative assessments, this paper identifies major accounting issues, evaluates the credibility of existing practices, and outlines general principles and good practices to guide future accounting efforts.
Existing practices for estimating such product impacts vary in terms of many key issues. The framework intends to identify important challenges, harmonize practices, and improve the credibility of companies' claims, including through the consideration of potential negative impacts.

Link: **GHG Protocol - Estimating and Reporting Avoided Emissions**

World Resources Institute Food Loss and Waste protocol

The Food Loss & Waste Protocol (FLW Protocol) is a multi-stakeholder effort that addresses the challenges in consistently measuring and credibly reporting on food loss and waste. Its standardized method of quantitative data collection helps countries and companies identify where to focus their efforts to reduce food loss and waste, spurring action and change that positively impacts both people and the planet.

Link: **Food Loss and Waste Protocol**

WRAP's Emission Factor Inclusion and Adjustment Guidance

This guidance has been created to aid both the tracking of emissions over time and the monitoring of data quality within a company's inventory. There is a need to ensure data is evaluated and included within companies' greenhouse gas (GHG) inventories in a consistent way. This guidance is particularly focused on the following situations:

- Adjusting emission factors (EFs) to account for interventions.
- Assessing supplier-supplied emission factors and intervention data.
- Assessing emission factors and intervention data from certification schemes.
- Determining when and how to assess new EFs for inclusion in a base year inventory to ensure consistency with a current inventory.

Link: Scope 3 GHG Measurement and Reporting Protocols for Food and Drink | WRAP

Annex E

Guidance for including and adjusting emission factors in scope 3 GHG accounting for Food and Drink

The Purpose of this Guidance

This guidance has been created to aid both the tracking of emissions over time and the monitoring of data quality within a company's inventory. There is a need to ensure data is evaluated and included within companies' greenhouse gas (GHG) inventories in a consistent way. This guidance is particularly focused on the following situations:

- Adjusting emission factors (EFs) to account for interventions.
- Assessing supplier-supplied emission factors and intervention data.
- Assessing emission factors and intervention data from certification schemes.
- Determining when and how to assess new EFs for inclusion in a base year inventory to ensure consistency with a current inventory.

More generally, this guidance is aimed at assessing new EFs for inclusion in a GHG inventory in either of the below situations. It should be noted that some sections of the guidance may only be applicable in certain scenarios.

1. A new activity is to be included within a GHG inventory, and therefore the most appropriate EF is to be determined from possibly multiple potential EFs.
2. A potential new EF or adjustment factor has been provided to, or identified by, a reporting company and this data is to be compared to the existing original EF in the current or previous year inventory.

Following consultation with UK grocery retailers and experts in supply chain scope 3 data, it was decided that these situations represent important scenarios where greater guidance on data inclusion is required. This guidance is meant to build on existing guidance for calculating GHG inventories, therefore it should be considered with, and where appropriate interpreted in accordance with: SBTi target setting documentation, which describes when and how to recalculate base year emissions; Greenhouse Gas Protocol Scope 3 Standard, and its interpretation in the WRAP Scope 3 Protocol for Food and Drink companies; the Greenhouse Gas Protocol Land Sector and Removals guidance; and PACT Pathfinder Framework.

The guidance does not focus on:

- Improvements in activity data (the quantitative measure of a level of activity that results in GHG emissions. Further detail on activity data for purchased goods is included in Section 6.3 of the **WRAP Scope 3 Protocols**).
- Product footprinting. The guidance is aimed at compilers of corporate scope 3 inventories, however there is considerable crossover between corporate inventories and product footprints, and as such this guidance may be used to help guide product footprinting decisions around EFs, however there may be more considerations required (such as an emphasis on data comparability and a minimum threshold for data quality) when determining data for use within a product footprint.

Guidance Overview

Section 1 – **Determining the data type:**

- Minimum expectations of the data to be used.

Section 2 – **Determining the data source:**

- Additional requirements that are expected depending on the source of the data (focussing on supplier-specific data and certification scheme data).

Section 3 – **Assessing the data quality:**

- Guidance on how to assess data quality, and when data is of a sufficient quality to be included within an inventory.

Section 4 – **Including the new data:**

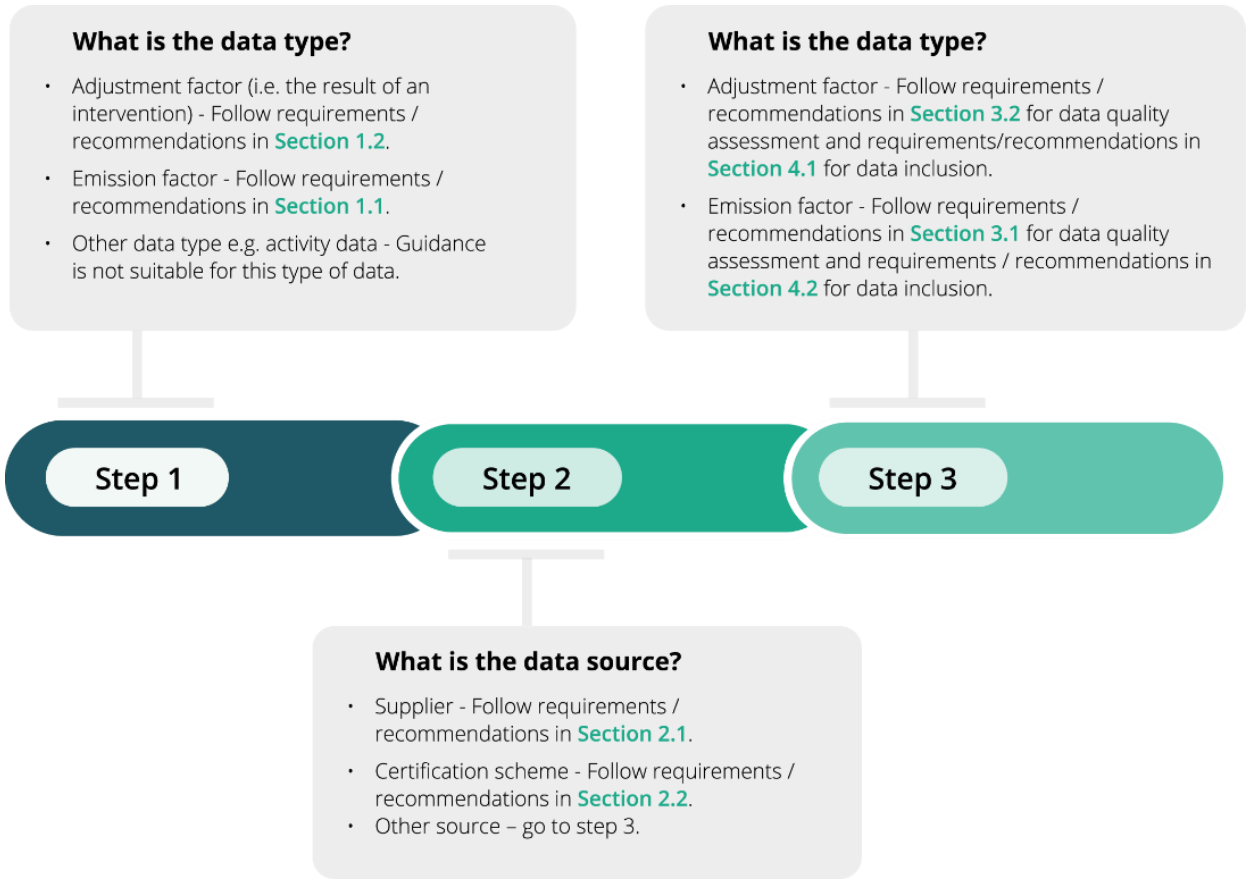
- Guidance on how data should be included within an inventory.

Section 5 – **Including new data in base year inventories:**

- For companies that have defined scope 3 targets, this section describes how to assess new data for inclusion in a target's base year inventory, and how companies may still account for genuine reductions that have occurred since the base year.

To use this guide, start at **Section 1** and follow the guidance from there, taking the appropriate steps depending on the data being evaluated. **Flowchart 1** can help to navigate through the guidance and clarifies which sections apply to each of the above scenarios.

Flowchart 1 – Navigating guidance for including new and adjusted EFs in GHG inventories.



Glossary	
EF	Emission Factor.
Original emission factor	An EF that is currently being included within an inventory, or was included in a previous inventory, prior to assessing whether new data may replace it.
New emission factor	An EF that is yet to be included in an inventory, often used to replace all or part of an original EF. To be assessed against the requirements and recommendations of this document to determine whether it may be included within an inventory.
Adjustment factor	A factor used to inform a proportional reduction or increase to emissions that can be applied to an EF, or part of it, to account for changes to GHG emissions as a result of an intervention. i.e. an intervention results in x% lower emissions.
Pre-adjusted emission factor	An EF that does not include the effects of an intervention, and is to be adjusted by an adjustment factor to account for the intervention.
Adjusted emission factor	The EF that results from adjusting a pre-adjusted EF by an adjustment factor to account for the intervention that the adjustment factor is related to.
Intervention	An action taken to change a process, which results in a change in emissions of the system that the process is a part of.

1 Determining the data type – What data can I use? How should I be using it?

Section principles

If assessing an adjustment factor, a relevant pre-adjusted EF shall be identified that will be modified by the adjustment factor, and system boundaries of the adjustment factor and pre-adjusted EF should align.

If replacing an original emission factor, or factors, with a new or adjusted EF, the lifecycle stage of the new /adjusted EF should align with the lifecycle stage of the original EF(s).

This guidance can be used to evaluate the use of an EF or an adjustment factor (along with a suitable pre-adjusted EF) related to a lifecycle stage or process in food supply chain scope 3 accounting. This section provides the specific requirements and recommendations for each data type (emission or adjustment factor). The purpose of this section is to ensure the right data is being used.

If the data is a new EF, the requirements from Section 1.1 shall be followed and the recommendations from Section 1.1 should be followed. If the data is an adjustment factor and a pre-adjusted EF, the requirements from Section 1.2 shall be followed and the recommendations from Section 1.2 should be followed. If multiple new EFs / adjustment factors are being assessed for a new activity, for example if a new activity is to be included in an inventory and there are multiple possible EFs that could be used with it, then all new EFs shall meet the appropriate requirements and should meet the appropriate recommendations.

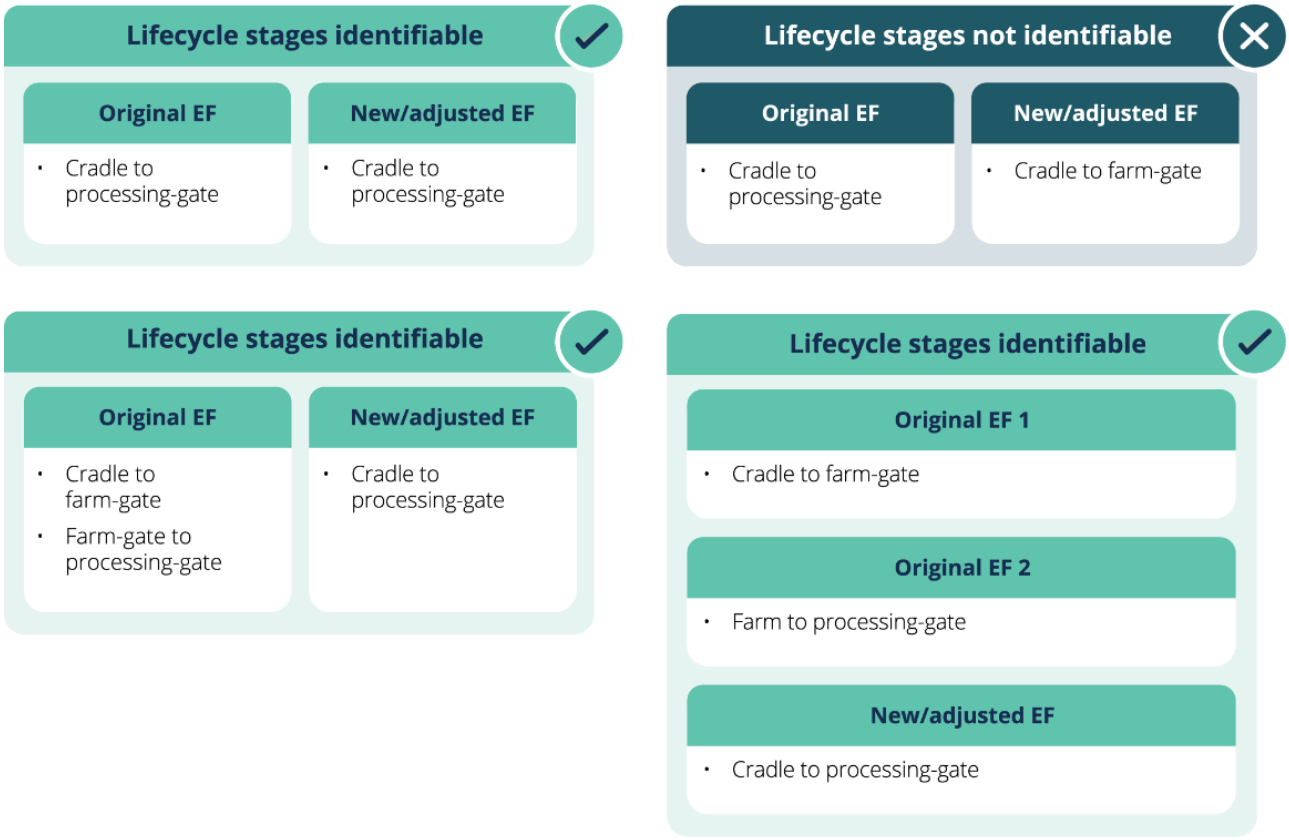
1.1 Emission factor

If the data to be evaluated is a new EF, the requirements in Table 28 shall be followed and the recommendations in Table 28 should be followed.

Table 28 – Requirements and recommendations for the inclusion of new emission factors in a GHG inventory

Criteria	Recommendation/ Requirement
If the new EF is being used to replace all or part of an original EF, the lifecycle stage that the new EF relates to shall be identifiable within the lifecycle stages of the original (see **Figure 1**). Multiple original EFs can be used but the same principle should be followed (see **Figure 1**).	Requirement
GHG emissions shall be calculated using **IPCC GWP100** conversion values.	Requirement
GHG emissions should be calculated using the most recent **IPCC GWP100** conversion values.	Recommendation
The new EF shall include emissions from land management and land-use change.	Requirement
Land management and land-use change (LUC) emissions should be calculated in alignment with the Greenhouse Gas Protocol (GHGP) Land Sector and Removals Guidance (LSRG).	Recommendation
Land management and LUC emissions should be reported separately to other emission sources.	Recommendation

Figure 10 – Alignment examples of new / adjusted EFs with original EFs.



1.2 Adjustment factor

If the new data to be evaluated is an adjustment factor to account for an intervention, the requirements in Table 2 shall be followed and the recommendations in Table 29 should be followed.

Table 29 – Requirements and recommendations for the inclusion of adjustment factors in a GHG inventory

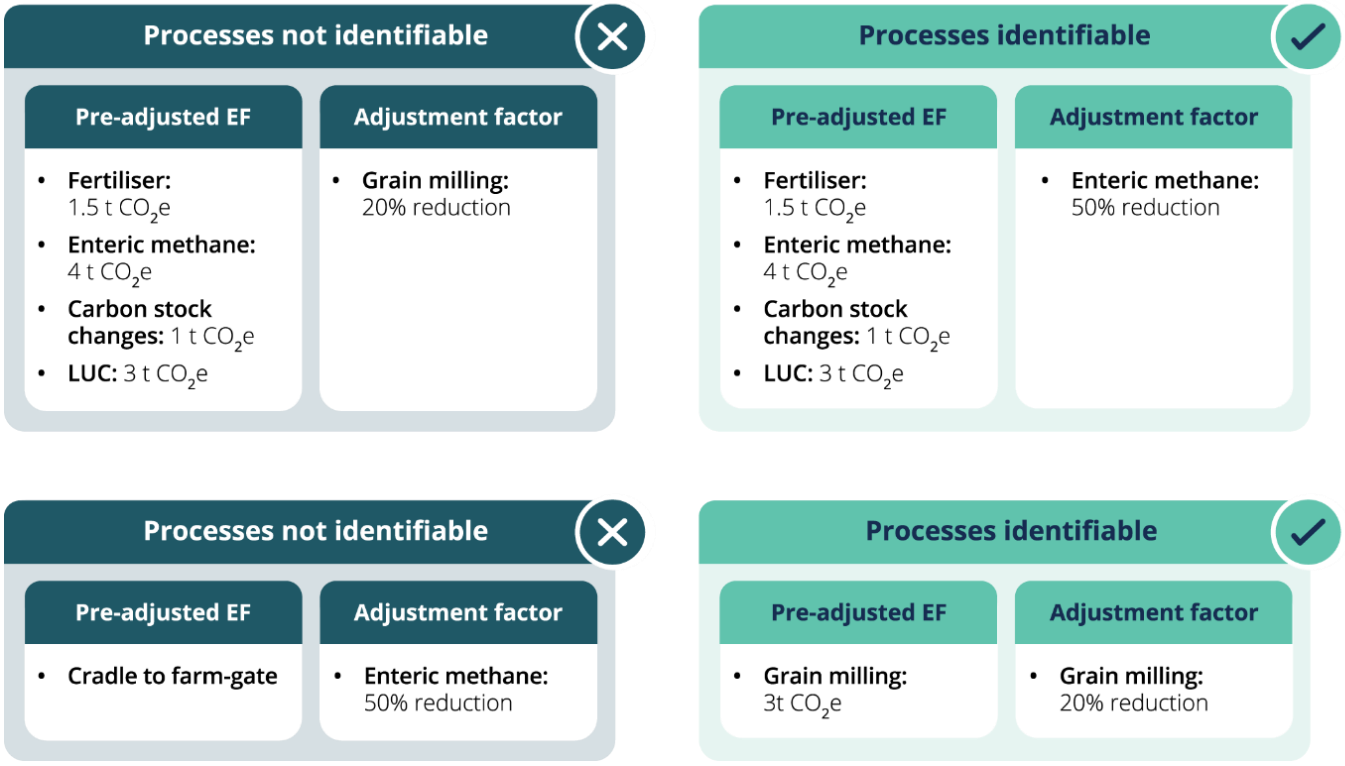
Criteria	Recommendation/ Requirement
A pre-adjusted EF shall also be identified that **does not** include the effect of the intervention.	Requirement
The process or lifecycle stage that the adjustment factor relates to shall be identifiable within the pre-adjusted EF (see Figure 2).	Requirement
If the adjusted EF is being used to replace all or part of an original EF, the lifecycle stage that the new EF relates to shall be identifiable within the lifecycle stages of the original (see Figure 1). Multiple original EFs can be used but the same principle should be followed (see Figure 1).	Requirement

Table 29 – Requirements and recommendations for the inclusion of adjustment factors in a GHG inventory *(cont.)*

Criteria	Recommendation/ Requirement
GHG emissions shall be calculated using IPCC GWP100 conversion values.	Requirement
GHG emissions should be calculated using the most recent IPCC GWP100 conversion values.	Recommendation
The pre-adjusted EF and the adjustment factor shall include emissions from land management and land-use change.	Requirement
Land management and land-use change (LUC) emissions should be calculated in alignment with the Greenhouse Gas Protocol (GHGP) Land Sector and Removals Guidance (LSRG).	Recommendation
Land management and LUC emissions should be reported separately to other emission sources.	Recommendation

These are minimum requirements for an adjustment factor and corresponding pre-adjusted EF. Data quality, including the quality of the source of the adjustment factor and pre-adjusted EF and the specificity of them, is assessed in Section 3.

Figure 11 – Process identification examples of adjustment factors within baseline EFs



2. Determining the data source

Section principles

If assessing data from a supplier, data quality should be assessed by both the supplier and the reporting company.

If assessing data from a certification scheme, those certification schemes should enable physical traceability of the certified commodities, and the emissions from proportion of product that is not certified should be calculated using EFs that exclude the certified products.

To enable inclusivity, data from any source may be evaluated in accordance with this guidance. This section defines additional criteria that shall be met depending on what the data source is. Due to the results of the consultation with UK retailers and experts in food system impact data, additional criteria are only defined for data sourced from either certification schemes or from suppliers. If the data is sourced from another provider, then this section can be ignored.

If the data is sourced from a supplier, the requirements from Section 2.1 shall be followed and the recommendations from Section 2.1 should be followed, note that Section 2.1 applies to all emission or adjustment factors sourced from or provided by the supplier, regardless of the level of specificity of the data. If the data is sourced from a certification scheme, the requirements from Section 2.2 shall be followed and the recommendations from Section 2.2 should be followed . If multiple new EFs / adjustment factors are being assessed, then they all shall meet the appropriate requirements and should meet the appropriate recommendations.

2.1 Supplier-specific data

If the new data to be evaluated is sourced from or provided by a supplier, the requirements in Table 30 shall be followed and the recommendations in Table 30 should be followed.

Table 30 – Requirements and recommendations for the inclusion of supplier-specific data in a GHG inventory

Criteria	Recommendation/ Requirement
The data quality assessment in **Section 3** should be undertaken by the supplier.	**Recommendation**
The data quality assessment in **Section 3** should be undertaken by the reporting company, with the help of answers provided by the WRAP supplier questionnaire.	**Recommendation**
The data quality assessment in **Section 3** shall be undertaken by either the supplier or the reporting company as a minimum.	**Requirement**
If the functional unit of the data does not match the unit the reporting company purchases in, the supplier shall provide a suitable conversion factor.	**Requirement**

2.2 Certification scheme

If the new data to be evaluated is sourced from a certification scheme, the requirements in Table 31 shall be followed and the recommendations in Table 31 should be followed.

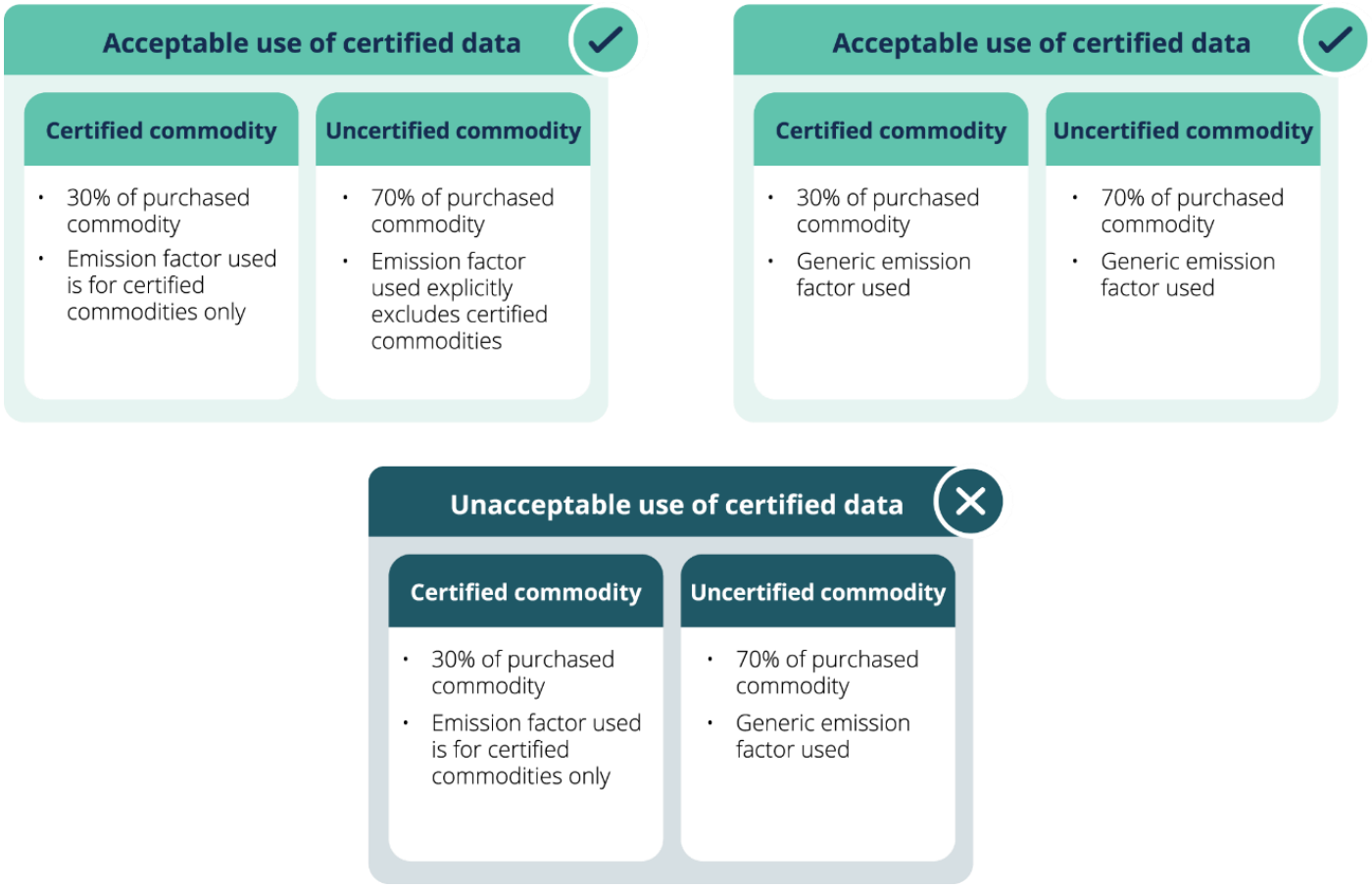
Table 31 – Requirements and recommendations for the inclusion of certification scheme data in a GHG inventory

Criteria	Recommendation/ Requirement
The certification scheme shall provide EFs for certified and non-certified commodities using the same methodology.	Requirement
The EF for certified commodities shall only be used for the proportion of commodities bought that is certified, and the EF for non-certified commodities shall be used for the proportion bought that is not certified (see **Figure 3**).	Requirement
Certified commodities should have physical traceability back to the commodity production site. *	Recommendation
If there is not physical traceability of the certified commodity, the reporting company shall engage with the certification scheme to promote physical traceability. *	Requirement

*Note:
These two requirements in the criteria for this section may not initially seem related to data quality. However, in reviewing certification scheme literature[1][2][3], and the new guidance for the Greenhouse Gas Protocol[4], there is an emphasis on physical traceability in order to evidence supply chain emissions. This is particularly true in relation to accounting for land-use change emissions, which many certification schemes are concerned with through certifying deforestation-free supply. These requirements and recommendations have been included in order to balance the robustness of the Greenhouse Gas Protocol and best practice with the reality of how many certification schemes currently operate. The requirements will be reviewed as that reality evolves.

[1] Understanding Better Cotton's Traceability Journey - Better Cotton
[2] deforestation-position-paper.pdf (rainforest-alliance.org)
[3] Reporting, Disclosure, and Claims | Accountability Framework (accountability-framework.org)
[4] Land Sector and Removals Guidance | Greenhouse Gas Protocol (ghgprotocol.org)

Figure 12 – Certification scheme examples of acceptable data usage



3 Assessing the data quality

Section principles

The EF with the best data quality should be used.

When assessing data quality, individual scores for each dimension of quality (time, geography, technology etc.) should be assessed and aggregated.

When assessing an adjustment factor, the pre-adjusted EF should also be assessed.

The data quality framework developed in WRAP's Scope 3 Protocols (Section 6, Table 9) is key for businesses to assess whether data is of sufficient quality to be included in their inventories. This section guides companies in determining what data quality thresholds there are, and whether they have been met.

If the new data is a new EF, the requirements from Section 3.1 shall be followed and the recommendations from Section 3.1 should be followed. If the new data is an adjustment factor and a pre-adjusted EF, the the requirements from Section 3.2 shall be followed and the recommendations from Section 3.2 should be followed.

3.1 Emission factor data quality

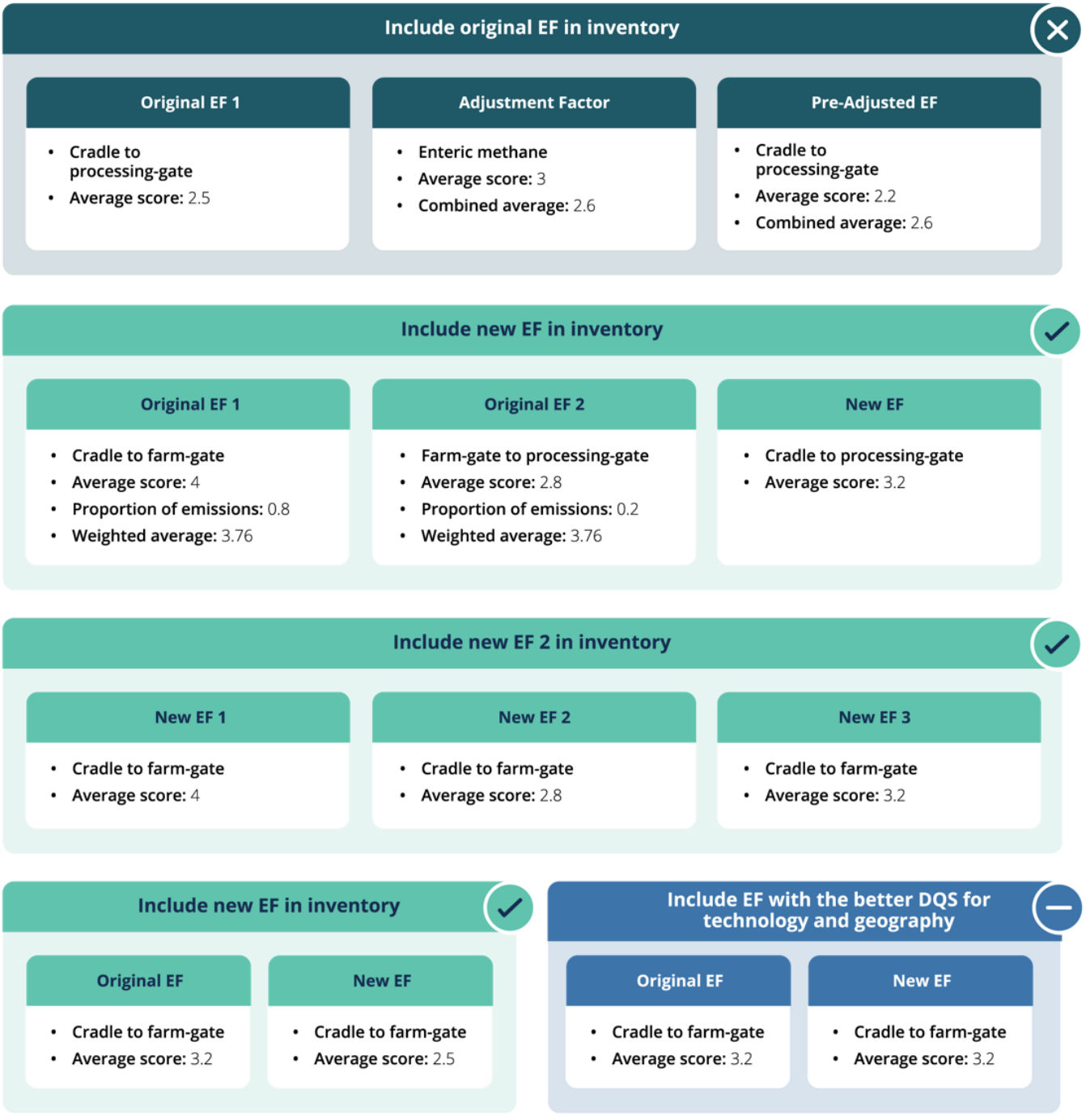
If the new data is a new EF, the requirements in Table 32 shall be followed and the recommendations in Table 5 should be followed.

Table 32 – Requirements and recommendations for data quality assessment of emission factors in a GHG inventory

Criteria	Recommendation/ Requirement
The new EF shall be assessed against each column individually in the data quality framework (DQF) for EFs, and the average score shall be recorded.	Requirement
Alongside data quality, data comparability is an important consideration for data within a scope 3 inventory. Therefore, if co-product allocation occurs within the LCA related to the new EF, it should be consistent with the existing EFs within the inventory.	Recommendation
If the new EF is replacing an original EF that is already being used within the reporting company's GHG inventory, then the new one shall have an equal or better (lower) average score than the original one when assessed against the data quality score (DQS). If the new and original EFs have the same score, then the preference is to the EF with the better DQS for **technology and geography** (see Figure 4, bottom right table). If there is still no preferred emission factor, the larger EF shall be used to reflect the conservativeness principle of the GHG Protocol.	Requirement
If the new EF is replacing a combination of original EFs that are already being used within the reporting company's GHG inventory, then the new one shall have an equal or better (lower) average score than the weighted average score of original ones when assessed against the DQFs, weighted by the original EFs' relative sizes. If the new and original EFs have the same score, then the preference is to the EF with the better DQS for **technology and geography** (see Figure 4, bottom right table). If there is still no preferred emission factor, the larger EF shall be used to reflect the conservativeness principle of the GHG Protocol.	Requirement
If there are multiple EFs being considered for use with new activity data, then the EF with the best (lowest) average score shall be used. If there are any adjustment factors being considered as well, their average score shall be calculated using Section 3.2 and the best scoring new / adjusted EF shall be used (see Figure 4).	Requirement

Note:
The DQF for EFs can be found in Appendix A, while further guidance on scoring technology and geography can be found in Appendix C.
We understand that in some cases DQFs that cover more properties, or greater granularity than that set out in the WRAP guidance may be used. However as a minimum we would expect the properties and granularity included in Appendix A to be covered.

Figure 13 – Data quality assessment examples for comparing between emission factors.



3.2 Adjustment factor data quality

If the new data is an adjustment factor and a pre-adjusted EF (an EF that does not include the effects of an intervention, and is to be adjusted by an adjustment factor to account for the intervention), the requirements in Table 33 shall be followed and the recommendations in Table 33 should be followed.

Table 33 – Requirements and recommendations for data quality assessment of adjustment factors in a GHG inventory

Criteria	Recommendation/ Requirement
The adjustment factor shall be assessed against each column individually in the DQF for adjustment factors, and the average score shall be recorded.	Requirement
The pre-adjusted EF shall be assessed against each column individually in the DQF for EFs, and the average score shall be recorded. When scoring for geography, time, and technology, this shall be in comparison to the pre-adjusted system (the true system, but with the assumption that the intervention represented by the adjustment factor has not occurred).	Requirement
The average data quality score for the adjusted EF shall be given by averaging the average data quality score for the adjustment factor and pre-adjusted EF. The average score shall be recorded as the data quality score for the adjusted EF.	Requirement
Alongside data quality, data comparability is an important consideration for data within a scope 3 inventory. Therefore, if co-product allocation occurs within the LCA related to the pre-adjusted EF or adjustment factor, it should be consistent with the existing EFs within the inventory.	Recommendation
If the adjusted EF is replacing an original EF, then the adjusted EF shall have an equal or better (lower) average score than the original one when assessed against the DQFs. If the adjusted and original EFs have the same score, then the preference is to the EF with the better DQS for **technology and geography** (see Figure 4, bottom right table). If there is still no preferred emission factor, the larger EF shall be used to reflect the conservativeness principle of the GHG Protocol.	Requirement
If the adjusted EF is replacing a combination of original EFs, then the adjusted EF shall have an equal or better (lower) average score than the weighted average score of original ones when assessed against the DQFs, weighted by the original EFs' relative sizes. If the adjusted and original EFs have the same score, then the preference is to the EF with the better DQS for **technology and geography** (see Figure 4, bottom right table). If there is still no preferred emission factor, the larger EF shall be used to reflect the conservativeness principle of the GHG Protocol.	Requirement
If there are multiple adjusted EFs being considered for use with new activity data, then the adjusted EF with the best (lowest) average score shall be used. If there are any emissions factors being considered as well, their average score shall be calculated using Section 3.1 and the best scoring new / adjusted EF shall be used (see Figure 4).	Requirement

Note:
The DQF for EFs can be found in Appendix A, and the DQF for adjustment factors can be found in Appendix B, while further guidance on scoring technology and geography can be found in Appendix C. We understand that in some cases DQF that cover more properties than that set out in the WRAP guidance may be used. However as a minimum we would expect the properties included in Appendices A and B to be covered.

4 Including the new data

Section principles

When using an adjustment factor, only the proportion of emissions that aligns with the system boundary of the adjustment factor should be adjusted.

When replacing an original EF, only the proportion of emissions that aligns with the lifecycle stage of the new / adjusted EF should be replaced.

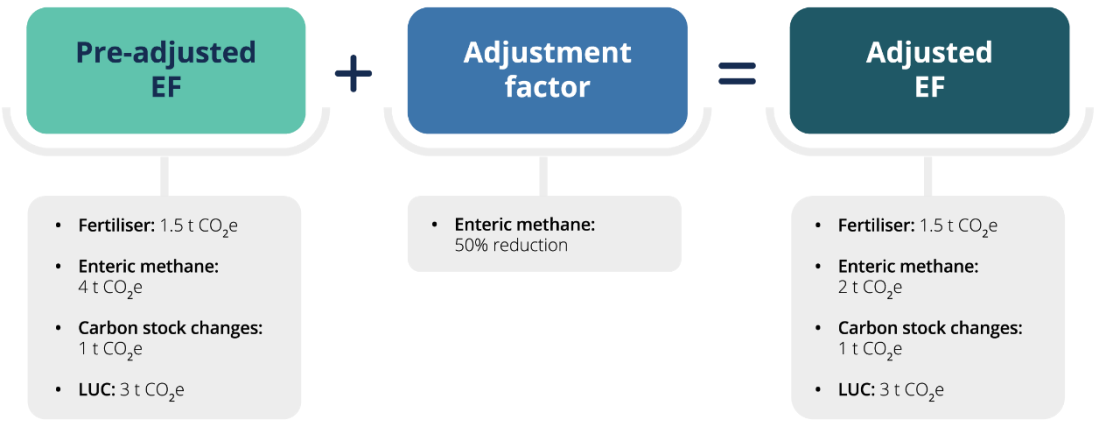
If the new data is a new adjustment factor and pre-adjusted EF, Section 4.1 of the annex shall be followed. If the new data is an EF, Section 4.2 of this annex shall be followed.

4.1 Adjusting an emission factor

If the new data is an adjustment factor and a pre-adjusted EF, the following steps are requirements and shall be followed (see Figure 14).

1. The part of the pre-adjusted EF that relates to the intervention to be adjusted for shall be identified and isolated.
2. The part of the pre-adjusted EF isolated in the previous step shall be modified by the adjustment factor.
3. The modified part of the pre-adjusted EF shall be added back into the rest of the pre-adjusted EF to create the adjusted EF.
4. The adjusted EF shall be included in the inventory by following the requirements and recommendations in Section 4.2 of this annex.

Figure 14 – Diagram for adjusting an emission factor



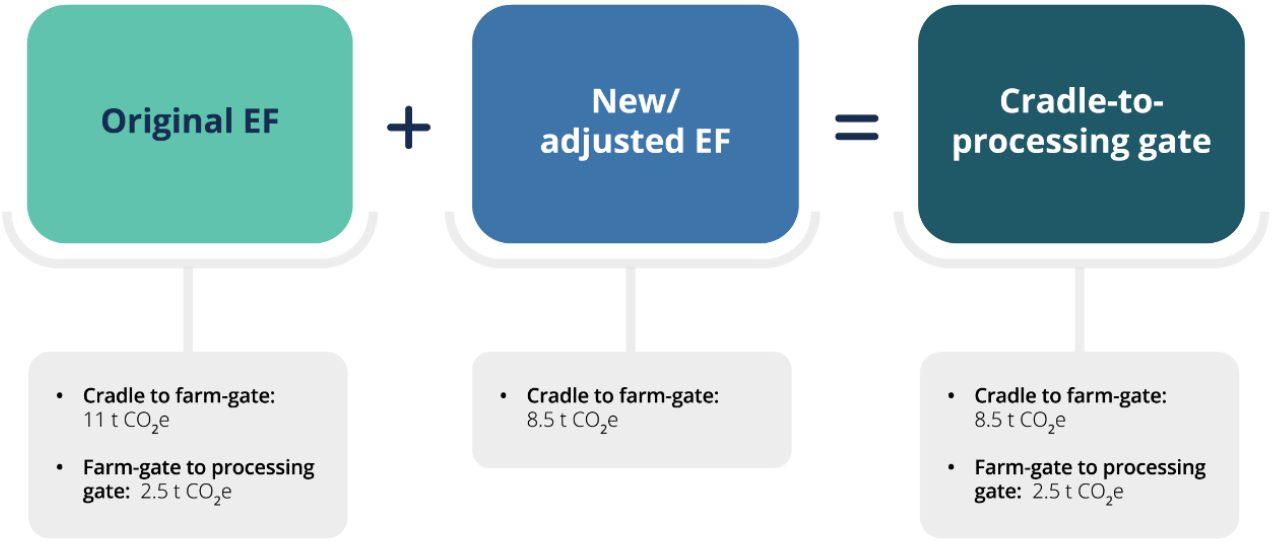
4.2 Replacing an emission factor

If the new data is a new EF, or if an adjusted EF has been calculated in Section 4.1, but it is not replacing an original EF (for example if it is for a new product line that hasn't previously had an EF related to it) then the new / adjusted EF can simply be used in the inventory as it is.

If the new / adjusted EF is replacing an original EF, then the following steps are requirements and shall be followed (see Figure 15):

1. The part of the original EF (or multiple EFs) that represent the same lifecycle stage as the new / adjusted EF shall be identified and isolated.
2. The part of the original EF isolated in the previous step shall be replaced by the new / adjusted EF.
3. The new / adjusted EF, along with any part of the original EF that represents a different lifecycle stage can now be used in the inventory.

Figure 15 – Diagram for replacing an emission



5 Including new data in base year inventories

Section principles

When new / adjusted emission factors are included in a current year inventory, they should be assessed for inclusion in the base year as well.

The assessment should focus on comparing data quality between the EF and the original one in the base year inventory. Data quality for the EFs should be assessed against the base year and the system from the base year.

If changes from the original base year EF to the new EF can be shown to represent true changes in practice, those changes should be able to be accounted for.

This section describes best practice for updating the emission factors in a base year inventory after new data has been included in the current year inventory, following Sections 1-4 of this document. After determining whether to include a new or adjusted EF in a current year inventory, it is best practice to assess the same data for inclusion in the base year inventory as well. This is done by going through Sections 1-4 of this guidance with the new / adjusted EF and the corresponding existing EF in the base year inventory, focussing on comparing the data quality score of the two. The EF with the highest data quality should be included in the inventory, noting that when data quality is assessed in this case, the scores for geography, technology and time are scored against the base year and the system from the base year. The requirements in Table 34 shall be followed and the recommendations in Table 34 should be followed.

Table 34 – Requirements and recommendations for including new data in a base year GHG inventory

Criteria	Recommendation/ Requirement
The new / adjusted EF should be assessed for inclusion in the base year inventory.	**Recommendation**
To assess for inclusion, **Sections 1-4** of this guidance shall be followed to compare the new / adjusted EF with the original EF in the base year.	**Requirement**
When following this guidance, the assessment should focus on comparing data quality between the new / adjusted EF and the existing one in the base year inventory. Data quality for the EFs should be assessed against the base year and the system from the base year.	**Recommendation**

Table 34 – Requirements and recommendations for including new data in a base year GHG inventory (cont.)

Criteria	Recommendation/ Requirement
Quantitative and / or qualitative evidence should be used to make adjustments to the new / adjusted EF before assessing it for inclusion in the base year inventory.	Recommendation
If a significant difference (>10%) in emission factors between the current year and base year remains after the above assessment, due diligence checks shall be taken and evidence recorded to show confidence that the change is a reasonable reflection of changes in practice.	Requirement

5.1 Examples

When assessing the EFs for inclusion in the base year, there are several important points to take account of: the data quality assessment shall be relative to the base year and the production system of the base year; how to use quantitative evidence to adjust EFs; and how to use qualitative evidence to adjust EFs. The following examples illustrate how these points work in practice.

Example 1: A new EF, no evidence of reductions

Reporting company A has assessed a new milk emission factor for inclusion within their 2023 inventory. The new EF is 0.8 kg CO_2e / L milk, and through the assessment they have decided to include the EF in company A's 2023 inventory. They are now assessing the new EF for inclusion in the base year inventory by following Sections 1-4 of this annex.

The requirements of Sections 1-2 of this annex have already been met because the new EF was assessed against them when it was included in the 2023 inventory. Therefore, the data quality score of the new EF shall be compared to the data quality score of the original EF to determine which should be included in the base year inventory.

The new EF represents milk produced conventionally from supplier X and has been obtained through a supplier-provided LCA from 2023. The original EF (2 kg CO_2e / L milk) represents milk produced conventionally from the UK and has been obtained from a standard database of default EFs. The original EF was produced in 2006. Company A's base year is 2015, and in that year they were supplied by multiple suppliers for milk from the UK. They have activity data available for conventionally produced milk, but it is not broken down by supplier. Table 35 shows the scores for each emission factor.

As a result of the data quality assessment, the original EF is found to have a better data quality score than the new EF for the base year inventory. Therefore, the original EF should continue to be used in the base year inventory. This means there is a 60% change in emission factors from the base year to the current year, and therefore company A shall undertake due diligence checks to be confident that the reduction reflects genuine changes in practice.

Table 35 – Assessment of new and original EFs against a company's base year

Emission Factor	Technology	Time	Geography	Completeness	Reliability
New EF: supplier X, conventional milk, 2023	Technological advances between 2015 and 2023 mean the production system is different and high variability between EF and the true prodution system	8 year difference between EF and emission inventory	EF represents a < 50% share of UK conventional milk, but variability expected to be low	High quality sampling, all relevant lifecycle stages included	Conducted to PAS2050 standard but not third-party verified
Score	**4**	**3**	**3**	**1**	**3**
Original EF: Standard default, UK average, conventional milk, 2006	Technological advances between 2006 and 2015 mean the production system is different but low variability between EF and the true production	9 year difference between EF and emission inventory	EF represents UK conventional milk, which is the same as known geography of the purchased milk	Good quality sampling, all relevant lifecycle stages included	Emission factor obtained from peer-reviewed journal
Score	**3**	**3**	**1**	**2**	**2**

Example 2: An adjusted EF

Reporting company B has assessed an adjusted beef emission factor for inclusion within their 2023 inventory, and through the assessment they decided to include it. The pre-adjusted EF was 14kg CO_2e / kg beef, it was taken from a database of emission factor that conform to PAS 2050. The adjustment factor was a 20% reduction due to the inclusion of algae as a methane inhibitor in diets to reduce methane production, which was identified in a peer-reviewed meta-analysis. Therefore, the adjusted beef EF that was used in company B's 2023 inventory is 11.2kg CO_2e / kg beef. They are now assessing the new EF for inclusion in the base year inventory by following Sections 1-4 of this guidance.

The requirements of Sections 1-2 of this guidance have already been met because the pre-adjusted EF was assessed against them when it was adjusted and included in the 2023 inventory. Therefore, the data quality score of the baseline EF shall be compared to the data quality score of the original EF to determine which should be included in the base year inventory. It is found that the data quality score for the pre-adjusted EF is 2.2, and for the original EF it is 2.4. Therefore, the pre-adjusted EF should replace the original EF in the base year inventory, and a reduction of 2.8kg CO_2e / kg beef can be claimed. This means there is a 20% change in emission factors from the base year to the current year. It has already been identified that this is a result of algae inclusion in the cows' diets, therefore this can be recorded and no further due diligence check are required.

Example 3: A new EF, quantitative evidence of reductions

Reporting company C has assessed a new wheat emission factor for inclusion within their 2023 inventory. The new EF is 0.2 kg CO_2e / kg wheat, and through the assessment they have decided to include the EF in company A's 2023 inventory. They are now assessing the new EF for inclusion in the base year inventory by following Sections 1-4 of this guidance.

The new EF has been provided by a supplier, along with evidence that their wheat yields have increased by 20% between their base year of 2015 and 2023 while per hectare emissions have not changed. As evidence they have supplied their recorded yields for 2015 and 2023 and evidence that genetic changes to their wheat variety has provided the changes in yield without affecting any input requirements.

Therefore, for the base year, an adjustment factor of 1.2 can be applied to the new EF and together they can be assessed against the original EF. The evidence for the adjustment factor (yield and wheat variety changes) shall be recorded by the reporting company.
The requirements of Sections 1-2 of this guidance have already been met by the new EF when it was assessed for inclusion in the 2023 inventory. Therefore, the requirements for an adjustment factor in Sections 1-2 shall be met, and then the data quality score of the EF and adjustment factor shall be compared to the data quality score of the original EF to determine which should be included in the base year inventory. **Table 9** shows how the requirements have been met.

Table 36 – Assessment of an adjustment factor against requirements and recommendations

Criteria	Met	Justification
A pre-adjusted EF shall also be identified that **does not** include the effect of the intervention.	Yes	The pre-adjusted EF is for wheat with enhanced genetics, while the adjustment factor reduces the effect of genetic enhancement.
The process or lifecycle stage that the adjustment factor relates to shall match the section of the pre-adjusted EF to be adjusted (see **Figure 2**).	Yes	The adjustment factor relates to cradle-to-farm gate emissions, which matches the entire EF.
If the adjusted EF is being used to replace all or part of an original EF, the lifecycle stage that the new EF relates to shall be identifiable within the lifecycle stages of the original (see **Figure 1**). Multiple original EFs can be used but the same principle should be followed (see **Figure 1**).	Yes	The original EF for the base year inventory is for cradle-to-farm gate emissions, matching the lifecycle stage for the adjusted EF.
GHG emissions shall be calculated using IPCC GWP100 conversion values.	Yes	The pre-adjusted EF has been calculated using the latest IPCC GWP100 values.

Table 36 – Assessment of an adjustment factor against requirements and recommendations (cont.)

Criteria	Met	Justification
GHG emissions shall be calculated using the most recent IPCC GWP100 conversion values.	Yes	The pre-adjusted EF has been calculated using the latest IPCC GWP100 values.
The pre-adjusted EF and the adjustment factor shall include emissions from land management and land-use change.	Yes	The pre-adjusted EF includes land management and LUC emissions. The adjustment factor is stated to affect yield only, and therefore land management and LUC emissions are accounted for.
Land management and land-use change (LUC) emissions shall be calculated in alignment with the Greenhouse Gas Protocol (GHGP) Land Sector and Removals Guidance (LSRG).	No	Recommendation only.
Land management and LUC emissions should be reported separately to other emission sources.	No	Recommendation only.
The data quality assessment in Section 3 should be undertaken by the supplier.	No	Recommendation only.
The data quality assessment in Section 3 should be undertaken by the reporting company, with the help of answers provided by the WRAP supplier questionnaire.	Yes	This is done below.
The data quality assessment in Section 3 shall be undertaken by either the supplier or the reporting company as a minimum.	Yes	This is done below.
If the functional unit of the data **does not** match the unit the reporting company purchases in, the supplier shall provide a suitable conversion factor.	Yes	Functional unit of kg wheat matches the purchasing unit.

Since the requirements of Sections 1-2 have been met, the reporting company may now assess the data quality of the new emission factor and adjustment factor to compare it to the data quality of the original EF in the base year inventory.

The new EF represents wheat produced conventionally from supplier Y and has been obtained through a supplier-provided LCA from 2023. The original EF represents wheat produced conventionally from the UK and has been obtained from a standard database of default EFs. The original EF was produced in 2010. Company A's base year is 2015, and in that year they were supplied by multiple suppliers for wheat from the UK. However, they have activity data available for conventionally produced wheat broken down by supplier, therefore they only assess the new EF and adjustment factor against that wheat.

When assessing the data quality, company C finds that the new EF scores 2.3, the adjustment factor score 3.5 and the original EF score 3.1. Therefore, the adjusted EF scores 2.9 and that is the one included within the base year inventory. It is used for supplier Y's wheat only, and the original EF continues to be used for the rest of the wheat in the base year. The emission factor related to supplier Y's wheat has reduced by 1/6 between the base year and current year, therefore due diligence checks shall be made to ensure the reduction reasonably reflects changes in practice.

Example 4: A new EF, qualitative evidence of reductions

Reporting company D has assessed a new, industry average, lamb emission factor for inclusion within their 2023 inventory. The new EF is 3.7 kg CO_2e / kg lamb, and through the assessment they have decided to include the EF in their 2023 inventory. They are now assessing the new EF for inclusion in the base year inventory by following Sections 1-4 of this guidance.

Company D know that there have been significant changes between their base year of 2016 and 2023, which is the year that the new EF relates to. In particular, they know there has been a reduction in embodied emissions related to the animal feed, and there has been a reduction in the age of slaughter. They are able to evidence these changes through industry reports, however, they have not been able to quantify their impact.

There are two ways in which this information may be used in the assessment of the new EF for the base year inventory. Either it may be used to justify a worse technology data quality score, or it may be used to identify and select processes within the EF to change.

In the first case, if the impacts are large enough, a score of 4 may be justified, over a score of 2 or 3 without this evidence. In the second case, if the new EF provides a breakdown of the sources of emissions, for example if Table 37 is provided, then the emissions from the changed process may be sourced elsewhere.

Table 37 – Identification of emissions sources available in a new and original EF.

Emission source	New EF Emissions (kg CO_2e / kg lamb)	Original EF Emissions (kg CO_2e / kg lamb)
Enteric methane	2.0	
Animal feed	0.8	1.2
Machinery	0.2	
Manure management	0.5	
Soil carbon stock changes	-0.1	
Other	0.3	
Total	**3.7**	**5.1**

For company D, they are able to identify animal feed changes within both the new EF and the original base year EF. Therefore, they decide to assess the new EF against the original EF in the base year, except for animal feed which they keep the as the number from the original EF (1.2 kg CO_2 e / kg lamb).

Company D also decide that the significance of the changes in age of slaughter means that they score the new EF a 4 in technology, resulting in an overall score of 2.8. In contrast, the original EF scores 3.1. Therefore, despite the evidence of changes in age of slaughter, the new EF is used in the base year instead of the original EF. However, for emissions related to animal feed, the original EF is still used. Therefore, the EF for the base year inventory is 4.1 kg CO_2 e / kg lamb a reduction of 0.4 kg CO_2 e / kg lamb can be claimed. This is a 9% reduction and therefore no due diligence checks are required.

Appendices

A: Data quality framework for emission factors

Descriptor	Score	Technology	Time	Geography	Completeness	Responsibility
Very good	1	Emission factor represents the same production method / technology (e.g. greenhouse production heated using natural gas)	Data age less than 3 years	Emission factor represents the same processing / production site (e.g. the specific farm where the product is sourced from)	Highly complete - all appropriate life cycle stages and GHGs are covered. Either all relevant production sites are covered, or if sampling has occurred then sampling is an excellent representation of the relevant production sites. Sampling is an excellent representation of sites when all **three** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the EF is being used in.	Emission factor is from a peer-reviewed meta-analysis, systematic review, umbrella analysis or equivalent, or it is quantified in accordance with a published **sector-specific** standard (e.g. PEFCR, PAS 2050 Category Rule, GHG Protocol Sector Guidance) and verified by a third party, or it is an aggregation of multiple of the above. Methodology reporting is explicit and detailed. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.
Good	2	Emission factor represents a similar production method / technology	Data age 3-5 years	Emission factor represents a processing / production site from the same geographical area (e.g. UK production for a UK-sourced product)	Mostly complete - All appropriate life cycle stages and GHGs included in models and reporting. Data sampling promises good representation of the relevant production sites. Sampling is a good representation of sites when **two** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the EF is being used in.	Emission factor is from a peer-reviewed journal paper, or it comes from a meta-analysis verified by a third party, or it is quantified in accordance with a published product footprinting standard (e.g. PEF, PAS2050, GHG Protocol Product Standard) and verified by a third party, or it is an aggregation of multiple of the above. Methodology reporting is explicit and detailed. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.

A: Data quality framework for emission factors (cont.)

Descriptor	Score	Technology	Time	Geography	Completeness	Responsibility
Fair	3	Emission factor represents a different production method / technology - but technological variability is expected to be low	Data age 5-10 years	Emission factor represents a geographical area which could have different production characteristics (e.g. European production) - but geographical variability is expected to be low	Generally complete - All appropriate life cycle stages and GHGs included in models, but not reporting. sampling of data promises reasonable representation of the relevant production sites. Sampling is a reasonable representation of sites when **one** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the EF is bein used in.	Emission factor comes from a meta-analysis, or it is quantified in accordance with a published product footprinting standard and/or sector-specific rules - but not verified by a third party. Methodology reporting is of limited detail. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.
Poor	4	Emission factor represents a different production method / technology - and technological variability is expected to be high	Data age more than 10 years	Emission factor represents a geographical area which could have different production characteristics (e.g. global average value) - and geographical variability is expected to be high	Some life cycle stages and GHGs not included, or uncertainty remains as to whether they were included. Data covers a small sample of overall activities and is unlikely to be representative of the relevant production sites. Sampling is unlikely to be representative of sites when **none** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the EF is being used in.	Calculation method for emission factor is not described in source publication; or not reported to be in line with a standard methodology, or it is an aggregation of multiple of the above. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.

A: Data quality framework for emission factors (cont.)

Descriptor	Score	Technology	Time	Geography	Completeness	Responsibility
Unsuitable	5	Technological representativeness of emission factor is unknown	[n/a - no threshold]	Geographical representativeness of emission factor is unknown	Completeness of emission factor is unknown	Source is unknown, or it is an aggregation of multiple unknown sources. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.

B: Data quality framework for adjustment factors

Descriptor	Score	Technology	Time	Geography	Completeness	Responsibility
Very good	1	Adjustment factor represents the same intervention on the same product and production method (e.g. seaweed methane inhibitor in dairy cows)	Data age less than 3 years	Adjustment factor represents the same processing / production site (e.g. the specific farm where the product is sourced from)	Highly complete - all appropriate life cycle stages and GHGs are covered. Either all relevant production sites are covered, or if sampling has occurred then sampling is an excellent repres-entation of the relevant production sites. Sampling is an excellent representation of sites when all **three** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the adjustment factor is being used in	Adjustment factor is from a peer-reviewed meta-analysis, systematic review, umbrella analysis or equivalent, or it is quantified in accordance with a published intervention accounting standard (e.g. Gold Standard intervention guidance, GHGP Project Protocol) and verified by a third party, or it is an aggregation of multiple of the above. Methodology reporting is explicit and detailed. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.
Good	2	Adjustment factor represents the same intervention on a similar product or production method (e.g. seaweed methane inhibitor in cows)	Data age 3-5 years	Adjustment factor represents a processing / production site from the same geographical area (e.g.UK production for a UK-sourced product)	Mostly complete - All appropriate life cycle stages and GHGs included in models and reporting. Data sampling promises good representation of the relevant production sites. Sampling is a good representation of sites when **two** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations.	Adjustment factor is from a peer-reviewed journal paper, or it comes from a meta-analysis verified by a third party, or it is an aggregation of multiple of the above. Methodology reporting is explicit and detailed. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.

B: Data quality framework for adjustment factors (cont)

Descriptor	Score	Technology	Time	Geography	Completeness	Responsibility
Fair	3	Adjustment factor represents the same intervention on a different product or production method - but variability of intervention efficacy is expected to be low	Data age 5-10 years	Adjustment factor represents a geographical area which could have different production characteristics (e.g. European production) - but geographical variability is expected to be low	Generally complete - All appropriate life cycle stages and GHGs included in models, but not reporting. sampling of data promises reasonable representation of the relevant production sites. Sampling is a reasonable representation of sites when **one** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, not in relation to the system that the adjustment factor is being used in	Adjustment factor comes from a meta-analysis, or it is quantified in accordance with a published intervention accounting standard (e.g. Gold Standard intervention guidance, GHGP Project Protocol) - but not verified by a third party, or it is an aggregation of multiple of the above. Methodology reporting is of limited detail. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.
Poor	4	Adjustment factor represents the same intervention on a different product or production method - and variability of intervention efficacy is expected to be high	Data age more than 10 years	Adjustment factor represents a geographical area which could have different production characteristics (e.g. global average value) - and geographical variability is expected to be high	Some life cycle stages and GHGs not included, or uncertainty remains as to whether they were included. Data covers a small sample of overall activities and is unlikely to be representative of the relevant production sites. Sampling is unlikely to be representative of sites when **none** of the following are true: • If there are n relevant sites, then at least $\sqrt{n}$ sites are sampled. • The sites sampled represent at least 50% of relevant production. • Sampling has occurred over multiple time periods to even out fluctuations. In this case, relevance is in relation to the LCA system, no in relation to the system that the adjustment factor is being used in	Calculation method for adjustment factor is not described in source publication; or not reported to be in line with a standard methodology, or it is an aggregation of multiple of the above. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.

Descriptor	Score	Technology	Time	Geography	Completeness	Responsibility
Unsuitable	5	Technological representativeness of emission factor is unknown	[n/a - no threshold]	Geographical representativeness of emission factor is unknown	Completeness of emission factor is unknown	Source is unknown, or it is an aggregation of multiple unknown sources. If methodologies refer to third party tools, then this level of reliability is reached by the third-party tool. Note that for aggregations to meet this level of reliability, every adjustment factor aggregated must meet or exceed this level of reliability.

C: Guidance for quality scoring technology and geography

Understanding what quality score to give technological and geographical representativeness can be more complex than the other categories within the DQF. This is primarily because the score for these categories depends on both what system the LCA represents and what system the reporting company is using the data for. An ideal situation is that the exact technological and geographical system that the EF related to is known, and so is the exact technology and geography of the product whose emissions are being calculated using the EF. However, a more realistic scenario is that the 'exact' technology is known only to some degree for the product (for example attempting to include whole milk in an inventory, without knowing exactly the farm management system), or for the LCA, or both. A similar scenario is frequently encountered with geography, and therefore further guidance is presented here to support scoring in such scenarios.

The overarching principle is that any missing information on technology or geography is assumed to be related to the market or purchasing share, or majority system, and that market / purchasing share is relative to the known technology or geography. For example, if it is known that a reporting company's product is whole milk from the UK, then a very good quality emission factor would be an emission factor that represents the 'average' market or reporting company purchased UK whole milk production system, and anything else would score worse. This difference might be because the EF is more specific (for example it is an EF for grass-fed UK whole milk), or it might be because the EF is less specific (for example it is an EF for 'average' UK milk), or it might have the same level of specificity for a different production system (for example it is an EF for 'average' UK semi-skimmed milk), but in any case the quality score would be worse than very good.

In the case that, following the above principle, the EF is not a very good match to the technology or geography of the product being included in the inventory then the following principle should be used to guide the scoring. For a good score, the technology or geography should be similar. By this it is meant that either the technology or geography of the product should be included in the emission factor as a proportionally large component, or the technology or geography of the emission factor is included in the product assumed market share as a proportionally large component. For example, if the product is UK whole milk, and it is understood that either the market share, or the purchasing share, is mostly from grass-fed cows, then an EF for whole milk from UK grass-fed cows would score good for technology. Similarly, if the product is UK whole milk and the EF is for UK and Irish whole milk with most of the milk assessed coming from the UK, this would score good for geography.

If the EF does not score very good or good, then deciding between whether it scores fair or poor depends on the expected difference between the emissions from the true production system and the emission factor. If this variability is likely to be low, then it would score fair, whereas if it is likely to be high it would score poor. Ideally this decision would be based on knowledge of differences in the production system, but when knowledge is lacking, or evidence cannot be found, a conservative approach is recommended.

It is important to understand that differences relating to geography should not be conflated with differences related to technology. For example, the production system for French broiler chickens may be very different to that of UK broiler chickens. If the reason for the difference is because of technologies or production processes then technological representativeness would be poor but not geographical necessarily, however if the reason for the difference is due to climatic conditions, weather, sunlight, or other geographical features of the region then the geographical representativeness would be poor but not necessarily the technological. There are times when both geography and technology are closely linked. For example, in the UK tomatoes are generally grown in heated greenhouses, while in Spain they are generally grown in unheated greenhouses or fields. There is a clear and very distinct difference in production technology between heated and unheated greenhouses, however the reason for the different production technologies is due to different climatic conditions. To untangle what scores to give geographical and technological representativeness in this case, the technology should be assumed to be the same between the product and emission factor and geography should be scored for representativeness, then keeping geography the same technology should be scored for representativeness. In the tomato example, first to score geographical representativeness, differences in unheated greenhouse tomatoes between the UK and Spain should be scored. Then, to score technological representativeness, differences between unheated and heated greenhouses in the UK should be scored. It should be noted that changing the order in which geography and technology are scored may affect the individual scores for each, and therefore geography should always be scored first while keeping technology the same.

To summarise

1. To score very good, the technology or geography of the product should match that of the EF, with any unknowns or aggregations assumed to be representative of the market or purchased share.
2. To score good, the technology or geography of the product should be a major contribution to that of the EF, or vice-versa, with any unknowns or aggregations assumed to be representative of the market or purchased share.
3. To score fair, the technology or geography of the product should be different, or not a major contribution, to that of the EF but with low expected variability, or vice-versa, with any unknowns or aggregations assumed to be representative of the market or purchased share.
4. To score poor, the technology or geography of the product should be different, or not a major contribution, to that of the EF and with high expected variability, or vice-versa, with any unknowns or aggregations assumed to be representative of the market or purchased share.
5. If there is potential conflation between technological and geographical scores, first technological representativeness should be assumed to be identical and geographical representativeness should be scored, then geographical representativeness should be assumed to be identical and technological representativeness should be scored.

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WRAP is a climate action NGO working around the globe to tackle the causes of the climate crisis and give the planet a sustainable future. We were established in the UK in 2000; we now work in 40+ countries.

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The Courtauld Commitment 2030 is a voluntary agreement that enables collaborative action across the entire UK food chain to deliver farm-to-fork reductions in food waste, GHG emissions and water stress that will help the UK food and drink sector achieve global environmental goals.

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