

Supply Chain GHG Emission Factors – Background and Plans for Update for Federal Reporting

Wesley Ingwersen, Ph.D.

Meeting of the Federal Scope 3 Community of Practice

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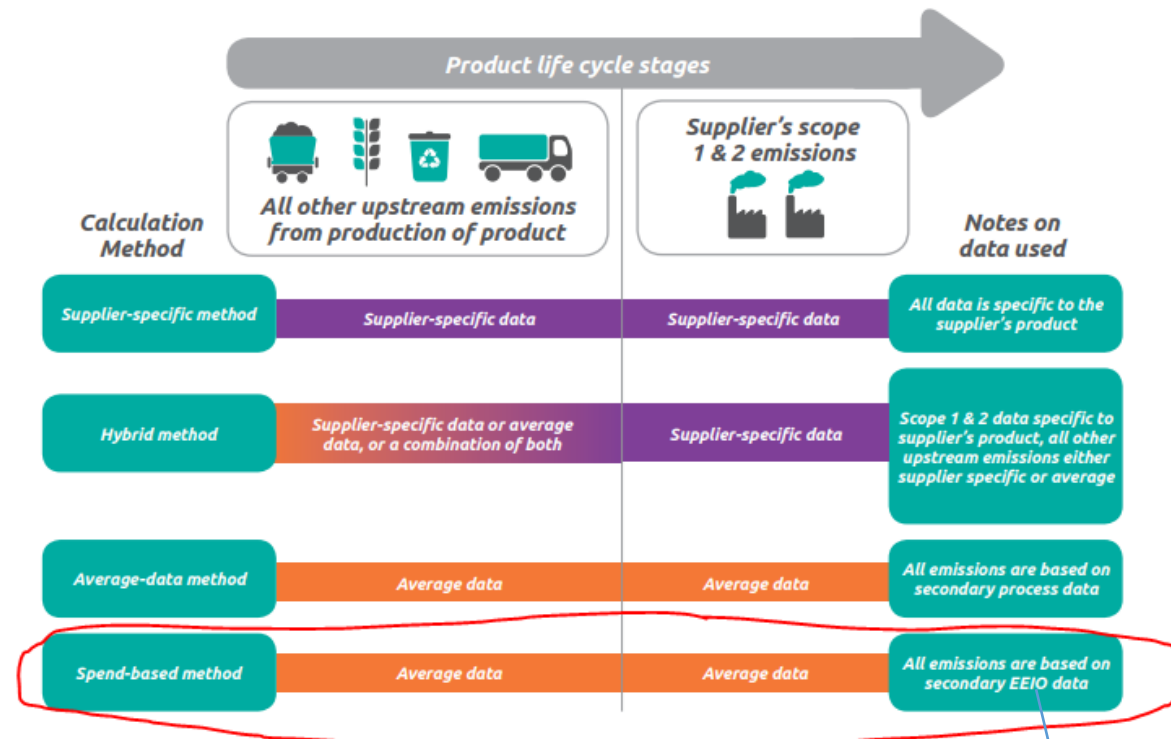
The U.S. Environmental Protection Agency, through its Office of Research and Development, funded and conducted the research described herein under an approved Quality Assurance Project Plan (K-LRTD-0030017-QP-1-3). It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Outline

- Scope 3 Reporting Methods
- Factor Overview
- Methods for Factors
- Discussion
- Plans for Factors for Federal Reporting

Scope 3 GHG Reporting Methods

Figure [1.1] Different data types used for different calculation methods



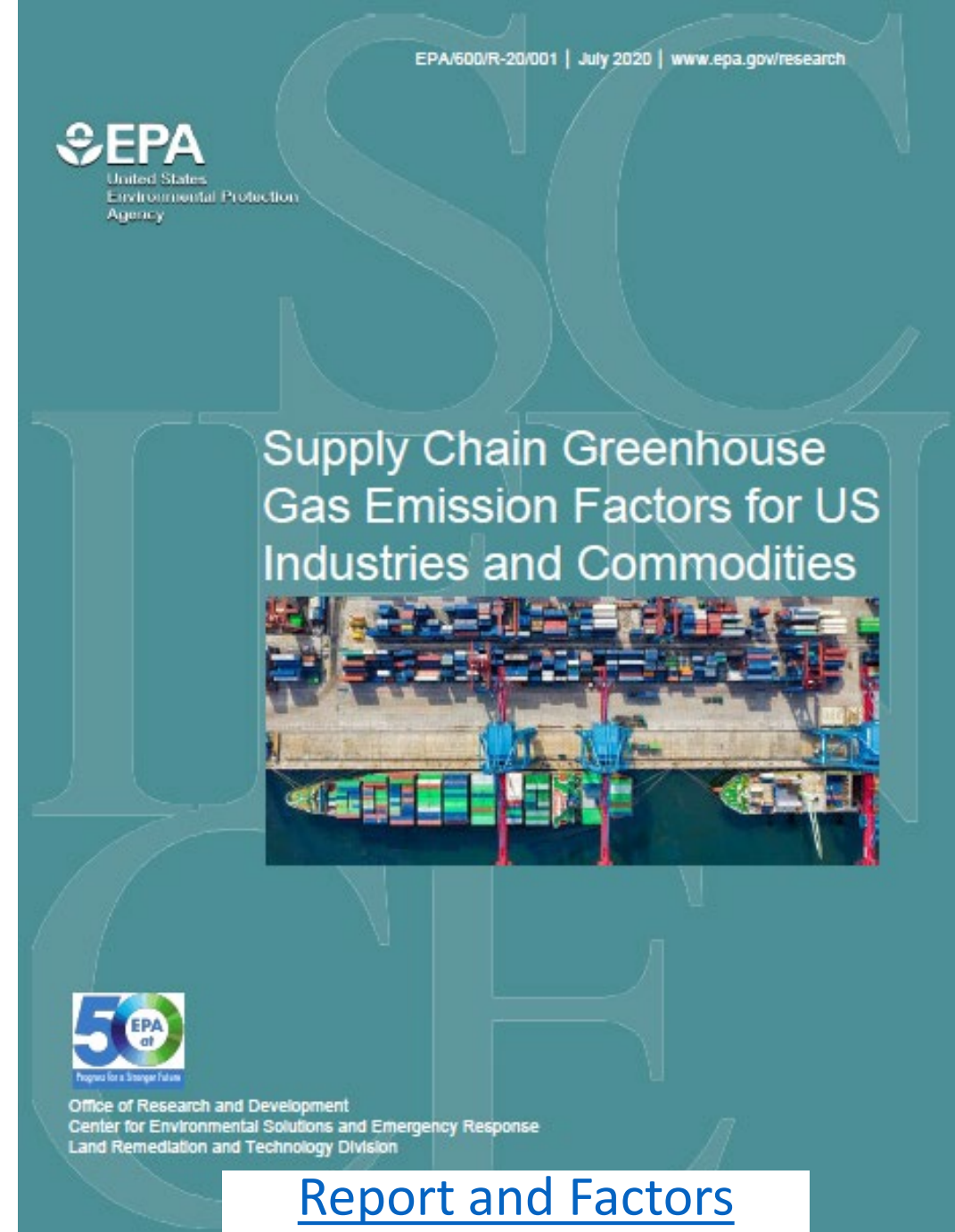
Source: WRI and WBCSB 2013

EEIO = environmentally-extended input-output

Factor Overview

Supply Chain Factors

- Spend-based factors, kg GHGs per \$
- Includes CO₂, CH₄, N₂O, other GHGs (SF₆, NF₃, CFCs/HFCs) reported in U.S. GHG Inventory
- v1.0 – v1.1.1 (releases to date)
 - Factors for all US-produced goods and services in summary-level classes (71) or detail-level classes (~385) for years 2010-2016
 - Either for industry or commodity classes



Form of the Factors

kg of GHG

\$ purchased of a commodity or from
an industry

*where \$ are in USD in purchaser
price*

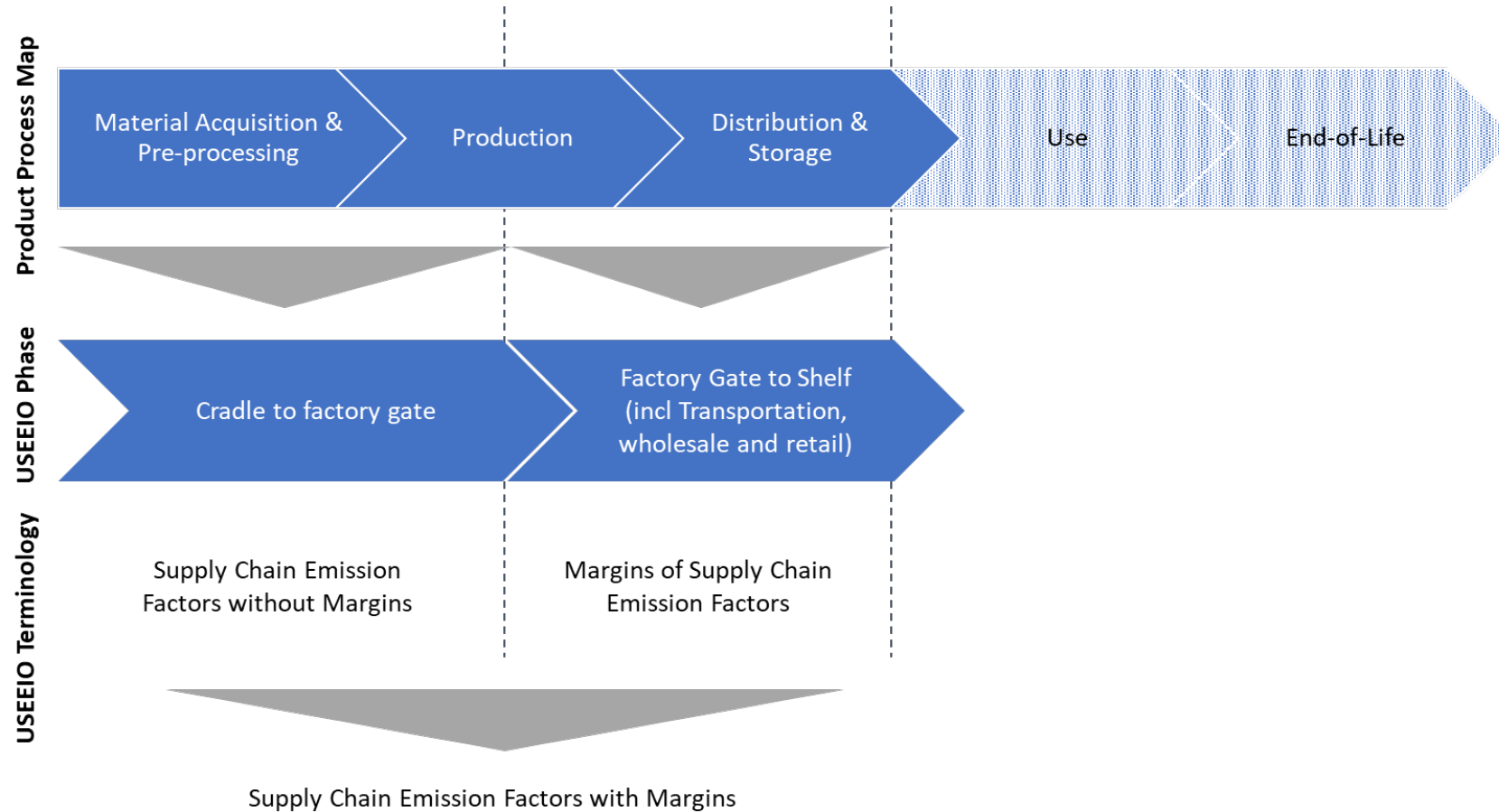
Examples

0.467 kg CO₂/\$ of farm commodities

0.008 kg CH₄/\$ of fresh wheat, corn,
rice and other grains

0.21 kg CO₂/\$ from the ship building
industry

The Coverage of the Factors in the Product Life Cycle



Types of Emission Factors (EFs)

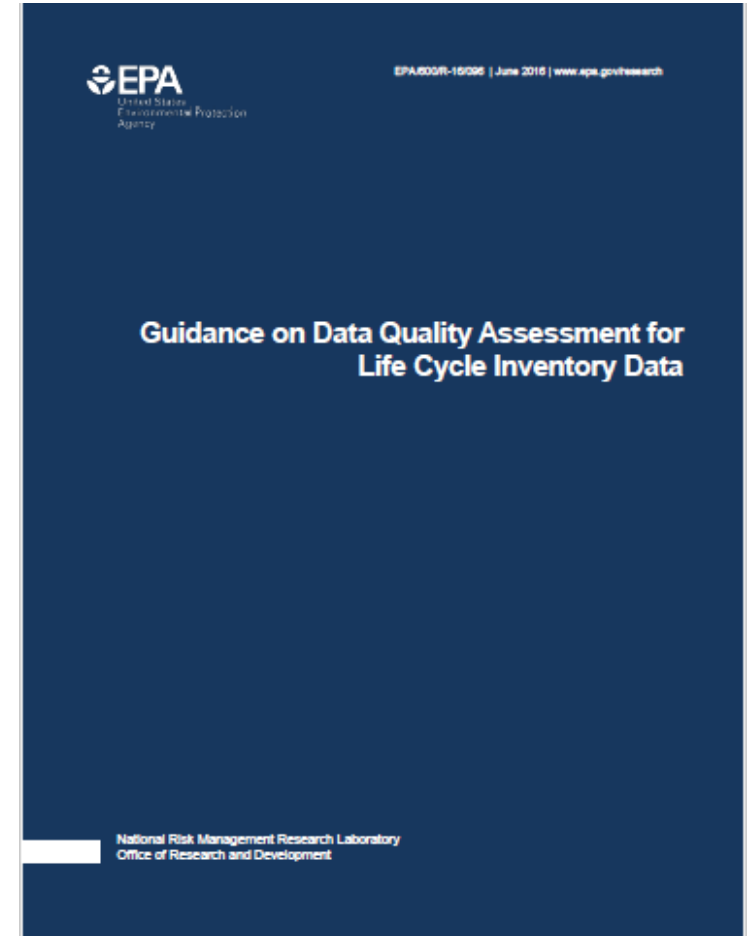
SEF (Supply Chain)

MEF (Margin)

SEF + MEF (Supply Chain +
Margin)

Data Quality (DQ) Scoring

- Pull in the DQ scores from the National GHG Industry Attribution Model
- Propagate the scores through the SEF calculations
- Provide each factor along with the 5 DQ scores
 - Scores for data reliability, temporal correlation, geographical correlation, technological correlation, data collection
 - 1 (best) to 5 (worst) quality



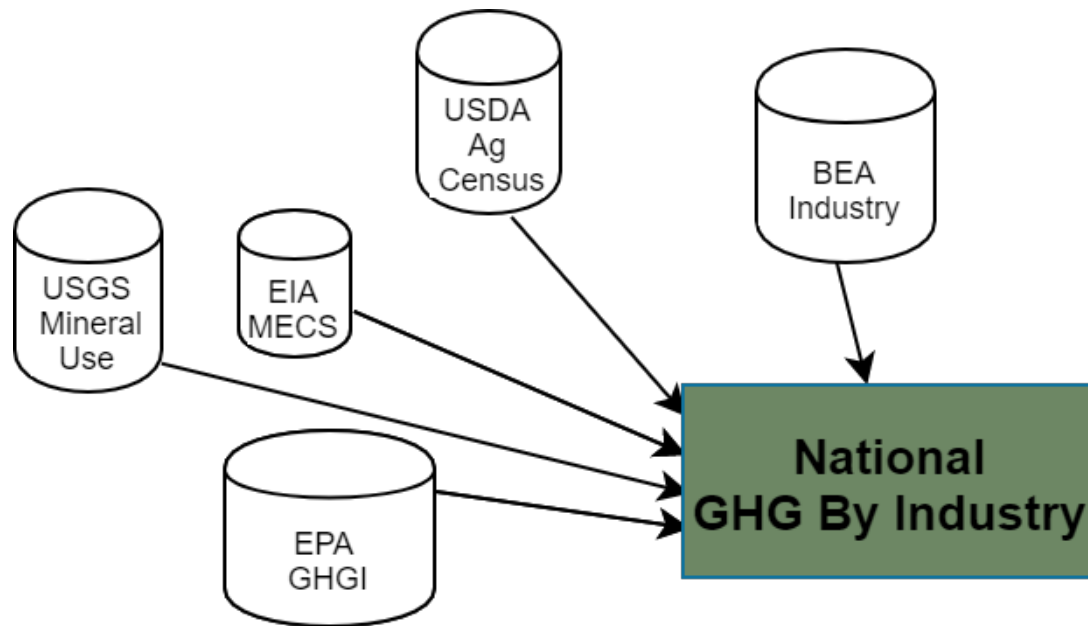
DQ Scores use USEPA (2016)

Methods for the Factors

Methods – Two Major Steps

1. Estimate direct GHG emissions by gas from US industries –
National GHG Industry (or Sector) Attribution Model
2. Combine direct GHG emissions with industry output and compute direct + indirect GHG emissions per industry per dollar –
U.S. Environmentally-Extended Input-Output (USEEIO) Model

National GHG Industry Attribution Model



- The EPA GHG Inventory is the source of all emissions data
- Additional sources are used to attribute/allocate emissions to industries
- Covered years 2010-2016
- Includes all GHGs in GHG Inventory excluding biogenic

National GHG Industry Attribution Model – Example Output

Sector	SectorName	Flowable	Year	FlowAmount	Unit	Data Reliability	Technological Correlation	Data Collection	Geographical Correlation	Temporal Correlation
1111A0	Oilseed farming	Methane	2016	1654711.554	kg	3	2	1	1	1
1111A0	Oilseed farming	Carbon dioxide	2016	9812587102	kg	4	4	1	1	1
1111A0	Oilseed farming	Nitrous oxide	2016	109284127.7	kg	4	4	1	1	1
1111B0	Grain farming	Methane	2016	560189821.1	kg	2	1	1	1	1
1111B0	Grain farming	Carbon dioxide	2016	41086224678	kg	4	5	1	1	1
1111B0	Grain farming	Nitrous oxide	2016	424056927	kg	4	4	1	1	1
111200	Vegetable and melon farming	Methane	2016	115507.6793	kg	4	4	1	1	1
111200	Vegetable and melon farming	Carbon dioxide	2016	1874759664	kg	4	5	1	1	1
111200	Vegetable and melon farming	Nitrous oxide	2016	26449355.41	kg	4	4	1	1	1
111300	Fruit and tree nut farming	Methane	2016	211937.7396	kg	4	4	1	1	1
111300	Fruit and tree nut farming	Carbon dioxide	2016	4383415557	kg	4	5	1	1	1

USEEIO Models

A family of environmentally-extended input-output (EEIO) models of the US

- Depict environmental and economic performance of all commodities and industries in the US
- Track ~2000 unique releases or resource types
- Report 20 environmental, resource and socio-economic impact indicator scores
- Built on > 10 million data points
- Include formal data quality characterization of results
- [Open source data and modeling framework](#)
- Most recent version (v2.0.1)
- Technical articles for [v1](#), [v2](#) and [slide overview](#)

Input-Output Data and USEEIO



- Uses of commodities by all industries and the Make of commodities by industries
- Detailed ~400 industry “benchmark” IO data every 5 yrs with 5+ yr delay; 2012 is latest
- Summary ~70 industry data annually with 1+ yr delay; 2021 is latest
- Supply Chain Factors can be created with either detailed or summary IO tables
- “Year” of factors = GHG Year; mix of IO year and GHG data year is done with appropriate adjustment procedures described in report

Price adjustments - Price Type and Year

1. Adjust \$ in denominator to correct price type from producer to purchaser price

- Commodity-specific margin data is used to make the price type adjustment

2. Adjust \$ in denominator to correct price year

- Industry-specific inflation data is used to make year adjustment

Discussion of Methods

Limitations

- Industry attribution challenges
- Lag time due to data release delays
- Margins method is aggregated
- International goods are modeled like their domestic equivalents

Comparing EEIO approach to others

- EEIO is most comprehensive
- The only approach that can be validated against national totals
- Not the best approach for specific products and supply chains

Plan for Factors for Federal Scope 3 Reporting

Planned Characteristics of Factors for Federal Reporting

- For year 2019, in USD 2019, for commodities by 6-digit NAICS 2017 codes (~1000 codes), in CO₂-equivalent (1 factor per commodity)
- Data inputs:
 - Using most recent GHGI data for 2019 emissions (2022 US GHGI report)
 - Built using USEEIO v2.1 GHG commodity-based model using 2012 Benchmark IO data
 - IPCC AR-4 GWP-100yr

Release Plan for Factors for Federal Reporting

- Factors will undergo internal and external expert peer-review and EPA management review
- Factors to be published in Excel sheet along with methodology and data update notes and updates to GHG attribution model
- Updated source code will be made available on [github/usepa/supply-chain-factors](https://github.com/usepa/supply-chain-factors)
- Expected early Spring 2023

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