



Facility and Plant Level Data: Incorporating Facility Reported Data into the U.S. GHG Inventory

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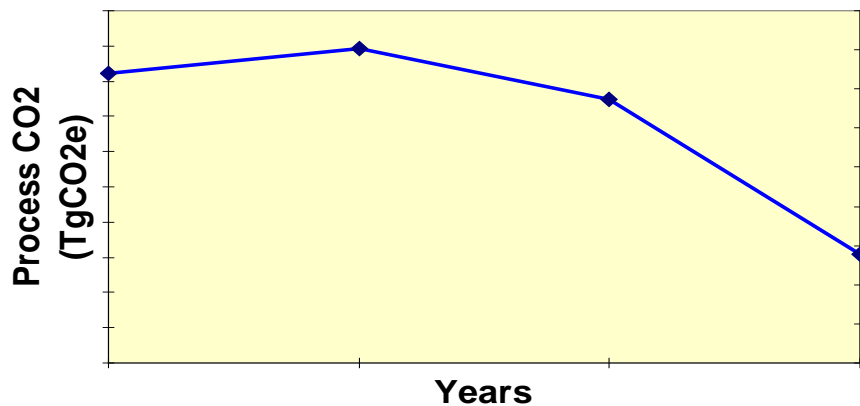
IPCC Expert Meeting on Use of Models
and Measurements in GHG Inventories
Sydney, Australia
August, 2010

Overview



- United States (U.S.) National Greenhouse Gas (GHG) Inventory
- U.S. Environmental Protection Agency (EPA) GHG Reporting Program (GHGRP)
- Opportunities for GHGRP to Inform U.S. National GHG Inventory
 - Overarching Opportunities
 - Energy Sector Example
- Integration Challenges

Current: National Level Cement Data



Now and In the Future

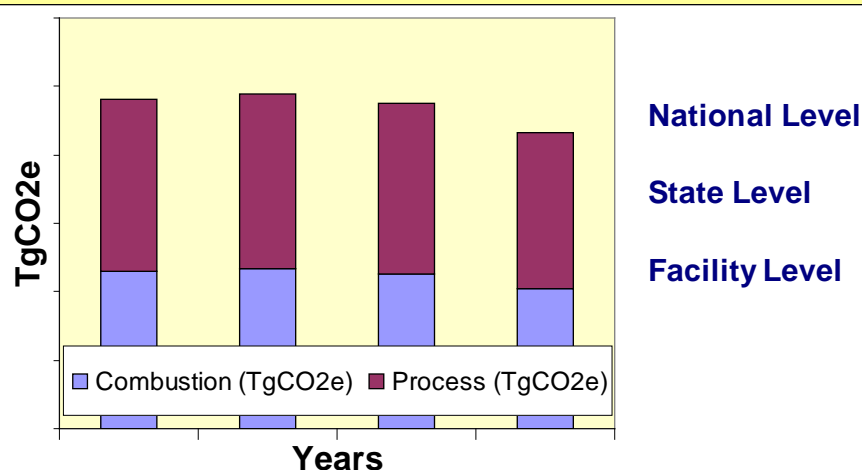


Additional facility-specific data that will be reported to support verification

If CEMS not used, data reported incl:

1. Monthly cement & clinker by kiln
2. Number of kilns
3. CKD not recycled to kiln
4. Fraction of total CaO, MgO, non-calcined CaO, non-calcined MgO.
5. Method used to determine non-calcined CaO/MgO in clinker and CKD.
6. Monthly kiln specific emission factors
7. Other related data.

With GHGRP- Cement Data at Various Levels

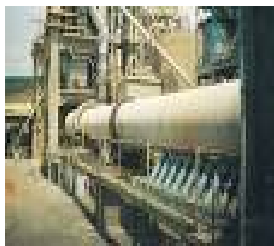


U.S. EPA GHG Reporting Program (GHGRP)



Goal of GHGRP is to collect accurate and timely data on GHG emissions to inform future policy decisions.

- Generally requires that facilities across certain sectors of the economy emitting equal to or greater than 25,000 mtCO₂e threshold annually report their GHG emissions and other related data to the U.S. EPA.
- Measurement begins in 2010 for most categories with first reports due in March 2011. Some pending categories report in March 2012.
- EPA estimates that over **10,000 facilities** will be reporting, accounting for 85-90% of U.S. GHG emissions.
- All relevant GHGs (CO₂, N₂O, CH₄, SF₆, HFCs, PFCs, other fluorinated gases) will be reported.
- Reporting only, no control requirement.
 - Control measures already in place often required to be reported



U.S. EPA GHGRP: Monitoring and Reporting



- Prescribed methods for calculating emissions
 - Generally relying on continuous emissions monitoring when relevant equipment is in place; otherwise facility-specific calculations.
- Emissions will be estimated using “Tier 3” methods
 - Direct measurement of emissions or feedstock consumption required for several large emissions source categories (e.g., ammonia)
 - Mass balance methods or source-specific emission factors for other large emissions source categories (e.g., iron and steel, cement)
 - Standard emission factors are used where emissions data quality is not compromised or source is small
- Facility-specific data will be reported
 - Activity data associated with emissions.
 - Other emission drivers (e.g., throughput, operational efficiency).
- EPA’s GHG Reporting System
 - Centralized data collection and quality control; all electronic.
- Data verification
 - Reporters need to develop monitoring plans.
 - Lab results, meter calibration standards, etc. need to be retained.
 - Facility-certification of data, EPA verification and auditing.

Coverage of GHG Reporting Program

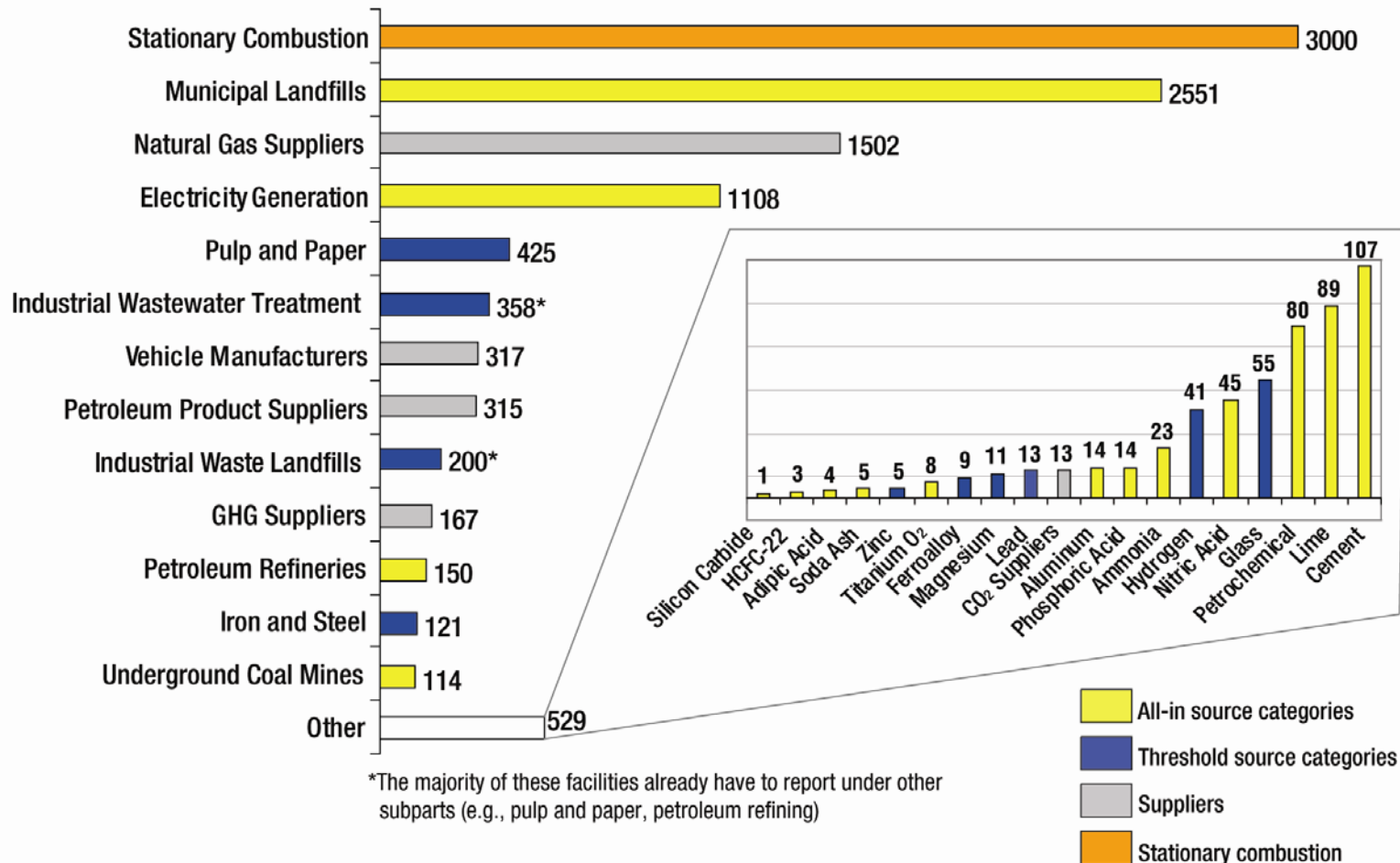


Figure 1. Estimated number of facilities and suppliers that must submit a GHG report
(Manure management, miscellaneous carbonates, and coal to liquid not included)

U.S. EPA GHGRP: IPCC Source Categories Included



| U.S. GHG Inventory Sectors | Reporters |
|---|--|
| Energy | Subparts C, D, W, FF: Stationary Fuel Combustion, Electricity generation, Petroleum and Natural Gas systems, Underground coal mining |
| Industrial Processes | <i>All large industrial emitters, including those in the following industries:</i> |
| Metals | Subparts F, K, Q, R, T, GG: Aluminum, Ferroalloy, Iron and Steel, Lead, Magnesium, Zinc |
| Minerals | Subparts H, N, S, AA, BB: Cement, Glass, Lime, Pulp and Paper, Silicon Carbide |
| Chemicals | Subparts E, G, I, V, X, Z, CC, EE, SS: Adipic Acid, Ammonia, Electronics, Nitric Acid, Petrochemicals, Phosphoric Acid, Soda Ash, Titanium Dioxide, Electric transmission and distribution equipment |
| F-Gases | Subparts L, O, DD: Fluorinated Gas production, HCFC-22 production and HFC-23 destruction, Use of electric transmission and distribution equipment |
| Solvent and Other Product Use | N/A |
| Agriculture | N/A |
| Land Use, Land-Use Change, and Forestry | N/A |
| Waste | Subpart II, HH, TT: Industrial Wastewater treatment, Municipal solid waste landfills, Industrial waste landfills |
| Upstream Suppliers | Subparts Y, LL, MM, NN, OO, PP, QQ: Petroleum refineries, Suppliers of coal-based liquid fuels, Suppliers of petroleum products, Suppliers of natural gas and natural gas liquids, Suppliers of industrial greenhouse gases, Suppliers of carbon dioxide, Imports and exports of pre-charged equipment with fluorinated GHGs or containing fluorinated GHGs in closed-cell foams |

Overarching Opportunities



- All facilities in “all-in” reporting categories (e.g., ammonia, lead, petrochemical production) must report emissions
 - Data can directly be used to support inventory development using Tier 3 methods.
 - Provides facility-specific production and consumption data
 - In some cases, information on penetration of mitigation technologies.
- Opportunities for improving emission factors from threshold categories
 - In some cases, only facilities equal to or greater than 25,000 mtCO₂e report (e.g., ferroalloys, glass, iron and steel).
 - Actual facility-level data received will be consistent with IPCC Tier 3 methodologies; however won't have facility-specific information for all facilities in that source category.
 - Provides opportunities to verify default IPCC 2006 emission factors and U.S.-specific emissions estimation factors.
 - Ability to use for Inventory development may depend on the source category (see examples starting)
- Data reported under GHGRP can support Inventory QA/QC and verification.
 - Regulatory development has already lead to improvement of national Inventory emission factors.
 - Data collected from both upstream suppliers/downstream emitters; inherent double counting in GHGRP that can help support verification of U.S. data.
 - Additional data for verification reported; serve as Tier 2 QA/QC checks.
 - Generally a one to one relationship between Inventory source categories and data reported under GHGRP.
- GHGRP will provide specificity to prepare Tier 3 emission estimates for CO₂ sequestration consistent with 2006 IPCC Guidelines.
 - Current rule will result in reporting of CO₂ produced. Also have proposed regulation that will provide site-specific data for sequestration operations for use in the U.S. GHG inventory



Examples:

**Opportunities to improve U.S. GHG
Inventory emissions estimates for
Stationary Combustion and Petroleum
and Natural Gas Systems**

Energy Sector: Overview of 2008 Source Categories



| Source (Gas) | GHG Emissions (TgCO ₂ Eq.) | Method Applied | Method Applied Source | Emission Factor | Emission Factor(s) Source | Consumption Data Source |
|---|---------------------------------------|----------------|-----------------------|-----------------|---------------------------|--|
| Energy | | | | | | |
| Stationary Combustion (CO ₂) | 3,787.50 | T2 | IPCC 2006 | CS | EIA | EIA |
| Transportation (CO ₂) | 1,785.30 | T1,T2 | IPCC 2006 | CS | EIA | EIA, FHWA |
| Non-Energy Use of Fuels (CO ₂) | | | | | IPCC, other | Multiple (19 sources of data) |
| Natural Gas Systems (CO ₂) | | | | | EPA, API, other | EIA, MMS, DOT, OGJ, states, other |
| Incineration of Waste (CO ₂) | | | | | | EPA, Rubber Manufacturers' Association |
| Petroleum Systems (CO ₂) | | | | | Indian, GRI, API, other | EIA, MMS, IOGA, OGJ, other |
| Biomass-Wood* (CO ₂) | | | | | | EIA |
| Biomass-Ethanol* (CO ₂) | 53.3 | T2 | IPCC 2006 | CS | EIA | EIA |
| Natural Gas Systems (CH ₄) | 96.4 | T3 | IPCC 2006 | CS | EIA | EIA, FHWA |
| Coal Mining (CH ₄) | 67.6 | T2, T3 | IPCC 2006 | CS | EIA | EIA, FHWA |
| Petroleum Systems (CH ₄) | 29.1 | T3 | IPCC 2006 | CS | EIA | EIA, FHWA |
| Stationary Combustion (CH ₄) | 6.7 | T1,T2 | IPCC 2006 | CS | EPA, CARB, ICF | FHWA |
| Abandoned Underground Coal Mines (CH ₄) | 5.9 | T2, T3 | EPA | CS | IPCC 2006 | EPA, Rubber Manufacturers' Association |
| Mobile Combustion (CH ₄) | 2 | M, T1, T2 | IPCC 2006 | CS | EPA, CARB, ICF | FHWA |
| Incineration of Waste (CH ₄) | 0 | T1 | IPCC 2006 | D | IPCC 2006 | EPA, Rubber Manufacturers' Association |
| Mobile Combustion (N ₂ O) | 26.1 | M, T1, T2 | IPCC 2006 | CS | EPA, CARB, ICF | FHWA |
| Stationary Combustion (N ₂ O) | 14.2 | T1,T2 | IPCC 2006 | D | IPCC 2006 | EIA |
| Incineration of Waste (N ₂ O) | 0.4 | T1 | IPCC 2006 | D | IPCC 2006 | EPA, Rubber Manufacturers' Association |

CO₂ from Stationary Combustion Accounts for 63 Percent of Energy Sector Emissions

CO₂ estimates based on Tier 2 methodology using U.S.-specific energy consumption data provided by the Energy Information Administration

T1: Tier 1

T2: Tier 2

T3: Tier 3

M: Model

D: Default

CS: Country Specific

MB: Mass Balance

Stationary Combustion from GHGRP



- Combustion emissions reported through GHGRP may not be complete enough to directly use in Inventory (only 85-90% U.S. GHG emissions); current national data sets likely preferred.
- GHGRP results will provide improved data on large emitters for which emissions are currently aggregated or estimated.
 - Emissions by industry sector, for some sectors will provide “complete data” for industry.
 - Number, distribution and operating characteristics of facilities
 - Types of combustors
- Combustion data may also improve understanding of splits between combustion and process emissions.
 - Still a challenge where continuous emissions monitors used and data measured through a common stack. Use of current Tier 2 inventory methods to apportion Tier 3 data collected through program?

Energy Sector: Overview of 2008 Source Categories



| Source (Gas) | GHG Emissions (TgCO ₂ Eq.) | Method Applied | Method Applied Source | Emission Factor | Emission Factor(s) Source | Consumption Data Source |
|---|---------------------------------------|----------------|-----------------------|-----------------|---------------------------|--|
| Energy | | | | | | |
| Stationary Combustion (CO ₂) | 3,787.50 | T2 | IPCC 2006 | CS | EIA | EIA |
| Transportation (CO ₂) | 1,785.30 | T1,T2 | IPCC 2006 | CS | EIA | EIA, FHWA |
| Non-Energy Use of Fuels (CO ₂) | 134.2 | MB | MB | D/CS | EIA, IPCC, other | Multiple (19 sources of data) |
| Natural Gas Systems (CO ₂) | 30 | T3 | IPCC 2006 | CS | GRI, EPA, API, other | EIA, MMS, DOT, OGI, states, other |
| Incineration of Waste (CO ₂) | 13.1 | T2 | IPCC 2006 | NA | | EPA, Rubber Manufacturers' Association |
| Petroleum Systems (CO ₂) | 0.5 | T3 | IPCC 2006 | CS | Radian, GRI, API, other | EIA, MMS, IOGA, OGI, other |
| Biomass-Wood* (CO ₂) | 198.4 | T2 | IPCC 2006 | CS | EIA | EIA |
| Biomass-Ethanol* (CO ₂) | 53.3 | T2 | IPCC 2006 | CS | EIA | EIA |
| Natural Gas Systems (CH ₄) | 96.4 | T3 | IPCC 2006 | CS | GRI, EPA, API, other | EIA, MMS, DOT, OGI, states, other |
| Coal Mining (CH ₄) | 67.6 | T2, T3 | IPCC 2006 | CS | MSHA, EPA, AAPG | EIA |
| Petroleum Systems (CH ₄) | 29.1 | T3 | IPCC 2006 | CS | Radian, GRI, API, other | EIA, MMS, IOGA, OGI, other |
| Stationary Combustion (CH ₄) | 6.7 | T1,T2 | IPCC 2006 | D | IPCC 2006 | EIA |
| Abandoned Underground Coal Mines (CH ₄) | 5.9 | T2, T3 | EPA 2003 | CS | EPA 2003 | EIA, EPA, MSHA |
| Mobile Combustion (CH ₄) | 2 | M, T1, T2 | IPCC 2006 | CS | EPA, CARB, ICF | FHWA |
| Incineration of Waste (CH ₄) | 0 | T1 | IPCC 2006 | D | IPCC 2006 | EPA, Rubber Manufacturers' Association |
| Mobile Combustion (N ₂ O) | 26.1 | M, T1, T2 | IPCC 2006 | CS | EPA, CARB, ICF | FHWA |
| Stationary Combustion (N ₂ O) | 14.2 | T1,T2 | IPCC 2006 | D | IPCC 2006 | EIA |
| Incineration of Waste (N ₂ O) | 0.4 | T1 | IPCC 2006 | D | IPCC 2006 | EPA, Rubber Manufacturers' Association |

Additional notable opportunities exist in the Petroleum and Natural Gas Systems source categories

Petroleum and Natural Gas Industry



- Current Inventory is a Tier 3 methodology based on GRI/EPA study conducted for a 1992 base year.
- There are several opportunities to improve current approach:
 - Small sample sizes in study for some sources lead to large uncertainty
 - Emissions factors have not been updated since some activity data are not available after the early 1990's. Have to project forward.
 - Lack of data on mitigation technologies decreases accuracy of estimates.
 - One large emission source, gas well liquid unloading, is improperly characterized, leading to emissions potentially an order of magnitude too low.
 - One large emission source, gas well completions and workovers from hydraulic fracturing, is omitted
 - In the base year, 1992, hydraulic fracturing was not done. In recent years it has become common and Natural Gas STAR Partners report large emissions. EPA estimates this to be one of the largest emission sources

Petroleum and Natural Gas Industry



- Greenhouse Gas Reporting Program will allow significant improvements:
 - Data will be collected covering over 80% of emissions; unlike with stationary combustion not currently a national dataset that could provide more comprehensive data.
 - Annual data reporting will provide actual emissions estimates instead of projected emissions.
 - Facilities will report penetration of mitigation technologies such as low-bleed pneumatic devices and vapor recovery unit installations on storage tanks.
 - Program is designed to collect more accurate data on large emissions sources such as gas well liquid unloading.
 - Program is designed to collect accurate data on missing pieces such as gas well completions and workovers from hydraulic fracture for which little data is currently available.

Petroleum and Natural Gas Industry



- Greenhouse Gas Reporting Program will provide verification of key activity data
 - Key activity drivers such as production rates, well counts, processing plants, transmission compressor stations, storage wells, LNG plants, and distribution stations will be collected to verify Inventory counts
- How will we incorporate collected data?
 - Revise equipment counts and activity frequencies based on collected data.
 - Determine if the top 80% of emissions from facilities that crossed the threshold are indicative of the remaining 20% on a source-by-source basis.
 - For sources where direct measurement or engineering estimates were conducted, use results to verify or correct emission factors.
 - Account for the actual penetration of mitigation technologies and practices
- Need to consider how to extrapolate results to cover facilities under the threshold and not reporting to EPA?
 - Do these larger sources have emissions profiles similar to the non-reporting sources?

Integration Challenges



- **Thresholds**

- For many source categories, only facilities above 25k tonnes CO₂e will report under the GHGRP
 - Impact of threshold on use of data for Inventory may be source-specific
 - For some sources, may be reasonable to fill gaps using GHGRP data sources (e.g., glass) for other (e.g., stationary combustion) the existing inventory approach may be more appropriate.

- **Time Series Consistency**

- The GHG Reporting Program will provide Tier 3 data in 2010. Aligning these granular data with earlier years in the time series (1990 – 2009) may be challenging.
 - Again source specific- for some industrial categories can perhaps apply Tier 3 EF back in time series if little change in the industry; for others, no.
- Accounting for facilities that cease reporting if they fall below the reporting threshold of 25k tonnes CO₂e

Integration Challenges



- **Methodological Issues**
 - For some subparts, facilities have the option to select from two or more reporting options (all of which would be equivalent to IPCC Tier 3). Different methods could have different associated uncertainties.
 - Mapping partial data available from GHGRP to the Inventory for threshold source categories is going to be challenging.
 - Method could lead to Tier 3 data, but inability to break into IPCC source categories (e.g., CEMS measuring a common stack).
- **Quality Assurance/ Quality Control**
 - Will have significantly more QA/QC and verification data available to EPA. Consider necessary QA/QC documentation to present in Inventory.
 - Will there be limitations on presenting QA/QC and verification data in Inventory due to CBI concerns?
 - Not yet clear which reported information will be CBI, so difficult to determine impact on transparency.
 - Some approaches (e.g., continuous emissions monitors) may result in less information reported than those relying on facility-specific calculations.

Potential Issues for the Inventory Community?



1. What is Tier 3? Are all facility-specific approaches to data collection equally considered Tier 3? Is it necessary to subdivide Tier 3 or does the mere collection of facility-level data make it broadly Tier 3?
 - What information should be documented in a national Inventory to support Tier 3 methods: not sufficient to just document that it is Tier 3.
 - How to assess comparability among Parties when Tier 3 methods can vary rather significantly across Parties.
2. Is existing guidance on time series consistency sufficient for consistently and transparently extrapolating facility-reported data to non-reporting facilities?
 - Are there instances where facility-reported data should not be extrapolated?
3. Is existing guidance on quality assurance and quality control sufficient for inventory agencies to assess QA/QC activities at the facility level and international expert review teams to assess at the national level?
 - Need to describe QA/QC by both Inventory compilers, as well as facility specific QA/QC. Current guidance mostly geared toward compilers.
 - Consider the impact of confidential business information: as countries use facility-specific data, more information may be considered CBI.
4. Uncertainty analysis: Is additional guidance needed for developing an uncertainty analysis where multiple Tier 3 methods used within a source category?



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