Climate Change

global warming

Simplified Estimation Methods for De Minimis Sources
April 7, 2009
De Minimis Overview

- Based on WCI / TCR system
- Not exclusion – all emissions must be reported
- Allows simplified estimation methods
  - Can develop own method
  - Upper bound assumptions
- Can select by source, pollutant, or combination
- Report separately – document on report
- Part of verification report
De Minimis Limits

- Direct and indirect emissions have separate de minimis limits of 5%, but combined must not exceed 10,000 MT CO$_2$e

- Combinations of sources or pollutants:
  - 5% of total direct emissions
  - and / or
  - 5% of total indirect emissions
  - Combined must not exceed 10,000 MT CO$_2$e
Example 1: Company X

Company X Direct Emissions

- Combustion emissions: 25,000 MT CO2e (66.4%)
- On-road CO2: 10,000 MT CO2e (26.6%)
- Refrergent: 1,700 MT CO2e (4.5%)
- On-road CH4 and N2O: 50 MT CO2e (0.1%)
- Forklifts: 100 MT CO2e (0.3%)
- De minimis: 1,850 MT CO2e (4.9%)

Total Direct Emissions: 27,850 MT CO2e
Example 2: Company Y

Company Y Direct Emissions

- on-road refrigerants 5,000 MT CO2e 2.2%
- refrigerant units > 50 lbs capacity 100,000 MT CO2e 44.2%
- refrigerant units < 50 lbs capacity 9,771 MT CO2e 4.3%
- de minimis 10,000 MT CO2e 4.4%
- on-road CO2 40,000 MT CO2e 17.7%
- combustion emissions 70,000 MT CO2e 31.0%
- forklifts 1,000 MT CO2e 0.4%
- on-road CH4 and N2O 200 MT CO2e 0.1%
Simplified Estimation Methods for Refrigerants

- Screening method
  - Does not count towards de minimis limits for on-road motor vehicles
  - Counts towards de minimis limits for all other sources
- If over de minimis limits must use Tier A or B from Chapter 16 TCR GRP
- Can mix methods if under limit and clearly separated on report
Example 2: Company Y Screening Method

Condition:
- Company consists of 10 similar sites

Method:
- Inventory units at largest site and multiply by 10 to get total
Example 2: Company Y Screening Method

Condition:
- Company does not track refrigerant use or equipment specifications for units < 50 lbs capacity

Method:
- Use default screening method factors
  - Use capacity of 50 lbs or maximum for unit type
  - Omit new equipment calculation for pre-charged units
  - Determine refrigerant type
Example 2: Company Y Screening Method

Condition:
- Operations stable: retired equipment = new equipment

Method:
- Assume operational lifespan for each unit type and prorate emissions from new and retired equipment
## Example 2: Company Y Screening Method

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Capacity Used (kg)</th>
<th>Number of Units Per Site</th>
<th>Years Until Unit Replacement</th>
<th>New Units Included?</th>
<th>Refrigerant</th>
<th>Emissions MT CO₂e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small refrigeration units &lt; 1 kg capacity</td>
<td>1</td>
<td>10</td>
<td>20</td>
<td>no</td>
<td>HFC-134A</td>
<td>1.1</td>
</tr>
<tr>
<td>Commercial Refrigeration</td>
<td>22.7</td>
<td>25</td>
<td>20</td>
<td>yes</td>
<td>R-404A</td>
<td>6,774</td>
</tr>
<tr>
<td>Industrial refrigeration</td>
<td>22.7</td>
<td>8</td>
<td>20</td>
<td>yes</td>
<td>R-404A</td>
<td>1,517</td>
</tr>
<tr>
<td>Residential and Commercial A/C</td>
<td>22.7</td>
<td>35</td>
<td>20</td>
<td>no</td>
<td>R-410A</td>
<td>1,479</td>
</tr>
<tr>
<td>Total</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>9,771</td>
</tr>
</tbody>
</table>
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Questions?
Screening Method

<table>
<thead>
<tr>
<th>Equation 16e</th>
<th>Estimating Emissions of Each Type of Refrigerant using the Screening Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>For each type of refrigerant:</td>
<td></td>
</tr>
<tr>
<td>Total Annual Emissions = [ (C_N \times k) + (C \times x \times T) + (C_D \times y \times (1 - z)) ] \div 1,000</td>
<td></td>
</tr>
<tr>
<td>(metric tons)</td>
<td>(kg)</td>
</tr>
</tbody>
</table>

Where:
- \(C_N\) = quantity of refrigerant charged into the new equipment \(^1\)
- \(C\) = total full charge (capacity) of the equipment
- \(T\) = time in years equipment was in use (e.g., 0.5 if used only during half the year and then disposed)
- \(C_D\) = total full charge (capacity) of equipment being disposed of \(^2\)
- \(k\) = installation emission factor \(^1\)
- \(x\) = operating emission factor
- \(y\) = refrigerant remaining at disposal \(^2\)
- \(z\) = recovery efficiency \(^2\)

\(^1\) Omitted if no equipment was installed during the reporting year or the installed equipment was pre-charged by the manufacturer
\(^2\) Omitted if no equipment was disposed of during the reporting year

- Use Table 16.3 for emission factors
- If charge capacity unknown, use upper bound of listed range
- All changes from default emission factors must be documented
### Table 16.3 Default Emission Factors for Refrigeration / Air Conditioning Equipment

<table>
<thead>
<tr>
<th>Type of Equipment</th>
<th>Capacity (kg)</th>
<th>Installation Emission Factor k (% of capacity)</th>
<th>Operating Emission Factor x (% of capacity / year)</th>
<th>Refrigerant Remaining at Disposal y (% of capacity)</th>
<th>Recovery Efficiency z (% of remaining)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Refrigeration</td>
<td>0.05 - 0.5</td>
<td>1 %</td>
<td>0.5 %</td>
<td>80 %</td>
<td>70 %</td>
</tr>
<tr>
<td>Stand-alone Commercial Applications</td>
<td>0.2 - 6</td>
<td>3 %</td>
<td>15 %</td>
<td>80 %</td>
<td>70 %</td>
</tr>
<tr>
<td>Medium &amp; Large Commercial Refrigeration</td>
<td>50 - 2,000</td>
<td>3 %</td>
<td>35 %</td>
<td>100 %</td>
<td>70 %</td>
</tr>
<tr>
<td>Transport Refrigeration</td>
<td>3 - 8</td>
<td>1 %</td>
<td>50 %</td>
<td>50 %</td>
<td>70 %</td>
</tr>
<tr>
<td>Industrial Refrigeration including Food Processing and Cold Storage</td>
<td>10 - 10,000</td>
<td>3 %</td>
<td>25 %</td>
<td>100 %</td>
<td>90 %</td>
</tr>
<tr>
<td>Chillers</td>
<td>10 - 2,000</td>
<td>1 %</td>
<td>15 %</td>
<td>100 %</td>
<td>95 %</td>
</tr>
<tr>
<td>Residential and Commercial A/C including Heat Pumps</td>
<td>0.5 - 100</td>
<td>1 %</td>
<td>10 %</td>
<td>80 %</td>
<td>80 %</td>
</tr>
<tr>
<td>Mobile Air Conditioning</td>
<td>0.5 – 1.5</td>
<td>0.5 %</td>
<td>20 %</td>
<td>50 %</td>
<td>50 %</td>
</tr>
</tbody>
</table>


Note: Emission factors above are the most conservative of the range provided by the IPCC. The ranges in capacity are provided for reference. You should use the actual capacity of your equipment. If you do not know your actual capacity, you should use the high end of the range provided (e.g., use 2,000 kg for chillers).
Tier A – Mass Balance

1. Determine the base inventory for each refrigerant
2. Calculate changes to the base inventory for each refrigerant
3. Calculate annual emissions of each type of refrigerant, convert to units of CO\textsubscript{2}e, and total
Tier B – Simplified Mass Balance

1. Determine the types and quantities of refrigerants used
2. Calculate annual emissions of each type of refrigerant
3. Convert to units of CO$_2$e and total

**Equation 16d**

<table>
<thead>
<tr>
<th>Calculating Emissions of Each Type of Refrigerant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Annual Emissions</strong> (metric tons) = (P$_N$ - C$_N$ + P$_S$ + C$_D$ - R$_D$) ÷ 1,000 (kg) (kg) (kg) (kg) (kg/metric tons)</td>
</tr>
</tbody>
</table>

Where:
- P$_N$ = purchases of refrigerant used to charge new equipment *
- C$_N$ = total full charge of the new equipment *
- P$_S$ = quantity of refrigerant used to service equipment
- C$_D$ = total full charge of retiring equipment
- R$_D$ = refrigerant recovered from retiring equipment

* Omitted if the equipment has been pre-charged by the manufacturer
Example 2b: Company Y Screening Method

Condition:

- Company does not track equipment specifications for units < 50 lbs capacity
- Only has total capacities of each refrigerant in emissions unit type

Method:

- Use default screening method factors
  - Use total refrigerant for each refrigerant and unit type
  - Use higher unit type screening method factors if unknown
  - Omit new equipment calculation for pre-charged units – prorate over lifespan
### Example 2b: Company Y Screening Method

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Total Capacity Used (kg)</th>
<th>Years Until Unit Replacement</th>
<th>New Units Included?</th>
<th>Refrigerant</th>
<th>Emissions MT CO₂e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small refrigeration units &lt; 1 kg capacity</td>
<td>50</td>
<td>20</td>
<td>no</td>
<td>HFC-134A</td>
<td>1.1</td>
</tr>
<tr>
<td>Commercial and Industrial Refrigeration</td>
<td>6,939</td>
<td>20</td>
<td>yes</td>
<td>R-404A</td>
<td>8,291</td>
</tr>
<tr>
<td>Residential and Commercial A/C</td>
<td>7,938</td>
<td>20</td>
<td>no</td>
<td>R-410A</td>
<td>1,479</td>
</tr>
<tr>
<td>Total</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>9,771</td>
</tr>
</tbody>
</table>
## De Minimis in Other Protocols

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Type</th>
<th>Amount of Permitted De Minimis (% of total or fixed amount, whichever is smaller)</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCI</td>
<td>Simplified Estimation Methods</td>
<td>3% up to 20,000 MT CO$_2$e</td>
<td>facility</td>
</tr>
<tr>
<td>TCR</td>
<td>Simplified Estimation Methods</td>
<td>5%</td>
<td>entity</td>
</tr>
<tr>
<td>EPA</td>
<td>None</td>
<td>Some lower tiers in specific sectors</td>
<td>facility</td>
</tr>
<tr>
<td>CA – CARB</td>
<td>Simplified Estimation Methods</td>
<td>3% up to 20,000 MT CO$_2$e</td>
<td>facility</td>
</tr>
<tr>
<td>CA – CAR</td>
<td>Simplified Estimation Methods</td>
<td>5%</td>
<td>entity</td>
</tr>
<tr>
<td>New Mexico</td>
<td>Simplified Estimation Methods</td>
<td>5%</td>
<td>facility</td>
</tr>
<tr>
<td>EU ETS</td>
<td>Simplified Estimation Methods</td>
<td>2% or 20,000 MT CO$_2$e</td>
<td>facility</td>
</tr>
<tr>
<td>UK ETS</td>
<td>Exclusion – Pre Threshold</td>
<td>&lt; 3 MW capacity</td>
<td>unit</td>
</tr>
<tr>
<td>Australia</td>
<td>Simplified Estimation Methods</td>
<td>25,000 MT CO$_2$e or 100 TJ</td>
<td>facility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50,000 MT CO$_2$e or 200 TJ</td>
<td>entity</td>
</tr>
</tbody>
</table>
1. **Direct emissions.** The owner or operator may elect to designate as de minimis one or more sources or pollutants that collectively emit no more than 5 percent of their total direct CO\textsubscript{2}e emissions. The owner or operator may estimate emissions for these de minimis sources using simplified estimation methods as an alternative to those required in WAC 173-441-100 and WAC 173-441-110. Simplified estimation methods must use upper-bound assumptions that error on the side of overestimating rather than underestimating emissions.

2. **Indirect emissions.** The owner or operator may elect to designate as de minimis one or more sources or pollutants that collectively emit no more than 5 percent of their total indirect CO\textsubscript{2}e emissions. The owner or operator may estimate emissions for these de minimis sources using simplified estimation methods as an alternative to those required in WAC 173-441-100 and WAC 173-441-110. Simplified estimation methods must use upper-bound assumptions that error on the side of overestimating rather than underestimating emissions.

3. **Combining de minimis emissions from direct and indirect emissions.** An owner or operator must account for direct and indirect emissions separately when applying the 5 percent threshold to designate de minimis sources or pollutants. The combined total direct and indirect emissions designated as de minimis must not exceed 10,000 metric tons CO\textsubscript{2}e.

4. **Verification.** If verification of the emissions report is required by this rule, then the selection of any simplified estimation method is subject to the concurrence of the verification team that the use of such methods provides reasonable assurance that the emissions so designated do not exceed the applicable de minimis limits as described in WAC 173-441-115-1, 2, and 3.

5. **Reporting.** The owner or operator must separately identify and include in the emissions data report the emissions from designated de minimis sources.