



DEPARTMENT OF  
**ECOLOGY**  
State of Washington



# *Climate Change*

*global warming*

Simplified Estimation Methods for De Minimis Sources  
April 7, 2009



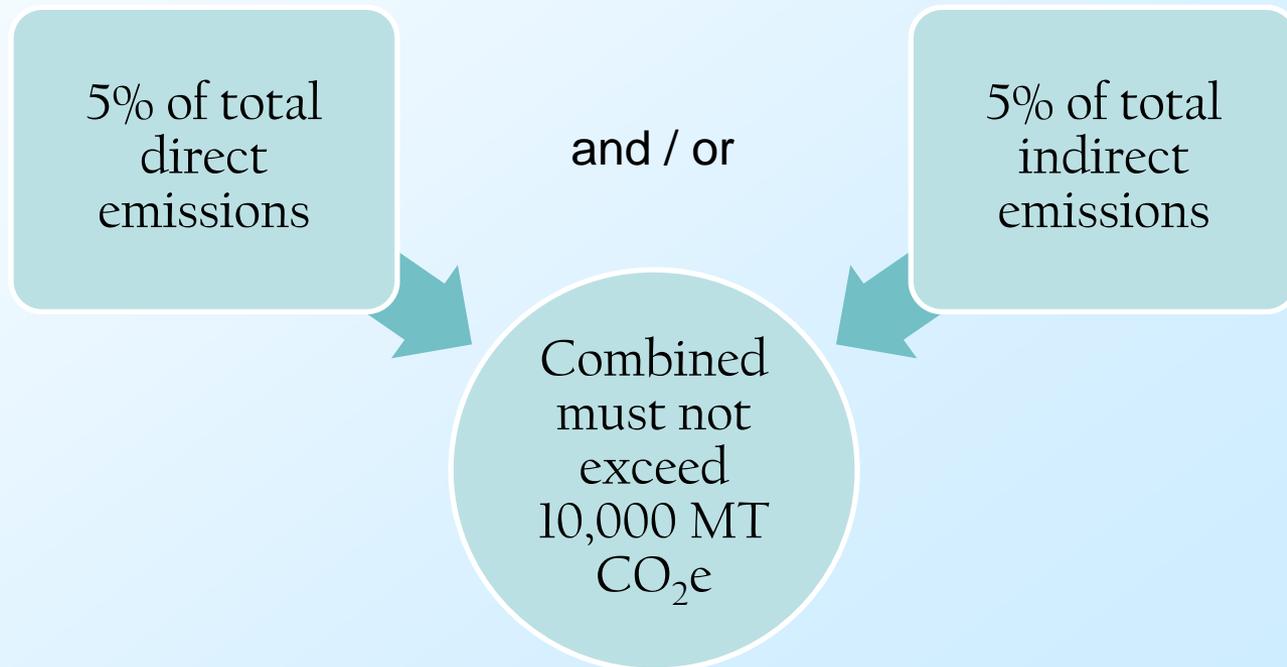
# De Minimis Overview

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- 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

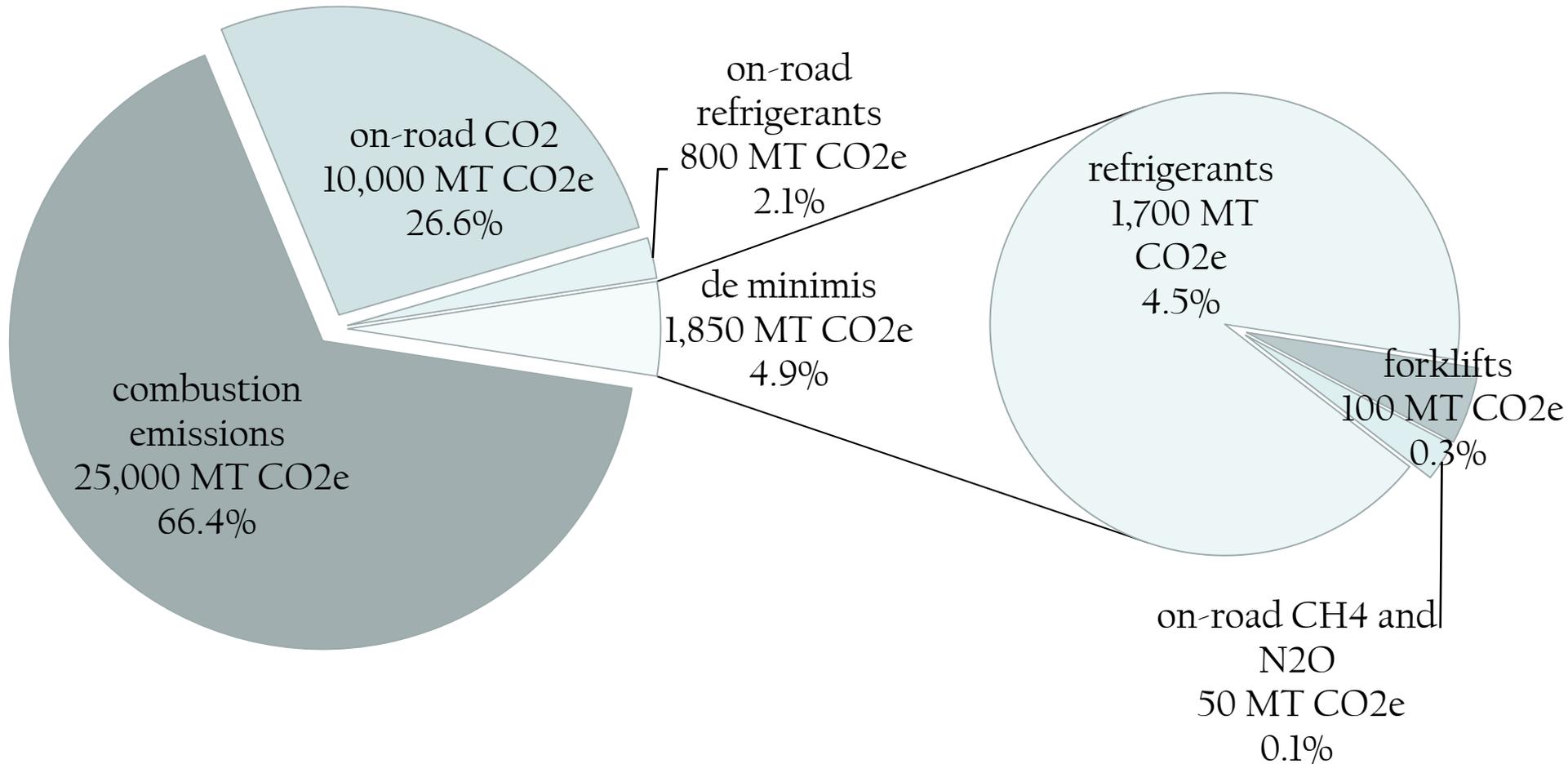
# De Minimis Limits

- Direct and indirect emissions have separate de minimis limits of 5%, but combined must not exceed 10,000 MT CO<sub>2</sub>e
- Combinations of sources or pollutants:



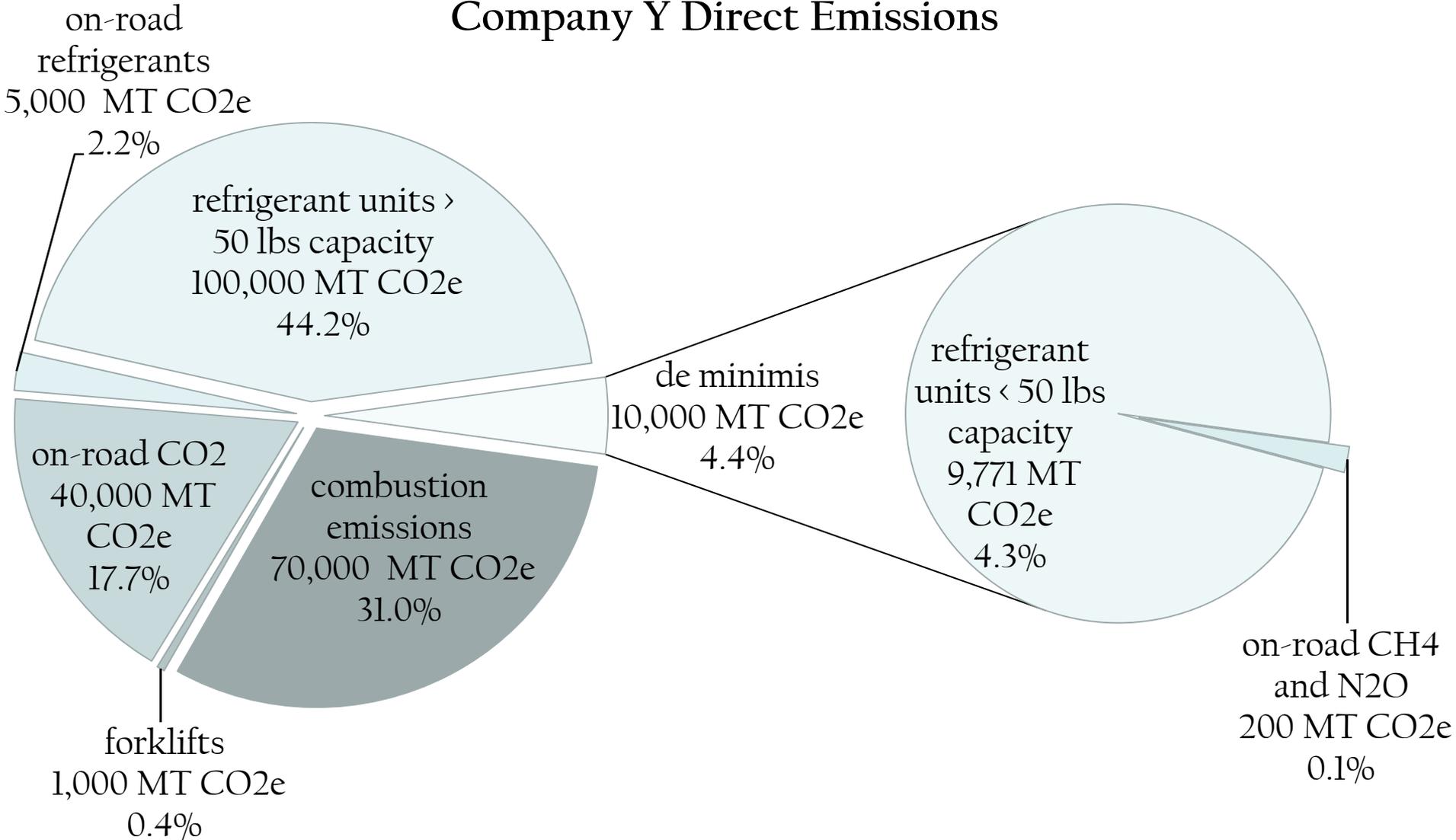
# Example 1: Company X

## Company X Direct Emissions



# Example 2: Company Y

## Company Y Direct Emissions





# Simplified Estimation Methods for Refrigerants

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- 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

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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

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## 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

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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

Unit Type	Capacity Used (kg)	Number of Units Per Site	Years Until Unit Replacement	New Units Included?	Refrigerant	Emissions MT CO <sub>2</sub> e
Small refrigeration units < 1 kg capacity	1	10	20	no	HFC-134A	1.1
Commercial Refrigeration	22.7	25	20	yes	R-404A	6,774
Industrial refrigeration	22.7	8	20	yes	R-404A	1,517
Residential and Commercial A/C	22.7	35	20	no	R-410A	1,479
Total	NA	NA	NA	NA	NA	9,771



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Questions?

# Screening Method

## Equation 16e

## Estimating Emissions of Each Type of Refrigerant using the Screening Method

For each type of refrigerant:

$$\text{Total Annual Emissions} = \left[ (C_N \times k) + (C \times x \times T) + (C_D \times y \times (1 - z)) \right] \div 1,000$$

(metric tons)
(kg) (%) (kg) (%) (years) (kg) (%) (%) (kg/metric ton)

Where:

$C_N$  = quantity of refrigerant charged into the new equipment <sup>1</sup>

$C$  = 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 <sup>2</sup>

$k$  = installation emission factor <sup>1</sup>

$x$  = operating emission factor

$y$  = refrigerant remaining at disposal <sup>2</sup>

$z$  = recovery efficiency <sup>2</sup>

<sup>1</sup> Omitted if no equipment was installed during the reporting year or the installed equipment was pre-charged by the manufacturer

<sup>2</sup> 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

# Screening Method

**Table 16.3 Default Emission Factors for Refrigeration / Air Conditioning Equipment**

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

Source: IPCC, *Guidelines for National Greenhouse Gas Inventories* (2006), Volume 3: Industrial Processes and Product Use, Table 7.9.

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<sub>2</sub>e, and total

## Equation 16a

## Calculating Emissions of Each Type of HFC and PFC Using the Mass Balance Method

$$\text{Total Annual Emissions (metric tons of HFC or PFC)} = \frac{(A - B + C - D - E)}{1,000}$$

(kg) (kg) (kg) (kg) (kg) (kg/metric tons)

Table 16.1 Base Inventory and Inventory Changes

Inventory		Amount (kg)
<b>Base Inventory</b>		
A	Refrigerant in inventory (storage) at the beginning of the year	
B	Refrigerant in inventory (storage) at the end of the year	
<b>Additions to Inventory</b>		
1	Purchases of refrigerant (including refrigerant in new equipment)	
2	Refrigerant returned to the site after off-site recycling	
→ C	Total Additions (1+2)	
<b>Subtractions from Inventory</b>		
3	Returns to supplier	
4	HFCs taken from storage and/or equipment and disposed of	
5	HFCs taken from storage and/or equipment and sent off-site for recycling or reclamation	
→ D	Total Subtractions (3+4+5)	
<b>Net Increase in Full Charge/Nameplate Capacity</b>		
6	Total full charge of new equipment	
7	Total full charge of retiring equipment	
→ E	Change to nameplate capacity (6-7)	

# 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<sub>2</sub>e and total

## Equation 16d

## Calculating Emissions of Each Type of Refrigerant

$$\text{Total Annual Emissions (metric tons) = } (P_N - C_N + P_S + C_D - R_D) \div 1,000$$

(kg) (kg) (kg) (kg) (kg) (kg/metric tons)

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

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## 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

Unit Type	Total Capacity Used (kg)	Years Until Unit Replacement	New Units Included?	Refrigerant	Emissions MT CO <sub>2</sub> e
Small refrigeration units < 1 kg capacity	50	20	no	HFC-134A	1.1
Commercial and Industrial Refrigeration	6,939	20	yes	R-404A	8,291
Residential and Commercial A/C	7,938	20	no	R-410A	1,479
Total	NA	NA	NA	NA	9,771



# De Minimis in Other Protocols

Protocol	Type	Amount of Permitted De Minimis (% of total or fixed amount, whichever is smaller)	Basis
WCI	Simplified Estimation Methods	3% up to 20,000 MT CO <sub>2</sub> e	facility
TCR	Simplified Estimation Methods	5%	entity
EPA	None	Some lower tiers in specific sectors	facility
CA – CARB	Simplified Estimation Methods	3% up to 20,000 MT CO <sub>2</sub> e	facility
CA – CAR	Simplified Estimation Methods	5%	entity
New Mexico	Simplified Estimation Methods	5%	facility
EU ETS	Simplified Estimation Methods	2% or 20,000 MT CO <sub>2</sub> e	facility
UK ETS	Exclusion – Pre Threshold	< 3 MW capacity	unit
Australia	Simplified Estimation Methods	25,000 MT CO <sub>2</sub> e or 100 TJ 50,000 MT CO <sub>2</sub> e or 200 TJ	facility entity



# Alternate Rule Text

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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<sub>2</sub>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<sub>2</sub>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<sub>2</sub>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.