



# Greenhouse Gases (GHGs) and You



# The Regulated GHGs

- CO<sub>2</sub> (Carbon Dioxide)
- CH<sub>4</sub> (Methane)
- N<sub>2</sub>O (Nitrous Oxide)
- SF<sub>6</sub> (Sulfur Hexafluoride)
- HFCs (Hydrofluorocarbons)
- PFCs (Perfluorocarbons)



# Combustion Calculation

- $\text{CO}_2\text{e (tons/yr)} =$   
     $\text{CO}_2 \text{ Potential Emission ton/yr} \times \text{CO}_2 \text{ GWP (1)}$   
     $+ \text{CH}_4 \text{ Potential Emission ton/yr} \times \text{CH}_4 \text{ GWP (21)}$   
     $+ \text{N}_2\text{O Potential Emission ton/yr} \times \text{N}_2\text{O GWP (310)}$



# Any CO<sub>2</sub>e Calculation

- $\text{CO}_2\text{e (tons/yr)} = \sum_i^n X_i \text{Potential Emission ton/yr} \times X_i \text{GWP}$



Abridged Table A-1 to Subpart A of 40 CFR 98 as of January 23, 2012

Name	CAS No.	Chemical formula	Global warming potential (100 yr.)
Carbon dioxide	124-38-9	CO <sub>2</sub>	1
Methane	74-82-8	CH <sub>4</sub>	21
Nitrous oxide	10024-97-2	N <sub>2</sub> O	310
HFC-23	75-46-7	CHF <sub>3</sub>	11,700
HFC-32	75-10-5	CH <sub>2</sub> F <sub>2</sub>	650
HFC-41	593-53-3	CH <sub>3</sub> F	150
HFC-125	354-33-6	C <sub>2</sub> HF <sub>5</sub>	2,800
HFC-134	359-35-3	C <sub>2</sub> H <sub>2</sub> F <sub>4</sub>	1,000
HFC-134a	811-97-2	CH <sub>2</sub> FCF <sub>3</sub>	1,300
HFC-143	430-66-0	C <sub>2</sub> H <sub>3</sub> F <sub>3</sub>	300
HFC-143a	420-46-2	C <sub>2</sub> H <sub>3</sub> F <sub>3</sub>	3,800
HFC-152	624-72-6	CH <sub>2</sub> FCH <sub>2</sub> F	53
HFC-152a	75-37-6	CH <sub>3</sub> CHF <sub>2</sub>	140
HFC-161	353-36-6	CH <sub>3</sub> CH <sub>2</sub> F	12

# Air



HFC-227ea	431-89-0	C <sub>3</sub> HF <sub>7</sub>	2,900
HFC-236cb	677-56-5	CH <sub>2</sub> FCF <sub>2</sub> CF <sub>3</sub>	1,340
HFC-236ea	431-63-0	CHF <sub>2</sub> CHFCF <sub>3</sub>	1,370
HFC-236fa	690-39-1	C <sub>3</sub> H <sub>2</sub> F <sub>6</sub>	6,300
HFC-245ca	679-86-7	C <sub>3</sub> H <sub>3</sub> F <sub>5</sub>	560
HFC-245fa	460-73-1	CHF <sub>2</sub> CH <sub>2</sub> CF <sub>3</sub>	1,030
HFC-365mfc	406-58-6	CH <sub>3</sub> CF <sub>2</sub> CH <sub>2</sub> CF <sub>3</sub>	794
HFC-43-10mee	138495-42-8	CF <sub>3</sub> CFHCFHCF <sub>2</sub> CF <sub>3</sub>	1,300
Sulfur hexafluoride	2551-62-4	SF <sub>6</sub>	23,900
Trifluoromethyl sulphur pentafluoride	373-80-8	SF <sub>5</sub> CF <sub>3</sub>	17,700
Nitrogen trifluoride	7783-54-2	NF <sub>3</sub>	17,200
PFC-14 (Perfluoromethane)	75-73-0	CF <sub>4</sub>	6,500
PFC-116 (Perfluoroethane)	76-16-4	C <sub>2</sub> F <sub>6</sub>	9,200
PFC-218 (Perfluoropropane)	76-19-7	C <sub>3</sub> F <sub>8</sub>	7,000

**Air**


Perfluorocyclopropane	931-91-9	C-C <sub>3</sub> F <sub>8</sub>	17,340
PFC-3-1-10 (Perfluorobutane)	355-25-9	C <sub>4</sub> F <sub>10</sub>	7,000
Perfluorocyclobutane	115-25-3	C-C <sub>4</sub> F <sub>8</sub>	8,700
PFC-4-1-12 (Perfluoropentane)	678-26-2	C <sub>5</sub> F <sub>12</sub>	7,500
PFC-5-1-14 (Perfluorohexane)	355-42-0	C <sub>6</sub> F <sub>14</sub>	7,400
PFC-9-1-18	306-94-5	C <sub>10</sub> F <sub>18</sub>	7,500
HCFE-235da2 (Isoflurane)	26675-46-7	CHF <sub>2</sub> OCHClCF <sub>3</sub>	350
HFE-43-10pccc (H- Galden 1040x)	E1730133	CHF <sub>2</sub> OCF <sub>2</sub> OC <sub>2</sub> F <sub>4</sub> OCHF <sub>2</sub>	1,870
HFE-125	3822-68-2	CHF <sub>2</sub> OCF <sub>3</sub>	14,900
HFE-134	1691-17-4	CHF <sub>2</sub> OCHF <sub>2</sub>	6,320
HFE-143a	421-14-7	CH <sub>3</sub> OCF <sub>3</sub>	756
HFE-227ea	2356-62-9	CF <sub>3</sub> CHFOCF <sub>3</sub>	1,540
HFE-236ca12 (HG-10)	78522-47-1	CHF <sub>2</sub> OCF <sub>2</sub> OCHF <sub>2</sub>	2,800
HFE-236ea2 (Desflurane)	57041-67-5	CHF <sub>2</sub> OCHF <sub>2</sub> CF <sub>3</sub>	989
HFE-236fa	20193-67-3	CF <sub>3</sub> CH <sub>2</sub> OCF <sub>3</sub>	487



## Other GHG sources

- CO<sub>2</sub> – all animals, fermentation, many processes, ?
- Methane – Landfills, Cows, many processes, ?
- N<sub>2</sub>O – Nitric Acid, Dentist, NFS<sup>©</sup>, sewage, ?
- Fluorinated Compounds– Refrigeration, Al, Mg, Energy, ?





# Limiting GHGs (as CO<sub>2</sub>e)

- Thresholds – Major PSD/TV -100,000 ton/yr
  - Significant level – 75,000 ton/yr
- Very limited guidance from U.S. EPA
- Use applied knowledge
- We want complete limits



# Biogenic Deferral (CO<sub>2</sub> only)

- Goes till July 20, 2014
- “mass of the greenhouse gas carbon dioxide shall not include carbon dioxide emissions resulting from the combustion or decomposition of nonfossilized and biodegradable organic material originating from plants, animals, or micro-organisms (including products, by-products, residues and waste from agriculture, forestry and related industries as well as the nonfossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material).”



# Step Down

- 40 CFR 70.12(b)
- “The Administrator shall solicit comment, under section 307(b) of the Act, on promulgating lower GHGs thresholds for applicability under § 70.2. Such action shall be finalized by **July 1, 2012** and become effective **July 1, 2013.**”
- “No later than **April 30, 2015** the Administrator shall complete a study projecting the administrative burdens that remain with respect to stationary sources for which GHGs do not constitute a pollutant subject to regulation.”



# Contacts

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# References

- Tailoring Rule - FR Vol 75 No 106 Thursday June 3, 2010 page 31514 to 31608 - <http://www.gpo.gov/fdsys/pkg/FR-2010-06-03/pdf/2010-11974.pdf>
- Our Permit Rules – 326 IAC 2 - <http://www.in.gov/legislative/iac/T03260/A00020.PDF>
- 40 CFR 98
- AP-42
- U.S. EPA GHG page – [www.epa.gov/climatechange/emissions/index.html](http://www.epa.gov/climatechange/emissions/index.html)
- Biogenic Deferral - FR Vol 76 No139 Wednesday July 20, 2011 page 43490 to 43508 - <http://www.gpo.gov/fdsys/pkg/FR-2011-07-20/pdf/2011-17256.pdf>