DOUGLAS PRODUCTS

ProFume®

THE FACTS ON SULFURYL FLUORIDE AND CLIMATE CHANGE

FUMIGANT

What is the GWP (global warming potential) of a gas?

The GWP compares the energy absorbing potential of a gas to that of carbon dioxide which is assigned a value of 1. The comparison is made on a weight to weight basis, generally for a 100 year time frame. The GWP value is used to compare other gases to carbon dioxide equivalents. The CO_2 equivalent of a gas is the product of emission of the gas in tonnes and its GWP value.

What is the GWP (global warming potential) for sulfuryl fluoride?

The 100-year GWP for sulfuryl fluoride is currently calculated to be 4740 (Carpenter et al. 2014).

Is GWP (global warming potential) a measure of global impact of a gas on climate change?

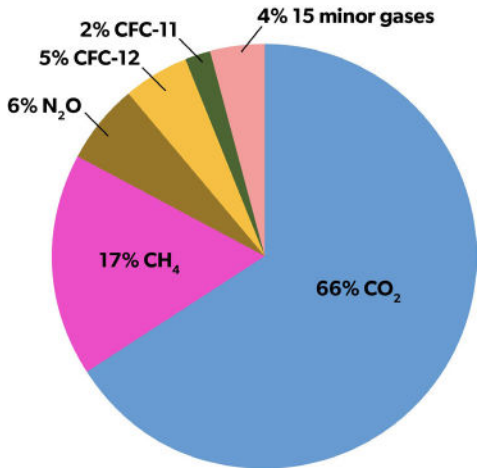
No, global impact of a gas on climate change is a function of its GWP and the abundance of the gas in the atmosphere.

How is the potential global impact of a gas on climate change measured?

The radiative forcing value is the measurement of the capacity of a gas to contribute to climate change. Radiative forcing is the difference between the amount of sunlight adsorbed by the earth and the amount of reflected sunlight radiated back into space. Gasses in the atmosphere can change the amount of sunlight absorbed and reflected by the earth, thereby affecting the temperature and climate of the earth. A gas with positive radiative forcing value is increasing the temperature of the earth. Conversely, a gas with a negative radiative forcing value is decreasing the temperature of the earth. The greater the radiative forcing value, positive or negative, the greater the gas contributes to climate change.

What is the radiative forcing value for sulfuryl fluoride compared to other gasses, such as carbon dioxide and methane?

The radiative forcing value of sulfuryl fluoride has been calculated to be about 0.36 mW/m^2 (Rigby et al. 2014). This value is extremely small when compared to the radiative forcing values of gasses associated with man's activities, such as carbon dioxide, CO_2 (1,850 mW/m^2) and methane, CH_4 (490 mW/m^2) (Carpenter et al. 2014). **The radiative forcing value of carbon dioxide is more than 5,000 times greater than that of sulfuryl fluoride.**



The figure above shows the global radiative forcing (Wm-^{2}) of major greenhouse gasses in 2017 (Butler and Montzka 2018). Carbon dioxide, CO_2, accounts for the majority (66%) of radiative forcing. **Sulfuryl fluoride is not included in the 15 minor gases because its contribution to climate change is so small.**

Why is the radiative forcing value for sulfuryl fluoride so much smaller that that of other gasses, such as carbon dioxide?

Sulfuryl fluoride has a calculated GWP of 4740, which is greater than the GWP of 1 for carbon dioxide. However, the quantities of sulfuryl fluoride released in the atmosphere are far less than those of carbon dioxide. The annual global emissions of carbon dioxide due to fossil fuel and industrial processes (32 x 109 tonnes, IPCC 2014) are about 8 million times greater than the annual emissions of sulfuryl fluoride.

What do the emissions of sulfuryl fluoride represent compared to all man-made greenhouse gas emissions?

In terms of CO_2 equivalents, the annual emissions of sulfuryl fluoride represent about 0.035% of the current total man-made greenhouse gas emissions, including CO_2 emissions from fossil fuel combustion and industrial processes.

Do any regulatory authorities agree that sulfuryl fluoride represents a negligible contribution to climate change?

The European Union Commission stated that the "carbon dioxide equivalent emissions of sulfuryl fluoride would still represent a negligible share of global greenhouse gas emissions."

"In the European Union, in line with its overall strategy for the negotiations on climate change, does not, at this stage, intend to propose the inclusion of sulfuryl fluoride in a future agreement under the United Nations Framework Convention on Climate Change (UNFCCC)" (European Union Commission 2009).

Is the concentration of sulfuryl fluoride in the atmosphere being measured?

A consortium of multi-national research institutions and government organizations provide funding to AGAGE – the Advanced Global Atmospheric Gases Experiment. AGAGE measures the atmospheric concentrations of more than forty gasses, including sulfuryl fluoride (https://agage.mit.edu). Concentrations of sulfuryl fluoride are measured using gas chromatography - mass spectrometry (GC-MS) systems located at monitoring stations in seven locations; Tasmania, Switzerland, Ireland, Barbados, Samoa, California (USA), and Norway. Multiple measurements are taken daily to calculate average monthly and annual sulfuryl fluoride concentrations for each location.

What is the current concentration of sulfuryl fluoride in the atmosphere?

The concentration of sulfuryl fluoride in the atmosphere, as of 2018, was about 2.5 parts per trillion (ppt) based on AGAGE data.

Is the concentration of sulfuryl fluoride in the atmosphere increasing?

The concentration of sulfuryl fluoride has increased by less than 1 part per trillion (ppt) in the past 10 years based on AGAGE data. For comparison, one ppt is equivalent to about one second in 32,000 years. The past and future projected increases in sulfuryl fluoride concentrations are small, and will continue to have a negligible impact on climate change.

Are any regulatory agencies reviewing the sulfuryl fluoride concentrations in the atmosphere?

The European Union Commission requires Douglas Products, a registrant for ProFume® and Vikane® fumigants which contain 99.8% sulfuryl fluoride, to submit a report every five years that reviews sulfuryl fluoride concentrations in the atmosphere (COMMISSION DIRECTIVE 2006/140/EC 2006, COMMISSION DIRECTIVE 2009/84/EC 2009). The report summarizes the sulfuryl fluoride concentrations measured by AGAGE, discusses the GWP and atmospheric lifetime of sulfuryl fluoride, and estimates future atmospheric concentrations of sulfuryl fluoride.

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