Sulfuryl Fluoride

Indispensable Pest Management Tool

But what is the impact of sulfuryl fluoride on the atmosphere?

Important Tool for IPM in Critical Commodities

Professional fumigation is often necessary to prevent or eliminate pest infestations. The choice of pest management method(s) is informed by a comprehensive Integrated Pest Management (IPM) process designed to protect against pests in a manner that minimizes unintended impact.

Protecting Critical Commodities from Pest Infestation

Sulfuryl fluoride (SF) can be used in a broad range spectrum of applications to eliminate a variety of pests, including protection of postharvest food commodities and agricultural products, protection of industrial structures and storages, as well as quarantine treatments prior to export of products such as wood and industrial machinery. Without SF, many countries could not export critical commodities.

SF is an important tool for pest infestations that are widespread or concentrated in areas that are difficult or impossible to access using alternative treatments. Left untreated, such infestations can threaten global trade, food safety and public health around the world.

SF fumigation has numerous advantages over alternatives, including greater efficacy on target pest species, lack of field pest resistance and flexible treatment time frames that may be necessary to expedite processing and shipment of time-sensitive exports. Treatment with SF does not leave pesticide residues on hard surfaces or processing equipment and is noncorrosive to sensitive equipment and electronics in commercial facilities.

SF is an indispensable tool to fight various pest infestations, and in certain quarantine scenarios, it is the only viable solution. SF helps preserve many items such as wooden structures, commercial facilities, and industrial machines and parts, thereby enhancing the sustainability and longer-term use of these materials.

Preserving the Greenest Structures – the Ones Already Built

SF is a highly effective chemical used to fumigate homes, buildings, historic structures and artifacts infested with wood-destroying insects. Fumigation with SF is a proven process that can completely control these destructive insects because it is able to penetrate the inaccessible areas where pests hide and cause serious damage by eating away the wood structure.

SF has preserved more than 3 million existing homes and structures globally. SF also:

- Reduces climate-changing carbon generated by replacement of existing buildings
- Protects historic monuments, wooden artifacts and churches
- Mitigates rising home costs and supports the real estate economy
- Protects public health and safety by eradicating pests

ProFume® FUMIGANT

Vikane® FUMIGANT

Based on research and more than 60 years of real-world use, fumigation with SF offers peace of mind because it penetrates the entire infested area to eliminate target pests without damaging property or leaving surface residues.

SF is an indispensable tool that helps to preserve wood structures, including houses and wooden construction parts, thereby enhancing their sustainability and long-term use.

Benefits of SF Outweigh Potential Environmental Impacts

Decades of scientific research and monitoring clearly demonstrate that the combined benefits of SF far outweigh its potential environmental impacts. Only licensed professionals that receive mandatory annual stewardship training and have a valid national fumigation license can apply SF, which is used under strict government regulations.

Critics of SF suggest it should be regulated as a greenhouse gas (GHG) because it has a global warming potential (GWP) of approximately 4,800 over a 100-year time frame. However, SF is not currently regulated as a GHG by the international community, including the 2015 Paris Agreement and the most recent United Nations Climate Change Conference (COP 27), which aims to reduce significant contributors of global GHG emissions.

SF has a negligible impact on climate change. The average atmospheric concentration of SF is extremely low and there is no indication in the published literature that it will ever rise to a level that would contribute meaningfully to global GHG emissions.

Q: I understand the benefits of using SF because it's been proven to eliminate target pests, but what impact does SF have on the environment?

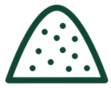
A: SF is not an ozone depleter and has, in fact, been recognized with environmental stewardship awards by the United Nations and the U.S. Environmental Protection Agency. The **Montreal Protocol** is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances, including methyl bromide, that are responsible for ozone depletion.

The **Paris Agreement** is an international agreement to reduce the impact of climate change. Climate change is often defined by the impact of GHGs, which are gases that trap heat in the atmosphere. The most commonly known and prevalent GHGs are carbon dioxide, methane and nitrous oxide. SF has not been recognized in the international community as a GHG that is a significant contributor to climate change.

Q: What are the concentrations of SF in the atmosphere?

A: The current average concentration of SF in the atmosphere is extremely low — about 2.62 parts per trillion (ppt).[1] To put this into a context that can be more easily understood, 2.62 ppt is roughly analogous to:

The energy consumed by one single 60W lightbulb running for about five days compared with the electricity produced in the EU in one year (about 2,784,554 gigawatt-hours)[2]



One grain of sand in roughly 190,000 kilograms (about 190 metric tons) of fine sand[3]

In addition, one ppt is equivalent to about one second in 32,000 years.[4]

There is nothing in the available literature, and no indications from model projections, to suggest that SF concentrations will ever rise to a level that would constitute a meaningful contribution to total global GHG emissions, much less global climate change.

The concentrations of the most common GHGs in the atmosphere are much larger than those of SF and account for the vast majority of the resulting effects on climate:

The concentrations of SF are negligible in comparison with these gases.

The ratio of carbon dioxide concentrations to SF in the atmosphere is greater than 164 million-to-1. The ratio of SF to carbon dioxide is comparable to one second in 5.2 years or to 1 centimeter in about 1,640 kilometers.[5]

The ratio of methane to SF exceeds 750,000-to-1.[5]

The ratio of nitrous oxide to SF exceeds 130,000-to-1.[5]

Q: What is the difference between effective radiative forcing and radiative forcing?

A: Earth's atmosphere receives energy in the form of solar radiation. If more radiation is entering Earth than leaving, the atmosphere will warm up. This is called radiative forcing (RF) because the difference in energy can force changes in Earth's climate. Effective radiative forcing (ERF) is an indicator of responses to human activities, such as emissions of carbon dioxide, methane and other greenhouse gases, and to natural processes, such as volcanic eruptions, that have changed Earth's climate.

Q: How does the effect of SF emissions compare with that of other greenhouse gases with respect to global warming?

A: The effective radiative forcing value of SF is extremely small when compared with the radiative forcing values of gases associated with human activities, such as carbon dioxide and methane. For example, the radiative forcing value of carbon dioxide is more than 4,000 times greater than that of SF.[6] The following charts clearly show the small effect of SF relative to other GHGs.

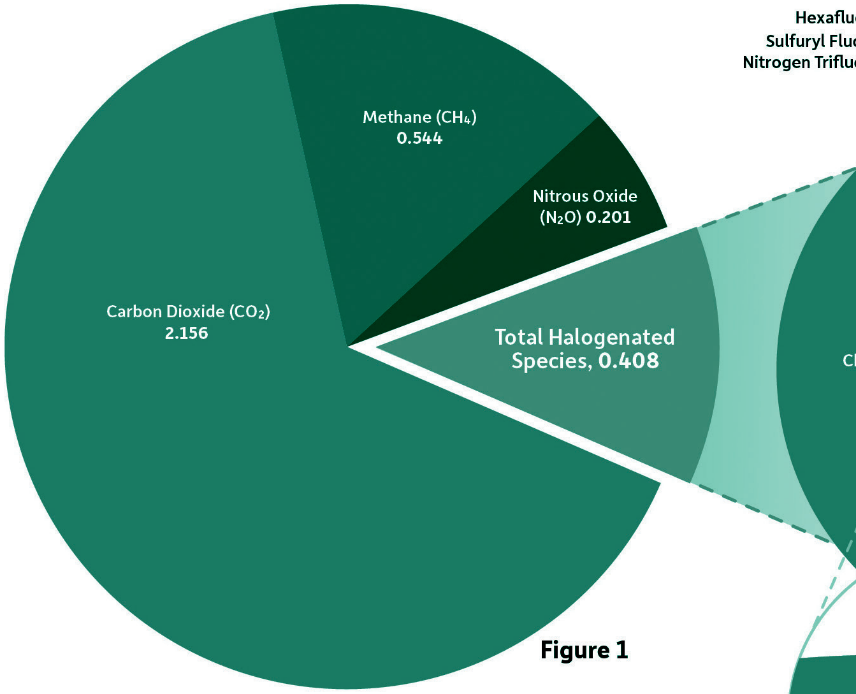
Total Effective Radiative Forcing (ERF)

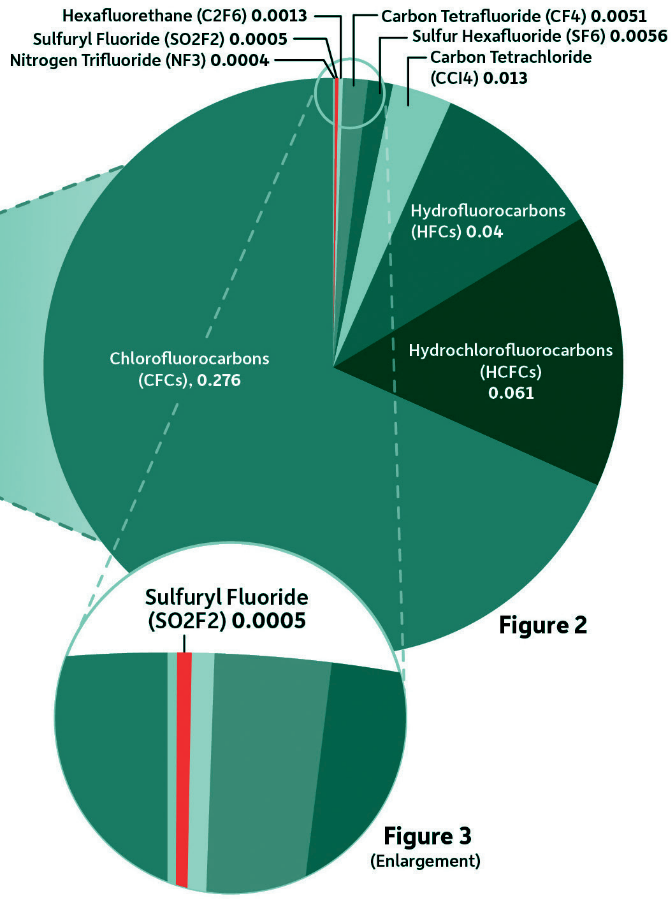
Contributions of Greenhouse Gases to Total Effective Radiative Forcing

(watts per square meter)[1]

Contributions of Various Halogenated GHGs to Total Effective Radiative Forcing

(watts per square meter)[1]





As shown in **Figure 1**, most of the total ERF from well-mixed GHGs is due to CO_2, CH_4 and N_2O, with most of the remainder from halogenated gases.

Figure 2 shows the total ERF from all halogenated gases, which include SF.

Figure 3 shows that SF is a negligible portion of the total ERF attributable to halogenated gases.

CONCLUSIONS

- Average concentrations of SF in the atmosphere are very low, especially in comparison with concentrations of the major GHGs.
- The effect of SF on the climate is negligible when compared with other GHGs.
- If the production and use of SF was eliminated, there would be no meaningful effect on total global GHG emissions or global climate change.

References:

[1]Global average SF concentration based on monthly background concentrations for the period October 2019 to September 2020 at seven monitoring stations as part of the Advanced Global Atmospheric Gases Experiment (AGAGE). Data available from: https://agage2.eas.gatech.edu/data_archive/agage/gc-ms-medusa/monthly/.

[2]EU total net electrical generation for 2020 obtained from Eurostat Data Browser: https://ec.europa.eu/eurostat/databrowser/view/NRG_BAL_C__custom_1970141/bookmark/table?lang=en&bookmarkId=d9edf51f-af56-42e2-a7f5-c8debed97494. Ratio calculated as follows: (2,784,554 x 109 watt-hrs x 2.62 x 10^{-12})/60 watts = 121.6 hr, or about 5 days.

[3]Calculated as follows assuming an average grain of fine quartz sand (spherical grain with radius of 0.1875 mm, density of 2.65 g/cm^3): Mass of a single sand grain = (4/3) x π x $(0.1875/10)^3$ cm^3 x 2.65 g/cm^3 = 7.32 x 10^{-5} g
Mass of 2.62 x 10^{12} grains = 7.32 x 10^{-5} g x 2.62 x 10^{12} grains x (kg/1000 g) = 191,784 kg.

[4]Calculated as follows: 2.62 x 10^{12} sec x (min/60 sec) x (hr/60 min) x (day/24 hr) x (year/365 days) = 83,080 years.

[5]Greenhouse gas concentrations for 2019 obtained from: IPCC, 2021: Annex III: Tables of historical and projected well-mixed greenhouse gas mixing radiative forcing of all climate forcers. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

[6]Effective radiative forcing (ERF) based on the period (1750-2019) obtained from: IPCC, 2021: Annex III: Tables of historical and projected well-mixed greenhouse gas mixing radiative forcing of all climate forcers. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Ratio of ERF for CO_2 (2.156 watts/square meter) to that of SF (0.0005 watts/square meter) = 4,312.