Emission of sulphur hexafluoride from fire extinguishing equipment

Some of the new substitutes for halon in fire extinguishing equipment contain sulphur hexafluoride, SF_6, probably in blends with HFC. If the products contain SF_6, it is emitted to the atmosphere in the same manner as HFC or PFC. The equations for the estimation of HFC and PFC emissions from fire extinguishing equipment are therefore also valid for SF_6, since they have to be adjusted for the proportion of the SF_6 in the original blend. Emissions of SF_6 are to be calculated according to the proportion of this chemical in the blend.

2.17.4.5 Estimation of Emissions of HFCs and PFCs from Aerosol Products

HFCs may be used as replacements for CFCs and HCFCs in aerosol propellants in industrial and technical applications, and household, medical and personal care products. The HFCs that may be used include HFC-125, HFC-134a, 152a, and HFC-227ea (Kroeze, 1995; U.S. EPA, 1992b).

Gases from aerosols are usually released shortly after production, on average six months after sale in the United States and Europe. During use of aerosols, 100 per cent of the chemical is emitted (Gamlen et al., 1986; U.S. EPA, 1992a). For this methodology, aerosol emissions are estimated to be one half of the current year sales of the aerosol plus one half of the previous year sales (Gamlen et al., 1986). In other words, aerosol emissions in year t can be calculated as follows:

Emissions of HFCs in year t
=
50% of the quantity of HFCs contained in aerosols sold in year t
+
50% of the quantity of HFC contained in aerosols sold in year t-1

This calculation accounts for the six month lag from purchase to use. Total aerosol use each year can be calculated as the number of aerosol cans sold in a given year times the charge of HFC or PFC in each can. Finally, Kroeze (1995) points out that technologies do not exist to reduce emissions from aerosol cans.

2.17.4.6 Estimation of Emissions of HFCs and PFCs from Solvents

HFCs and PFCs may be used as replacements for CFC-113 in metal cleaning, electronics, and precision cleaning applications and as replacements for aerosol cleaning. The compounds that may be used include HFC-43-10, PFC-614, PFC-512, PFC-612, PFC-716, and PFC-819 (Kroeze, 1995; U.S. EPA, 1992b).

Chemicals used as cleaning agents are emitted during, or shortly after, use and are typically 100 per cent of total use (Fisher and Midgley, 1993; U.S. EPA, 1992a). This methodology assumes that solvents, on average, are used six months after they are sold. Total HFC or PFC emissions in year t can therefore be calculated as follows:

Emissions of HFCs or PFCs in year t

=

50% of the quantity of HFCs or PFC sold for use in solvent applications in year t

+

50% of the quantity of HFCs sold for use in solvent applications in year t-1

It has been estimated that solvent emissions can be reduced by up to 80 per cent through the use of improved housekeeping and recycling practices.

2.17.4.7 Estimation of Emissions of HFCs and PFCs from Other Applications

Other Applications

Other applications in which HFCs and PFCs may replace CFCs and HCFCs include sterilisation equipment, tobacco expansion applications, and use as solvents in the manufacture of adhesives, coatings, and inks. The specific compounds include HFC-125, HFC-134a, and HFC-227ea (Kroeze, 1995; U.S. EPA, 1992b).

For other applications, it is assumed that all HFCs and PFC are released within 6 months after production. Emissions in the year t can be calculated as follows:

Emissions of HFCs or PFCs in year t

=

50% of the quantity of HFCs/PFCs sold for other applications in year t

+

50% of the quantity of HFCs/PFCs sold in year t-1

2.17.4.8 Sulphur Hexafluoride (SF_6) Emissions

Primary uses of SF_6

Primary uses of SF_6 include the following:

Gas-Insulated Switchgear and Circuit Breakers

SF_6 is used as an insulation medium in high tension electrical equipment including gas insulated switchgear (GIS) and circuit breakers.

Fire suppression and explosion protection

Some of the new gases placed on the market as substitutes for halons in fire extinguishing equipment, may contain up to 20 per cent sulphur hexafluoride, SF_6. These applications are described in Section 2.17.4.4.

Globally, it is estimated that about 80 per cent of SF_6 is used in gas-insulated switchgear and circuit breakers, 5 to 10 per cent in the magnesium and aluminium industries, and 5 to 10 per cent in a number of smaller applications (Ko et al., 1993).

Other applications

SF_6 is used in a variety of additional applications including as an insulating medium in sound proof windows, in leak detectors, gas-air tracers, and various electronic applications. The use of SF_6 in production of aluminium and magnesium is covered under Section 2.13.8.

Recommended methodology for estimating SF_6 emissions

Total emissions of SF_6 used in GIS application and circuit breakers can be assumed to be approximately 1 per cent of the total quantity of SF_6 contained in such equipment each year (NILU, 1993). In addition, if it is assumed that GIS equipment has a lifetime of 30 years, then approximately 70 per cent of the SF_6 will remain in the equipment upon retirement and will then be released upon disposal of the equipment (NILU, 1993). Total emissions from GIS applications can therefore be estimated as:

Emissions of SF_6 in year t
=
1% of the total charge of SF_6 contained in the existing stock of equipment in year t
+
70% of the quantity of equipment manufactured in year t-30.

The total charge of SF_6 contained in equipment can be estimated as the product of the total quantity of equipment in operation and the typical charge size of equipment. Charge sizes for GIS equipment rated to 50 kV or more can range from hundreds to thousands of kilos per installation, and for low-voltage switches contain 1-2 kg per installation (Kroeze, 1995).

If data on the total stock of GIS are unavailable, then it should be assumed that emissions equal consumption.

2.18 References

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