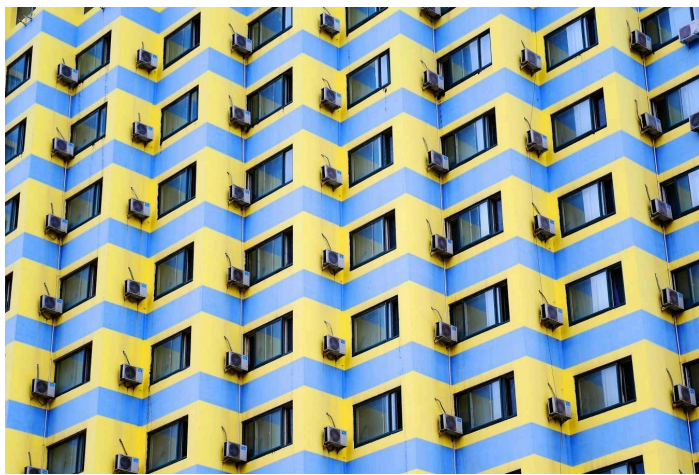


Global treaty is failing to curb ultra-potent greenhouse gas emissions

Countries have pledged to phase out HFC-23, a powerful greenhouse gas, but atmospheric data shows that emissions are five times higher than governments are reporting

By [Madeleine Cuff](#) on January 2, 2025



Air-conditioning units, which often use HFC gases, on a building in Shenyang, China. Visual China Group via Getty Images

Emissions of a powerful greenhouse gas released as a byproduct in the manufacture of refrigerants are much higher than reported by governments, suggesting a global agreement to stamp out such emissions is failing.

Under the [Kigali Amendment to the Montreal Protocol, signed in 2016](#), more than 160 countries said they would do their best to [eradicate emissions of HFC-23](#), a gas with 14,700 times more warming potential than carbon dioxide. Data provided by governments suggest emissions have fallen by more than 80 per cent since 2008.

But analysis of atmospheric data paints a different picture, indicating that countries haven't succeeded in reducing HFC-23 emissions by anywhere near as much as they claim.

HFC-23 is a byproduct of the process used to create HCFC-22, a refrigerant and a feedstock for some kinds of plastics. Emissions can be plugged by adjusting manufacturing processes and retrofitting factories.

A research team led by [Ben Adam](#) at the University of Bristol, UK, compared estimates of HFC-23 emissions based on atmospheric analysis with estimates based on “bottom-up” emissions data and policy action published by individual countries.

[The researchers found](#) that although HFC-23 emissions are falling, they remain well above reported levels and out of line with the aims of the Kigali Amendment.

In 2019, global HFC-23 emissions hit a high of 17.3 kilotonnes per year, the team found. By 2023, the latest year for which data is available, this had dropped to 14.1 kilotonnes per year. But that is still five times as much as the reported emissions based on information from national governments.

[Tim Arnold](#) at Lund University in Sweden says the research is “pretty rigorous” and demonstrates that the Kigali Amendment “isn’t working as well as it should be”. “For some reason, it appears that these HFC-23 emissions are just not being abated at the rate they should be,” he says. Arnold wasn’t involved in the analysis.

China is a major global producer of HCFC-22, and therefore a major emitter of HFC-23. It [claims](#) to have virtually eliminated HFC-23 emissions by implementing abatement strategies.

But this latest analysis used atmospheric data from a monitoring station in South Korea to assess the true scale of HFC-23 emissions in eastern China, where most of the country’s HCFC-22 producers are located. Estimates based on China’s reported action suggest the country’s emissions should be around 1 kilotonne per year. Atmospheric analysis indicates the emissions from eastern China were closer to 5.6 kilotonnes per year in 2023, with emissions having fallen by only 40 per cent since 2018.

These emissions make up around one-third of the global discrepancy between reported emissions and atmospheric observations. Russia and India are also major HCFC-22 producers, so HFC-23 emissions may well be continuing in these nations as well, says Arnold, but there is no nearby monitoring station to detect them.

“Russia and India could have a big impact on global HFC-23 emissions. But unfortunately, we just don’t have the measurements in place to make those calculations,” he says.

A more comprehensive monitoring system would help scientists trace where fugitive HFC-23 emissions are coming from. But ensuring countries stick to their international commitments is a political challenge, he says.

New Scientist contacted China’s Ministry of Ecology and Environment for comment, but did not receive a response. In 2024, China announced further action to crack down on HFC-23 emissions, including a new requirement for large HFC producers to install monitoring equipment that would report emissions information to a government tracking system.

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