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# China plans CFC-monitoring network to investigate rogue emissions

*The move follows a recent study that attributed a spike in an ozone-depleting chemical to two Chinese provinces.*

David Cyranoski



A rogue source of ozone-destroying gas has been tracked to China, and foam manufacturers are in the firing line. Credit: JG/Alamy

When atmospheric models traced a mysterious spike of an ozone-destroying gas to two provinces in China [earlier this year](#), scientists waited to see how the Chinese government — and other nations — would respond to this possible violation of international law.

Now the government is under pressure to act — and has presented a plan to help it track and reduce emissions of the chemical, known as trichlorofluoromethane or CFC-11. Measures include establishing a national monitoring network to track ozone-depleting chemicals, along with heftier penalties for companies caught illegally producing the chemical.

Details of the plan emerged in notes released last month from a May meeting of the Multilateral Fund for the Implementation of the Montreal Protocol, held in Montreal, Canada.

The “document sets the stage for real progress on this important issue”, says David Fahey, director of the Chemical Sciences Division at the US National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory in Boulder, Colorado.

The Chinese environment ministry disputes that there is enough evidence to pin the recently discovered spike in emissions on China, but agrees that more data are needed to understand the problem. The ministry was “shocked and perplexed” when it heard of rising levels of the chemicals, a spokesperson told *Nature’s* news team.

## Popular refrigerant

CFC-11 was once a popular refrigerant, and widely used to produce polyurethane foam insulation. But the 1987 Montreal Protocol, a legally binding global treaty to protect the ozone layer, called for its production and trade to be phased out by 2010. The multilateral fund has distributed billions of dollars to nearly 150 countries, including China, to help them phase out chemicals that deplete the ozone layer (known as ozone-depleting substances, or ODS).

The [treaty worked](#), and global CFC-11 production dropped until 2013, when a surprising slowdown in that decline suggested that there was a new source of emissions.

The studies that pointed to China as the source of the mysterious spike<sup>1,2</sup> used data from monitoring stations in Japan and South Korea to trace the gas to the provinces

of Hebei and Shandong — but no more precisely.

Scientists suspect that factories there might have resumed production of a CFC-11-based foam insulator. Because China has ratified the Montreal Protocol, it is obliged to address any illegal CFC-11 production.

China has released few details about its plan for a national monitoring network. But the documents from the Montreal meeting say it plans to select several key cities where routine monitoring will begin within three years.

Scientists say that if the network uses stations close to Hebei and Shandong, it could pinpoint the source of the mysterious CFC-11 spike much more exactly.

That would aid ongoing Chinese and international efforts to eliminate the spike, says Stephen Montzka, an atmospheric chemist at the NOAA Earth System Research Laboratory. He was part of the research team that used atmospheric models to identify the spike, tracing it first to east Asia, in a study published in *Nature* in May 2018<sup>1</sup>, and then to northeast China, in a *Nature* paper published in May 2019<sup>2</sup>. Montzka hopes that any data gathered by the national network will be open to the global scientific community.



The Hateruma Global Environment Monitoring Station in Japan helped to detect CFC-11 emissions that were traced to northeast China. Credit: NIES

## Government denial

In May, China's environment ministry questioned the conclusions of the most recent study, noting "great uncertainty" in the reported amount and location of emissions. "China has always maintained its tough stance on illegal production and use of ODS," said a statement released by the ministry.

But the statement also said that the study "makes us realize the importance of atmosphere monitoring".

The Chinese government acknowledges some illegal CFC-11 production: before the meeting, it provided the multilateral fund with a report detailing how it had seized 114 tonnes of illegally produced CFC-11 since 2012.

But such amounts could not account for the roughly 7,000 tonnes of CFC-11 that, according to estimates in the May *Nature* paper, is being newly produced each year. (*Nature's* news team is editorially independent of its journal team.)

Independent scientists say they have confidence in those estimates. "The measurements are of a very high quality," says Claire Reeves, an atmospheric chemist at the University of East Anglia in Norwich, UK. She is leading a team that is building a CFC-11 data set from samples taken in northern Taiwan, which also points to a source of CFC-11 emissions in northeastern China, she says.

A former central-government employee who worked on the regulation of ozone-depleting chemicals, and who asked to remain anonymous because of the sensitivity of the issue, says it is likely there is ODS production that the Chinese government does not know about. Only a few people at local environment and ecology bureaus are assigned to oversee an entire province's monitoring and enforcement efforts on these gases, the source says: "It's not a core task of the ministry."

Attempts by *Nature's* news team to contact the environment and ecology board for Hebei province were unsuccessful. Shandong province responded to queries about its efforts by forwarding the formal statements from the national environment ministry.

China's national environment ministry did not offer a direct response to these comments either, but its spokesperson acknowledged that some problems have arisen

during the 30 years since the Montreal Protocol was established. "We believe that as part of international collaborative efforts, we can work for the continued success and progress of the Montreal Protocol."

## 1,000 stations

To measure CFC-11, the new network could make use of China's more than 1,000 existing air-quality monitoring stations, which currently measure pollutants such as PM2.5 (pollutant particles smaller than 2.5 micrometres across).

Some are already used to measure CFC-11, says Montzka. He participated in Chinese studies indicating that emissions of the chemical had declined as of 2012.3. But published measurements from inside China rely on infrequent sampling or consider atmospheric changes only over short periods, he says. Finding the source of the spike that emerged in 2013 would require more frequent sampling over a longer period. Montzka says those capabilities could be added to monitoring stations or might even already exist.

China has a northeastern monitoring station in Shangdianzi that is part of the Advanced Global Atmospheric Gases Experiment (AGAGE), a worldwide network that also includes the stations in Japan and South Korea used in the May 2019 *Nature* study.

But some researchers say that the Shangdianzi data seem to be contaminated. One possible explanation is that the building that has housed the station since 2011 contains insulation made using CFC-11. The station has not produced usable data since then, says Sunyoung Park, an atmospheric chemist at Kyungpook National University in Daegu, South Korea, who collaborates with scientists in China and is a co-author of the *Nature* paper published in May.

"This is quite unfortunate given that good measurements from this site would have likely been very useful in enhancing our understanding of this issue," says Montzka. (Using insulation that was made with CFC-11 before the 2010 phase-out does not violate the Montreal Protocol, which banned only production of and international trade in the gas.) Park hopes the contamination will eventually dissipate.

China also told the multilateral-fund meeting that it will establish six new laboratories capable of testing for ozone-depleting chemicals in insulation foam, which will speed up the testing of suspect products and help the government to crack down on such activity. Two will be in Beijing and one in Jinan, the capital of Shandong province, according to the environment ministry's spokesperson. The others will be in the cities of Guangzhou, Hangzhou and Chongqing.

Many representatives at the meeting in Montreal, including those from the United States and Japan, the top two contributors to the fund, expressed frustration with China's apparent failure to curb emissions and demanded quick action. Japan even warned that it might withdraw funding if the cause of the CFC-11 emissions is not addressed.

China says that it will report on its progress at the next meeting of the fund, in Montreal in December.

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