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Chinese industrial areas identified as a major source of illegal ozone-depleting CFC gas

ABC Science / By Anna Salleh

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Hot spots of CFC-11 emissions have been tracked down to industrial areas in the provinces of Hebei and Shandong. *(Getty/Kevin Frayer/Stringer)*

A puzzling burst of a banned ozone-depleting gas has been tracked to industrial areas in northeastern mainland China.

According to a study published today in Nature, emissions from eastern China of the chlorofluorocarbon CFC-11 have been increasing by 7,000 tonnes a year since 2013.

The findings are based on air monitoring stations in South Korea and Japan, which were able to pick up tell-tale plumes of the gas as they wafted across the sea from China.

Key points:

- Ozone-depleting CFCs are banned but evidence last year showed many tonnes of CFC-11 were still being produced
- Air monitoring stations in Japan and Korea show evidence China is

CFC-11 is used in polyurethane foams that insulate buildings and refrigerators, but its production was supposed to have been phased out by 2010 under the Montreal Protocol. The gas also contributes to global warming.

But research published in May last year using NOAA's network of air monitoring stations found evidence someone in the world was producing and emitting thousands of tonnes of CFC-11 into the atmosphere.

a major source of the pollution

- Continued CFC production contravenes international agreement and if it is not stopped it could delay repair of the ozone hole for decades

A monitoring station on Mauna Loa in Hawaii suggested eastern Asia might be the source.

map showing where CFC-11 pollution has increased and decreased in China

e red hotspots show where CFC-11 emissions have increased in China since 2013. *(Supplied: Nature/CSIRO)*

In the months that followed, a NGO called the Environmental Investigation Agency reported the first on-the-ground evidence of illegal production and use of CFC-11 in China.

At the time, the head of the United Nations Environment Program told a New York Times investigation that illegal production of CFC-11 was "nothing short of an environment crime which demands decisive action."

The scale of that crime has now been quantified.

Measurements and modelling by an international team of researchers has shown an extra 11,000 to 17,000 tonnes of CFC-11 per year is being emitted into the atmosphere.

The analysis shows 40 to 60 per cent of the total emissions are coming from industrial areas in northeastern China.

"We found a hot spot over somewhere near Shandong and Hebei provinces," said lead researcher Matt Rigby, an atmospheric chemist from the University of Bristol.

Global air monitoring network key to research

The emissions were picked up by the Gosan air monitoring station in Korea and the Japanese Hateruma station, both part of the Advanced Global Atmospheric Gases Experiment (AGAGE) network.

"The Korean data showed the magnitude of those pollution events started to increase after 2012," said Dr Rigby.

"Someone in that area started to emit more CFC-11 than they used to.

"We looked at the rest of the network as well and didn't find any evidence of increasing emissions from other places."

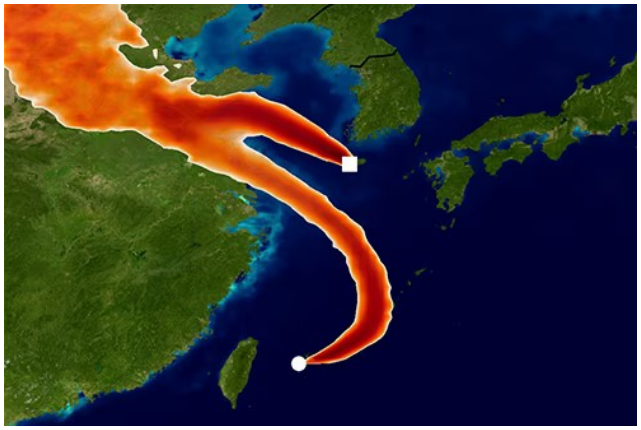
The researchers said they have ruled out the idea that emissions had come from gas leaking out of foam that was produced before the ban on CFCs.

"Some people have proposed that maybe buildings made in the 70s and 80s were being demolished more rapidly and they could be releasing this pulse of CFC-11 into the air," said Dr Rigby. "But we just didn't find there was enough CFC-11 locked up in existing foams to make that plausible.

> "It's difficult to get this emissions signal without new production after 2010."

Dr Rigby said the team hoped to work with Chinese researchers to better nail down the culprits.

"It would be great to see if data from China could help us locate the major emissions sources more precisely, or to see if there are emissions originating from more westerly or southerly areas of China, which the Gosan and Hateruma data are not sensitive to."



Simulation of movement of CFC-11 gases from northeastern China to tracking stations in Gosan and Hateruma *(Supplied: M Rigby et al/Nature)*

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graph showing CFC-11 emissions

e extra emissions have affected the expected decline in CFC-11 emissions. *(Supplied: Paul Krummel/CSIRO)*

Tasmania's Cape Grim station provided a comparison

The Cape Grim air monitoring station in north-west Tasmania also played an important role in the latest findings, said Australian co-author Paul Krummel from CSIRO's Climate Science Centre.

It helped provide background measurements of CFC-11 in the circulating global air. This relatively clean air could provide a baseline to which air from the Korean and Japanese stations could be compared.

e cliff-top Cape Grim air monitoring station in north-west Tasmania helped provide the 'clean' control samples for the alysis. *(Supplied: BOM)*

"This paper highlights the importance of doing long-term measurements of compounds like CFC-11 to verify that global environmental agreements (like the Montreal Protocol) are being adhered to," said Dr Krummel.

"And we need more measurement stations to undertake these at locations not covered around the world."

Dr Rigby agreed large areas of the world were not being monitored in detail which means some of the rogue emissions may be coming from elsewhere.

"We may have just been 'lucky' that a substantial fraction of the global emissions — those from eastern China — are within the footprint of our measurement stations."

What will happen to the ozone hole now?

Atmospheric chemist Susan Strahan of NASA, who was not involved in the study, welcomed the new research.

"It helps to point to where those emissions are coming from," said Dr Strahan, who has been studying the recovery of the ozone hole over Antarctica.

The ozone layer is Earth's "sunscreen", and its thinning due to CFCs makes us more vulnerable to the harmful effects of the Sun's ultraviolet rays.

While ozone depletion occurs across the planet, it is particularly severe in the Antarctic, where the cold speeds up the conversion of CFC breakdown products into ozone-damaging chlorine atoms.

Depending on how cold each winter is this will also cause fluctuation in the size of the hole.

The hole was the largest in 2000, when it reached 30 million square kilometres, nearly four times the area of Australia.

But by 2018 it had shrunk to 24.7 million square kilometres and was on track to be largely recovered by around the middle of the century or a bit after.

YOUTUBE: The ozone hole gets bigger and smaller each year but has generally been shrinking.

Dr Strahan said we won't know what impact the recent increase in CFC-11 emissions will have on the ozone hole.

"The new emissions will definitely slow down the recovery of the ozone hole, but will it be five years, 10 years, 20 years? I'm not sure," she said.

"The answer really depends on whether or not these emissions cease."

To make matters more complicated there is also a delay between when the gas is released and it has an impact on the ozone layer, as well as a delay in when the gas is released from the products it was used in.

"If it's all locked up in foams now that have gone into buildings then it could be decades before we see the full amount released into the atmosphere," said Dr Rigby.

"There's potentially a bit of a tip of the iceberg situation here."

What is China doing?

China, which has been a major producer of polyurethane foam, recently reported to the United Nations Environment Program that it has been cracking down on illegal production and use of ozone depleting chemicals, by destroying facilities and imposing fines.

And according to news reports, the Chinese Ministry of Ecology and Environment promised to strengthen its policing activities this year.