Mysterious rise in banned ozone-destroying chemical shocks scientists

CFCs have been outlawed for years but researchers have detected new production somewhere in east Asia

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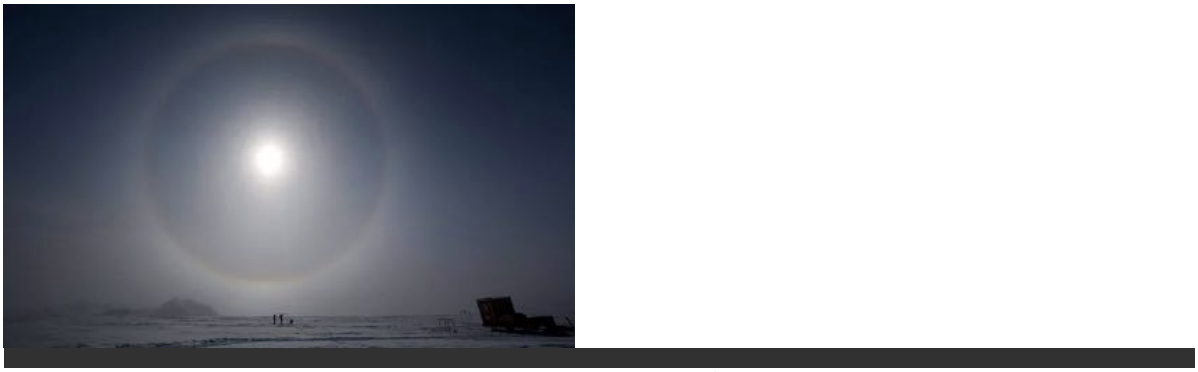

If the new emissions continue they could set back the recovery of the ozone layer by a decade. Photograph: Felipe Trueba/EPA

A sharp and mysterious rise in emissions of a key ozone-destroying chemical has been detected by scientists, despite its production being banned around the world.

Unless the culprit is found and stopped, the recovery of the ozone layer, which protects life on Earth from damaging UV radiation, could be delayed by a decade. The source of the new emissions has been tracked to east Asia, but finding a more precise location requires further investigation.

CFC chemicals were used in making foams for furniture and buildings, in aerosols and as refrigerants. But they were banned under the global Montreal protocol after the discovery of the ozone hole over Antarctica in the 1980s. Since 2007, there has been essentially zero reported production of CFC-11, the second most damaging of all CFCs.

The rise in CFC-11 was revealed by Stephen Montzka, at the US National Oceanic and Atmospheric Administration (NOAA) in Colorado, and colleagues who monitor chemicals in the atmosphere. “I have been doing this for 27 years and this is the most surprising thing I’ve ever seen,” he said. “I was just shocked by it.”

“We are acting as detectives of the atmosphere, trying to understand what is happening and why,” Montzka said. “When things go awry, we raise a flag.”

Erik Solheim, head of UN Environment, said: “If these emissions continue unabated, they have the potential to slow down the recovery of the ozone layer. It’s therefore critical that we identify the precise causes of these emissions and take the necessary action.”

CFCs used in buildings and appliances before the ban came into force still leak into the air today. The rate of leakage was declining steadily until 2013, when an abrupt slowing of the decline was detected at research stations from Greenland to the South Pole.

Scientists then embarked on an investigation, published in the journal Nature, to find out the cause. The detective work began by assessing whether there had been changes in how the atmosphere distributes and destroys CFC-11 that could explain the changed measurements. But this factor was mostly ruled out and in the most recent data – 2017 – it appears to have played no role at all.

Next, the researchers looked at whether the release of CFC from older materials could have doubled, as required to explain the data. “But we don’t know of any folks who are destroying buildings at a much more dramatic rate than they were before,” said Montzka.

Lastly, the team considered whether the new CFC-11 was being produced as a by-product of some other chemical manufacturing process. But they ruled this out too, as the quantities involved are too high, representing a 25% rise in global emissions.

“You are left with, boy, it really looks like somebody is making it new,” said Montzka, who noted that the less damaging replacement for CFC-11 is more expensive to make.

“If the increased emissions were to go away [soon], it’s influence on the recovery date for the ozone layer would be minor,” he said. “If it doesn’t go away, there could be a 10-year delay, and if it continued to increase, the delay would be even longer.” The last option is a possibility, as if the new CFC-11 is being used in foams, then only a small fraction will have made it to the atmosphere so far and more could leak out for many years into the future.

Michaela Hegglin, at the University of Reading, UK, and not part of the research team said researchers had taken rigorous steps to rule out alternative explanations for the rise in CFC-11 when reaching their conclusion that new production must be occurring.

She said: “The study highlights that environmental regulations cannot be taken for granted and must be safe-guarded, and that monitoring is required to ensure compliance.” Prof Piers Forster, at the University of Leeds, UK, said: “This new study is atmospheric detective work at its finest.”

Paul Young, at Lancaster University, UK, said: “The Montreal Protocol has been rightly hailed as our most successful international environmental treaty, so the suggestion that there are possibly continued, unreported emissions of CFCs is certainly troubling and needs further investigation.”

Montzka said the world’s nations are committed to its enforcement. “I have a feeling that we will find out fairly quickly what exactly is going on and that the situation will be remedied,” he said. Even just the publicity about the new CFC-11 production could lead to its shutdown, he said: “Somebody who was maybe doing it purposefully will realise – oh, someone is paying attention – and stop doing it.”

Ozone layer not recovering over populated areas, scientists warn

While the hole over Antarctica has been closing, the protective ozone is thinning at the lower latitudes, where the sunlight is stronger and billions of people live

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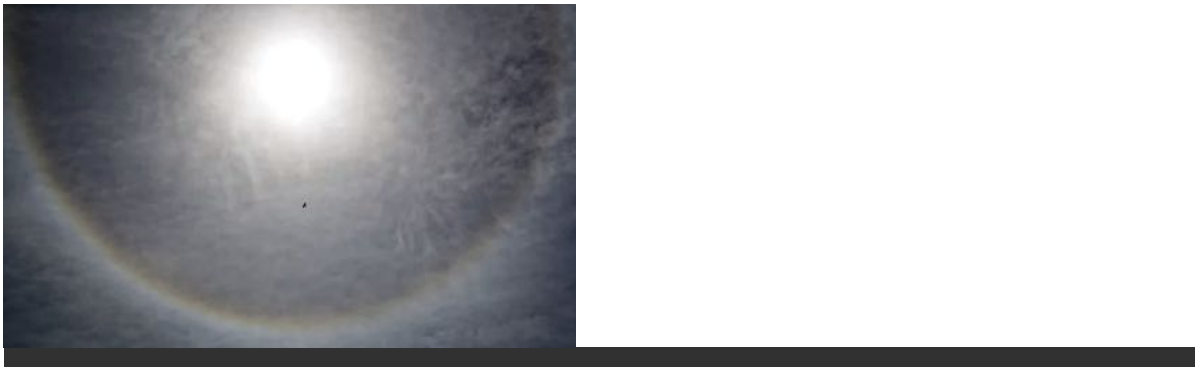

The greatest losses in ozone occurred over Antarctica. Photograph: Ben Curtis/AP

The ozone layer that protects people from the sun's ultraviolet radiation is not recovering over most highly populated regions, scientists warned on Tuesday.

The greatest losses in ozone occurred over Antarctica but the hole there has been closing since the chemicals causing the problem were banned by the Montreal protocol. But the ozone layer wraps the entire Earth and new research has revealed it is thinning in the lower stratosphere over the non-polar areas.

Reduced protection from cancer-causing UV rays is especially concerning towards the equator, where sunlight is stronger and billions of people live. The reason for the falling ozone at lower latitudes is not known, though scientists suspect a chemical used in paint stripper and a change in atmospheric circulation caused by climate change.

"The study is in lower to mid latitudes, where the sunshine is more intense, so that is not a good signal for skin cancer," said Prof Joanna Haigh at Imperial College London, a member of the international research team. "It is a worry. Although the Montreal protocol has done what we wanted it to do in the upper stratosphere, there are other things going on that we don't understand."

Anna Jones, an atmospheric chemist at the British Antarctic Survey and not involved in the new study, said: "To identify what action might be needed to prevent further decreases, it is extremely important to understand what is causing the observed downward trend." Scientists say budget threats to US satellite monitoring programmes must be reversed.

The new research, published in the journal Atmospheric Chemistry and Physics, carefully combined measurements of atmospheric ozone from 11 different datasets to produce a record of the last 30 years. It looked at ozone levels between the 60th parallels, an area that ranges from Scandinavia, Russia and Alaska in the north to the tip of South America. (London is 51 deg N, Sydney is 34 deg S and New York city is at 41 deg N.)

The stratosphere stretches from 10km above the Earth to 50km and ozone is slowly rising in the upper stratosphere, back towards the levels seen before CFC chemicals caused their damage.

But in the lower stratosphere, when there is the most ozone, levels are falling. Overall, the effects balance out but this means the ozone layer over the area studied is remaining in its depleted state.

The cause of the decline is unknown but might be the result of global warming. Ozone is produced by chemical reactions in the atmosphere over the tropics and then distributed towards the poles world by large air circulation currents. But warming trends could be strengthening these currents, moving more ozone to the poles and leaving less at lower latitudes.

Another suspect is so-called "very short lived substances" (VSLS) - industrial chemicals that destroy ozone. It was thought they broke down too quickly to reach the stratosphere, but that may need to be re-examined.

Research published in July by Ryan Hossaini, at Lancaster University, UK, and colleagues showed that levels of a key VSLS, called dicholoromethane and used in paint stripper and aerosol sprays, have doubled in the last decade. It is not banned by the Montreal protocol and little is known about where it is leaking from or why emissions have risen so rapidly.

William Ball, an atmospheric scientist at ETH Zurich university in Switzerland, who led the new research, said: "The finding of declining low-latitude ozone is surprising, since our current best atmospheric circulation models do not predict this effect. Very short-lived substances could be the missing factor in these models."

Hossaini welcomed the "important" new study, but he argues that the current concentrations of VSLS in the atmosphere are too low to explain the falling ozone in the lower stratosphere.

"This work clearly highlights there are still unanswered questions regarding the drivers of long-term changes in stratospheric ozone," he said. "The implications of the downward ozone trend from the perspective of surface UV and health need to be evaluated as a pressing matter."

Ozone hole recovery threatened by rise of paint stripper chemical

The restoration of the ozone hole, which blocks harmful radiation, will be delayed by decades if fast-rising emissions of dichloromethane are not curbed

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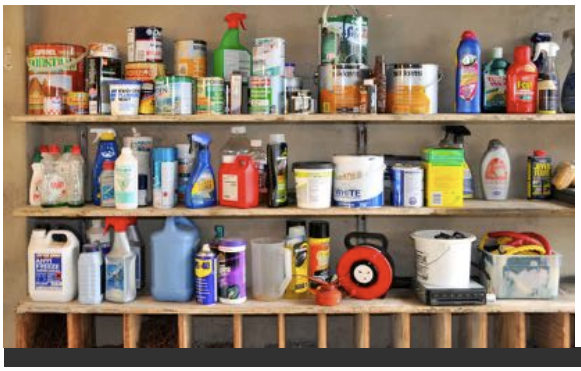

Dichloromethane, found in paint-stripping chemicals, has a relatively short lifespan so action to cut its emissions would have rapid benefits. Photograph: Justin Kase/Alamy

The restoration of the globe's protective shield of ozone will be delayed by decades if fast-rising emissions of a chemical used in paint stripper are not curbed, new research has revealed.

Atmospheric levels of the chemical have doubled in the last decade and its use is not restricted by the Montreal protocol that successfully outlawed the CFCs mainly responsible for the ozone hole. The ozone-destroying chemical is called dichloromethane and is also used as an industrial solvent, an aerosol spray propellant and a blowing agent for polyurethane foams. Little is known about where it is leaking from or why emissions have risen so rapidly.

The loss of ozone was discovered in the 1980s and is greatest over Antarctica. But Ryan Hossaini, at Lancaster University in the UK and who led the new work, said: "It is important to remember that ozone depletion is a global phenomenon, and that while the peak depletion occurred over a decade ago, it is a persistent environmental problem and the track to recovery is expected to be a long and bumpy one."

"Ozone shields us from harmful levels of UV radiation that would otherwise be detrimental to human, animal and plant health," he said.

The new research, published in the journal Nature Communications, analysed the level of dichloromethane in the atmosphere and found it rose by 8% a year between 2004 and 2014. The scientists then used sophisticated computer models to find that, if this continues, the recovery of the ozone layer would be delayed by 30 years, until about 2090.

The chemical was not included in the 1987 Montreal protocol because it breaks down relatively quickly in the atmosphere, usually within six months, and had not therefore been expected to build up. In contrast, CFCs persist for decades or even centuries.

But the short lifespan of dichloromethane does mean that action to cut its emissions would have rapid benefits. "If policies were put in place to limit its production, then this gas could be flushed out of the atmosphere relatively quickly," said Hossaini.

If the dichloromethane in the atmosphere was held at today's level, the recovery of the ozone level would only be delayed by five years, the scientists found. There was a surge in emissions in the period 2012-14 and if growth rate continues at that very high rate, the ozone recovery would be postponed indefinitely, but Hosseini said this extreme scenario is unlikely: "Our results still show the ozone hole will recover."

Grant Allen, an atmospheric physicist at the University of Manchester, said: "Whatever the source of this gas, we must act now to stop its release to the atmosphere in order to prevent undoing over 30 years of exemplary science and policy work which has undoubtedly saved many lives."

Jonathan Shanklin, one of the scientists at the British Antarctic Survey (BAS) who discovered the ozone hole in 1985, said: "The Montreal protocol has proved very effective at reducing the emissions of substances that can harm the ozone layer. I am sure that the warning made in this paper will be heeded and that dichloromethane will be brought within the protocol in order to prevent further damage to the ozone layer."

There are other short-lived gases containing the chlorine that destroys ozone, but few measurements have been taken of their levels in the atmosphere. "Unfortunately there is no long-term record of these, only sporadic data, but these do indicate they are a potentially significant source of chlorine in the atmosphere," said Hossaini, adding that further research on this was needed.

Anna Jones, a scientist at BAS, said: "The new results underline the critical importance of long-term observations of ozone-depleting gases and expanding the Montreal protocol to mitigate new threats to the ozone layer."

Overall the Montreal protocol is seen as very successful in cutting ozone losses, with estimates indicating that without the protocol the Antarctic ozone hole would have been 40% larger by 2013. Scientists discovered four "rogue" CFCs in 2014 that were increasing in concentration in the atmosphere and contributing to ozone-destruction.