



Australia's atmospheric monitoring station.

Protecting the ozone layer: Three decades of progress

2017 MARKED THE 30TH ANNIVERSARY OF BOTH THE MONTREAL PROTOCOL AND ACTION IN AUSTRALIA TO PROTECT THE OZONE LAYER. CSIRO HONORARY FELLOW, DR PAUL FRASER, REFLECTS ON THREE DECADES OF PROGRESS.

IN 1974, A landmark paper appeared in the journal *Nature*, describing how increasing concentrations of chlorofluorocarbons (CFCs) in the atmosphere could potentially destroy the life-sustaining stratospheric ozone layer. This paper inspired me and set my career-changing research path for many years to come. It highlighted the need for quality atmospheric monitoring of ozone depleting substances and this, together with carbon dioxide-induced climate change research, were the pivotal issues leading to the establishment in 1976 of Australia's atmospheric monitoring station at Cape Grim, Tasmania.

Over the past 30 years, there have been dramatic improvements in our capacity to accu-

rately measure atmospheric concentrations of a variety of greenhouse and ozone depleting gases. At various times the introduction of new, CFC-replacing industrial gases – hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) – began before there were techniques to measure their impact on the atmosphere. We were fortunate and, as it turned out, far-sighted, when we established an archive of pristine air samples at Cape Grim in 1978, that continues through to today, enabling CSIRO to determine the complete atmospheric history of these new species, leading to accurate estimations of their environmental impacts.

As a result, we have been able to identify a number of environmental issues and provided

policy makers with evidence to justify prompt policy action. We established, for example, that HFC-23 (CHF₃) appeared in the atmosphere long-before its initial use in industry (refrigeration) and was growing at rates that could not be explained by known sources. This led to the discovery that it was being created inadvertently as a by-product of HCFC-22 (CHClF₂) production (a widely used refrigerant) and, as a result, governments and the United Nations were able to act to reduce, capture and destroy these emissions.

So, what can the current atmospheric readings tell us about the effectiveness of what we have done globally and in Australia?

Encouragingly, since the introduction of Montreal Protocol restrictions on CFC production, atmospheric CFC concentrations have declined at a rate that suggests a very low level rate of residual emissions. As a result, the ozone hole is on track to be closed as predicted by late 2050s.

Global concentrations of HCFCs are increasing, but at a declining rate, that promises a halt in their growth over the next decade, followed by a predicted decline.

Global concentrations of HFCs are increasing rapidly leading to their inclusion in the Montreal Protocol, which will curb their production, the fastest proven route to stabilising their atmospheric concentrations.

As a result of where Cape Grim is located, 300km south of the major urban source region of Melbourne, about 15 per cent of the time we can assess the emissions of CFCs, HCFCs and HFCs from the Melbourne area. This is a useful indicator for what is happening across Australia. The data shows that emissions of CFCs and HCFCs are decreasing and emissions from HFCs have flat lined despite the size of the bank increasing. This clearly shows that equipment today is far less leaky than in the past and attempts to improve the service industry through licensing and other actions are clearly working.

This model of industry/science collaboration has been the linchpin for success in ensuring good science and effective policy. Australian industry has actively supported the research at Cape Grim both with financial contributions of over \$1 million and in providing detailed information (some of which was very commercially in confidence) on production and consumption processes. Industry also actively engaged with the scientific findings and initiated changes as a result – sometimes well in advance of government policy.

Governments, industry and science began working together when there were only model calculations of a potential problem and before there was direct evidence of an issue. This early action, based on the "precautionary principle", was fundamentally important in taking prompt action to fix the ozone problem before it was dire. The data that we produced in the past and today helps both government and industry continue to take action to reduce emissions of ozone depleting and greenhouse gases. *

ABOUT THE AUTHOR
Dr Paul Fraser researched at CSIRO issues of ozone depletion and climate change from 1974 until he retired in 2015. He, and the atmospheric monitoring station he helped establish at Cape Grim in Tasmania in 1976, have been pivotal in understanding both global and regional emissions of ozone depleting and synthetic greenhouse gases. He is held in extremely high regard in the international scientific community, receiving the US EPA Ozone Protection Award in 2002, the Nobel Peace Prize as a member of the IPCC in 2007, and a UNEP Science Leadership Award in 2017. He is still very active in research as an Honorary Fellow at CSIRO.



Closing the Hole: A 30-year retrospective on refrigerant policy

ONE MAN THAT HAS BEEN ON THE FRONTLINE OF CLIMATE CHANGE POLICY ISSUES FOR THE PAST 30 YEARS IS STEVE ANDERSON, WELL KNOWN TO READERS AS THE FORMER EXECUTIVE DIRECTOR OF REFRIGERANTS AUSTRALIA. HE REFLECTS ON THE GROWING PARTNERSHIP BETWEEN INDUSTRY AND GOVERNMENT.

OVER THE PAST 30 years, the Australian Government – in close collaboration with industry – has developed world leading initiatives on refrigerant policy covering both ozone depletion and climate change issues. However, initial Australian policy was developed haphazardly and the outcome was far from inevitable.

As scientific understanding of ozone depletion advanced during the 1980s, there was an increase in public concern and state politicians saw the opportunity to lead on a popular issue.

The states took action early but inconsistently. Riding a wave of legitimate public concern, state ministers made many public pronouncements on the need for rapid action. At one point in the late 1980s, Tom Roper – then Victorian environment minister – bravely proclaimed that "Victoria leads the world".

The Federal Government proceeded more cautiously. Conscious of the need to be an effective part of the emerging international consensus.

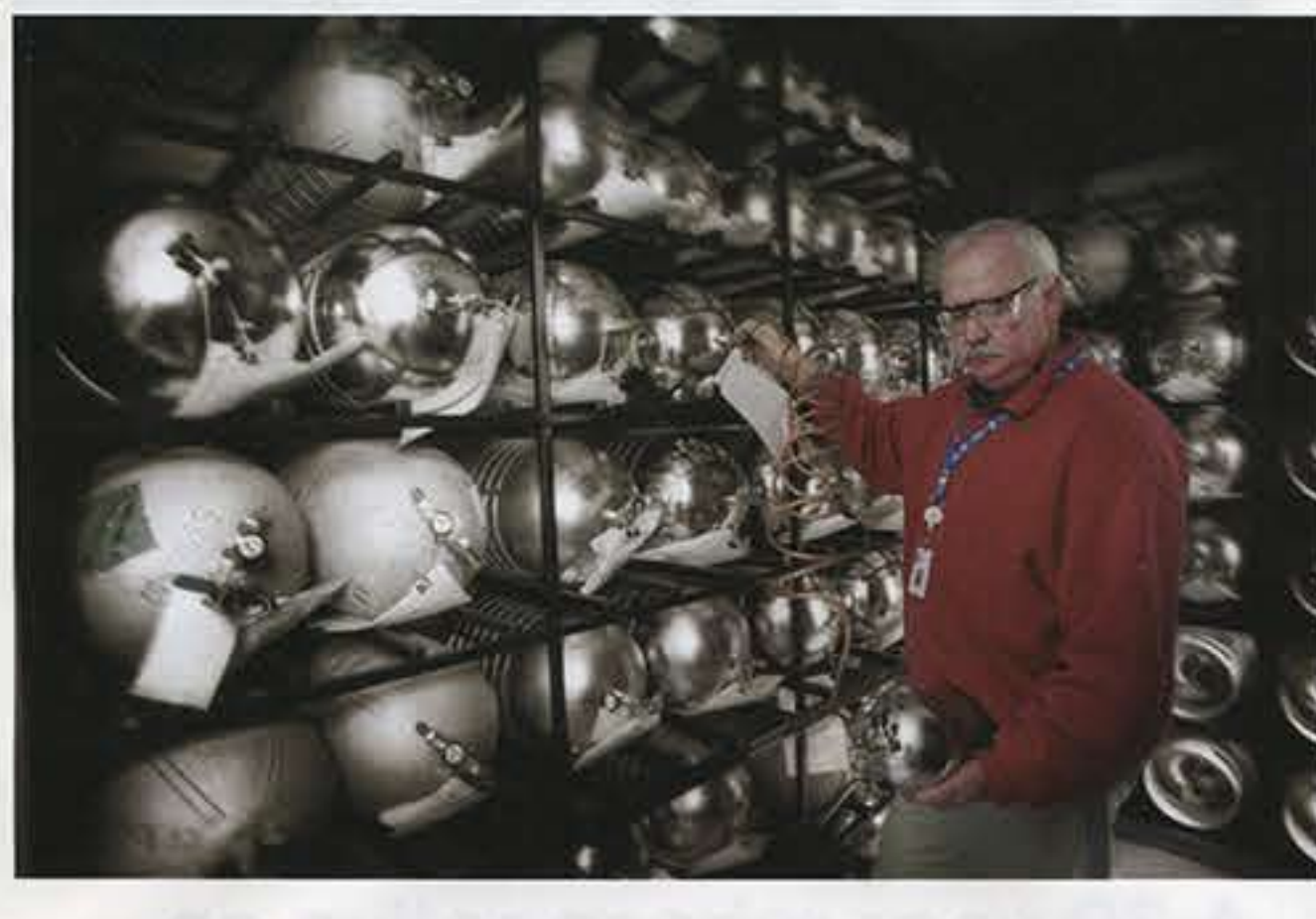
Throughout the 1980s, Australia was represented at international meetings by officials

from the Department of Foreign Affairs from whatever embassy or high commission near where the meeting was being held. The need to have officials that understood the scientific, industry and policy issues associated with ozone depletion was simply not acknowledged.

Industry wanted a national response to ensure both consistency of approach and to provide longer term certainty regarding policy. It pushed the Federal Government to send Canberra-based experts, particularly from the Environment Department, to the international negotiations, given it was those officials who would need to lead a national response. Industry even had to provide the funding for the first such Commonwealth official to attend international meetings.

This political dynamic changed during the 1990s for three main reasons.

Firstly, there was a consumer backlash on the use of ozone depleting substances in aerosols. In response to this public pressure the then Aerosol Association brokered a ban on CFC use in aerosols. This required engagement with and in-



CSIRO Honorary Fellow, Dr Paul Fraser.



involvement of the Federal Government. As part of this process, Paul Fraser of the CSIRO had been actively engaged with the Aerosol Association. That close engagement – followed by him working closely with the refrigeration and air conditioning industry – resulted in industry accepting both the science and the need for changing technology. This reduced time and acrimony in planning policy responses that, while economically and technically challenging, were clearly necessary.

Lastly, there was significant confusion on the regulatory landscape. The states independently developed broad and diverse range of approaches, many of which were effectively unworkable. The Commonwealth Government eventually recognised the cost to industry from this dysfunction and decided to impose import level and some end use controls.

Additionally, to better ensure national consistency, a committee was established that was led by the Commonwealth and included New Zealand and all of the states and territories, as well as a wide range of stakeholders. This body managed to corral many of the "seat of the pants" ideas which emerged and worked towards a nationally consistent approach. By the late 1990s, the states were losing interest in ozone policy, while the Commonwealth

Government concurrently increased its engagement internationally, based on a non-partisan, scientifically based policy.

The review of the Ozone Protection Act in 2001 was a pivotal moment in the development of Australian policy. It showed that while the cost of policy to protect the ozone layer had cost \$1 billion to date, the benefit was seven times larger. Further analysis demonstrated that significant further benefits would be achieved if the legislation was extended to HFCs used as replacements of ozone depleting substances – if the Commonwealth managed all of the legislation centrally and if it also managed end use controls. These reforms were delivered with revi-

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sions to the Ozone Act in 2003.

The increased political interest in climate change from about 2005 shifted the policy landscape again. There was an increasing focus on using emissions trading to manage climate change emissions by public servants who had no knowledge or interest in how both ozone depleting substances and HFCs had been successfully managed for well over a decade. They were focused on economy-wide responses and operated from the naive belief that every economic sector

could be managed identically. They refused to even engage the industry in genuine dialogue.

Despite industry publicly supporting an HFC phasedown from 2007, a carbon price was introduced in 2013, and then repealed in 2015. This ill-fated exercise was driven by ex-Treasury bureaucrats with no understanding of the industry, who tried to impose a one-size-fits-all approach, straight out of a first year economics textbook. This policy experiment failed dismally in managing refrigerant emissions and only resulted in confusion and turmoil. Any environmental benefits were far overshadowed by market confusion, turmoil and pain.

Thirty years after the Montreal Protocol was agreed, and with the carbon price in the rear view mirror, refrigerant policy is in a good place. Sensible, thoughtful policy has been implemented to deliver a phasedown of high GWP refrigerants in a measured way that delivers certainty both for the environment and for business.

Over the last 30 years, emissions of refrigerants have decreased from the carbon dioxide equivalent of more than 100 million tonnes, to less than 10 million tonnes. Over the next 20 years that will be reduced to just over one million tonnes – a total reduction of about 99 per cent. As the former Environment Minister said in 2015, no other sector in the Australian economy has delivered environmental benefits anywhere near this amount particularly while continuing to prosper and develop.

While initially uncertain, 30 years after the Montreal Protocol, Australia is managing issues around refrigerants well and will continue to do so into the future. *



Former Refrigerants Australia executive director, Steve Anderson.