OZONACTION SPECIAL ISSUE

30 Years of Healing Ozone Together:
BEYOND HCFCs

Contents

Montreal Protocol Reduces Emissions and Protects Climate!

Dr Shamila Nair-Bedouelle, Head, UNEP DTIE OzonAction

As the international community proudly celebrates the 30th anniversary of the Vienna Convention for Protection of the Ozone Layer, the success story of protecting the ozone layer resonates in all fora. Today the world boasts of having phased out 98 per cent of ozone depleting substances (ODS). However, the use of ODS continues to increase in technologies which are indispensable to life on Earth.

The achievements of the refrigeration and air conditioning (RAC) sector over the past century are astounding: they have created a revolution in equipment and refrigerants to meet consumer demands, improve livelihoods and address environmental challenges.

Today, the emissions of refrigerants, as well as the carbon dioxide emissions generated from the electricity used to run the equipment, is at the heart of global debates on climate change, ozone layer protection and energy efficiency.

Globally, refrigeration consumes 15 to 20 per cent of the world's total electricity. An estimated 185 billion KWh of energy is used annually on residential cooling. Thus we urgently need refrigeration and cooling options that are both energy efficient and climate friendly.

Not only does energy efficiency reduce or avoid greenhouse gas emissions, but it can also increase productivity and sustainability through the delivery of energy savings, and support social development by increasing employment and energy security.

Indeed, energy efficiency is the area where most emission reductions can be achieved in the short term and is therefore critical to combating climate change. Energy efficient technologies use less energy to provide the same or better service. When deployed in large numbers, they can substantially reduce greenhouse gas emissions.

This year, 2015, is crucial for global and regional action on the environment and sustainable development.
In late September 2015, the world leaders meeting at the United Nations headquarters in New York adopted a new global plan of action known as the Sustainable Development Goals (SDGs). Defining the next phase in international development, the SDGs comprise 17 goals and 169 targets aimed at resolving the social, economic and environmental problems troubling the world.
The SDGs aim to ensure lasting protection of our planet and its natural resources. They show that efforts to eradicate energy poverty, promote universal access to cleaner forms of energy, and a doubling of energy efficiency would go a long way in mitigating the worst impacts of climate change.

We in the global ozone community are very proud that the Montreal Protocol is contributing both directly and indirectly to energy efficiency, pursuit of SDGs, promoting public health and protecting the environment.
The Montreal Protocol has far exceeded its original aims. While protecting the ozone layer, it has contributed substantially to climate mitigation, social development, food safety and security, public health and the creation of large numbers of green jobs.

Reducing the production and use of HFCs, refrigerants/ foaming agents with global warming potentials (GWP) hundreds to thousands of times higher than CO_2 is the largest, fastest and most cost effective short-term climate mitigation option currently available.

A variety of climate-friendly, low GWP alternatives for refrigerants and foaming agents are currently available. These include carbon dioxide, ammonia, hydrocarbon, low GWP HFCs and some 'not-in-kind" technologies such as solar technologies and district cooling.

In December 2015, the United Nations Climate Change Conference, or COP21, will be held in Paris, where governments hope to achieve a legally binding and universal agreement on climate change. The road to Paris has not been an easy one, but as the 30 year history of ozone protection shows, nations can and do rise to meet global environmental threats.

Climate change represents one of the greatest challenges to humanity. But it is also an opportunity to move to a low-carbon, resource-efficient Green Economy.
The Montreal Protocol is already contributing in all its dimensions to the climate, energy and ozone nexus and will continue to serve as the beacon of hope for environmental sustainablility.

The Multilateral Fund - Further Opportunities for Success!

Eduardo Ganem, Chief Officer, Multilateral Fund Secretariat

The Vienna Convention for the Protection of the Ozone Layer, which serves as a framework for global efforts to protect the Earth's ozone shield, was negotiated 30 years ago at a time of scientific uncertainty and doubts surrounding the ozone depletion process and our capacity to address it. One of the most important lessons we can learn from the generation that negotiated the Vienna Convention and its Montreal Protocol, is that while we must carefully reflect on our doubts, we must have the courage to make the necessary decisions to move forward.

One clear example of the benefits brought about by past decisions is that of the establishment of the Multilateral Fund by the Parties to the Montreal Protocol. Since 1991 the Multilateral Fund has provided almost US $3 billion of financial assistance to 148 countries for the phase-out of almost 460,000 tonnes of ODS. Significant climate benefits were achieved as a result of the phase-out of CFCs in Article 5 countries and, despite the challenges ahead, are achievable in the framework of HCFC phase-out.

The demand for refrigeration and air conditioning equipment continues to increase so it is imperative to decrease industry's reliance on HCFC technologies or technologies that could have a major negative impact on the environment, in particular the climate. In the servicing sector, technicians will require further training on how to deal safely with non-HFC technologies. The foam and refrigeration/air conditioning manufacturing sectors will have to adopt alternative technologies, and thus the Executive Committee will have to pay particular attention to addressing the needs of small and medium sized enterprises and finding cost-effective ways for them to adopt sustainable technologies.

The Executive Committee, in accordance with decision XIX/6 of the Parties, is paying careful attention to alternatives to HCFCs that minimize environmental impacts, in particular impacts on climate, and has developed policies allowing additional funding to provide for the introduction of low GWP technologies. With respect to the availability of climate friendly alternative technologies, the Multilateral Fund has funded demonstration projects to independently assess HCFC alternatives technologies in different industrial sectors. A number of countries have made choices to adopt low GWP alternatives as a result of such projects, which will surely motivate industry to further develop alternatives to HCFC and HFCs.

The Multilateral Fund's success was founded in the Montreal Protocol community's ability to think and its capacity to question when necessary. Decision II/8, like many other sound decisions of the Parties, has withstood the test of time. If the Montreal Protocol community continues to act collectively and inclusively as it has done in the past, the Multilateral Fund will have further opportunities to build on the extraordinary success and continue to reap ozone and climate benefits that will protect human health and the environment for generations to come. The Multilateral Fund Secretariat, as always, stands ready to provide all assistance and support required by Article 5 country governments to achieve these goals and compliance with the Montreal Protocol.

Precious Ozone

Tina Birmpili, Executive Secretary, Ozone Secretariat

Imagine this. If the Earth were a basket of fruits, the ozone layer would be the thin wrapping film around the basket. This is how thin and fragile the ozone layer is that filters out deadly ultraviolet radiation from the sun and protects life on Earth. The discovery of a hole in the ozone layer over Antarctica in the mid-1980s alerted the international community of impending environmental disaster.

Thirty years ago, 28 nations signed up to the Vienna Convention for the Protection of the Ozone Layer. And today, 197 parties are celebrating the results of their united efforts to control chemicals that have been destroying the ozone layer and contributing to significant global warming. 2015, marks the 30th Anniversary of the Vienna Convention.

What is the thrust of the ozone narrative and its relevance for policy makers? Three major points can be highlighted.

- United action and universal membership of 197 parties to the ozone treaties achieved results.
- Effective Science-Policy interface and an agreement on finance and technology reconciled our different needs as nations.
- Even with concerted actions, it took 30 years to see the signs of positive results.

What are those positive results of the concerted actions?

In terms of the global environment, the Montreal Protocol (MP) has so far led to the phase-out of 98 per cent of the historic baseline levels of production and consumption of ozone-depleting substances (ODS) globally. As a result, the ozone layer is healing itself. We carried out a repair job on a planetary scale.

In terms of the "human face" of our achievements, up to two million cases of skin cancer may be prevented each year by 2030. In terms of the green economy, ODS phase-out has brought investment and innovation. The MP has also implemented technology transfer via the Multilateral Fund contributing almost US $3 billion from 1991 until today to developing countries.

The ozone success story is a model for united action that can inspire countries when implementing the post-2015 development agenda and has an important contribution to the climate discussions in Paris in December. Action taken on ODS under the MP has avoided 135 gigatonnes of carbon dioxide (CO_2) equivalent making the Protocol one of the most effective tools in climate change mitigation to date. If the use of CFCs had grown unabated, their climate effect would have rivaled that of CO_2.

The climate mitigation accomplishment may be offset by the emerging challenge of rapidly growing emissions of hydrofluorocarbons (HFCs). MP parties are seeking ways to tackle this problem and are discussing possibilities of managing HFCs under the Protocol. If agreed by the parties, HFC phase down would provide a sizable benefit for the climate, estimated to be equivalent to emissions of up to 165 gigatonnes of CO_2 by 2050, and avoid up to 0.2°C - 0.4°C of warming. So, there is more to climate mitigation than only the CO_2 agenda.

The hallmark of the Vienna Convention and its MP is the global partnership of governments, scientists, industries and other stakeholders. We are all committed to this cooperation as we continue with our mission of protecting the ozone layer and minimizing impacts on climate.

Ozone: All There is Between You and UV

Prof Nigel Paul, Lancaster Environment Centre, UK, Co-chair of the Montreal Protocol Environmental Effects Assessment Panel

The ozone layer has protected life on the Earth's surface from the sun's intense ultraviolet radiation for more than 500 million years. Indeed, it is likely that life would never have been able to colonise the land without the protection of the ozone layer.

So when damage to the ozone layer was identified in the 1980s, it was recognised as a potential threat to all life on Earth. By increasing exposure to ultraviolet (UV) radiation, ozone depletion would have damaged agriculture, fisheries and natural ecosystems or people. Uncontrolled ozone depletion would have increased the damaging effects of exposure to too much UV. These damaging effects include increases in skin cancers and cataracts. These are major global health problems: for example, in some pale-skinned populations, skin cancers are already the commonest of all cancers, while cataracts are the major cause of vision loss across the globe.

With the successful implementation of the Montreal Protocol, severe ozone depletion has been prevented outside the Antarctic "ozone hole" and a few, short-term depletion episodes over the Arctic. As a result, increases in UV due to ozone depletion have been small outside the Polar regions. In fact, apart from a few short episodes, increases in UV in most inhabited parts of the globe have been hard to measure against the natural variability due to clouds and other factors.

By preventing large increases in UV radiation, the Montreal Protocol has protected people around the world from an increased risk of skin cancers and cataracts. In fact, changes in the incidence of skin cancers in recent decades have been due less to ozone depletion than people's lifestyle choices -- for example, how much time we choose to spend in the sun, especially around mid-day when the UV in sunlight is most intense.
The world would have been a very different place without the successful implementation of the Montreal Protocol. Without control of ozone depleting substances, there would have been a global collapse of stratospheric ozone by the middle of the 21st century. This uncontrolled ozone depletion would have resulted in large increases in UV in all parts of the world, from the poles to the tropics. Without the Montreal Protocol, almost all inhabited areas of the planet would have become exposed to levels of sun-burning UV, two to four times greater than the value that is considered 'extreme' in the current UV scale used by World Health Organisation (WHO).

The health effects of these uncontrolled increases in UV radiation are beginning to be quantified. It is estimated that the effective implementation of the Montreal Protocol will have avoided at least 100 million cases of skin cancer by the end of this century. Some estimates suggest a far greater benefit. For example, a recent model suggests over 300 million skin cancers will be prevented in the USA alone. Implementation of the Protocol will also have prevented many millions of extra cases of cataracts by 2100, with one estimate suggesting tens of millions of cases in the USA alone.

Living with the Sun: Promoting Sun Safety at School

Pierre Cesarini, Director of Securite Solaire

The Sun is our planet's life-giving source of energy, but too much exposure to sunlight can pose health hazards, especially to children. Thus, sun safety has become a valuable survival skill in the 21st century.

Living with the Sun is a multidisciplinary school education programme about health, citizenship and sustainable development. The aim is to turn children into sun damage prevention activists.

Intended for schoolchildren aged 4 to 13, it can be used by any teacher, whether or not they have a scientific background: the teaching guide is a complete self-learning resource.

Living with the Sun has been developed by La Sécurité Solaire (Sun Safety), a French NGO founded in 1994 by a group of scientists to raise public awareness about sun risks. As a World Health Organisation (WHO) collaborating centre, it operates with private and public funds under the guidance of a multidisciplinary scientific council.

Living with the Sun comprises ten lessons for a complete "solar education". They cover topics such as the sun's effect on our health, the origin and sensitivity of skin colours, variation of UV-index, and protection tools. The learning package includes some ultra-violet sensitive paper, and involves different disciplines such as sciences, geography, geometry and language.

The final session, called "*Becoming an Actor of Prevention*", asks the class to design and implement a sun damage protection activity project designed for other pupils and their families. Some classes may create public information materials to be displayed in the school, the local district, or to be sent to the local media. Other classes may engage directly with the local government councils on problems such as the lack of shade in public spaces.

A dedicated website (www.livingwiththesun.info) offers free access to all the educational resources. It presents the various measures for solar protection and includes news and testimonies from participating schools, as well as links to other useful resources. Additional information is provided for the teachers to assist them in answering the many questions pupils may ask, such as: Is the sun a danger for our health? What is cancer? What are ultra-violet rays? What does the ozone layer do?

During eight years of implementing *Living with the Sun* in France, over 40,000 copies of the teacher's guide have been distributed. More than one million schoolchildren have been directly involved at a cost less than 1.5 euros (US $1.7) per student. The programme is regularly evaluated has shown a positive impact on the knowledge and behaviour of pupils involved in the short, medium and long terms.

While created for school pupils in France, this programme offers a wide variety of educational material that is appropriate and useful for children in developing countries. The programme has been outreached internationally, and thousands of teachers in other French-speaking countries now participate. The resources have also been translated into German, Portuguese, Serbian and Catalan, thanks to partnerships with NGOs, universities and government agencies. Developing countries that are interested in adapting and translating these materials to be able to use them to inspire and educate school children in their own countries are encouraged to do so. *Living with the Sun* course materials are available through: www.livingwiththesun.info/contact/

Climate Change and Human Health: Research for a Better Future

Prof Yves LEVY, President Director General of Institut pour la Santé et la Recherche Médicale (INSERM, French Ministry of Health and Research), President of Aviesan

The human health consequences of global environmental changes are among the top priorities of citizens worldwide. The signing of the Montreal Protocol in 1987 and its implementation recall how we collectively and successfully managed an environmental problem. According to epidemiological models, the phase-out of HCFCs will have prevented two million skin cancers in North America and Europe between now and 2030.

Climate change is a more complex and global challenge than ozone layer protection. However, there is strong evidence that it has already had significant effects on population health. Additional negative consequences are expected in the coming decades. The link between climate and health is therefore a subject of concern for decision-makers and citizens. It is also a very active area of research.

Recent scientific evidence has confirmed that increased temperatures, humidity and floods are directly involved in mortality and morbidity, as are extreme temperatures (heatwaves, cold waves). Indirect effects are also extremely important. Some infectious diseases are known to be strongly affected by climate change. Both short term and long term environmental processes interact to lead to disease epidemics and this has clearly been shown in the case of vector-borne and water-borne infections.

The effects of climate change on health would be better assessed if integrated with other environmental stressors. As an example, climate change will affect respiratory health through multiple ways: an increased number of deaths and acute morbidity due to heatwaves; an increased frequency of cardiorespiratory events due to higher concentrations of ground-level ozone; changes in the frequency of respiratory diseases due to transboundary long-range air pollution; an altered spatial and temporal distribution of allergens and some infectious disease vectors. The complexity of the issues involved requires coordination and collaboration across research disciplines.

While studies on climate change and health have mainly focused on a number of specific diseases such as respiratory, cardiovascular and climate sensitive infectious diseases, unexpected observations have been made recently that tend to enhance the complexity of climate related health effects. A very illustrative example comes from recent epidemiological studies showing that air pollution has a significant effect on child birthweight and cognitive and psychomotor development (for example, ESCAPE's results, European Study of Cohorts for Air Pollution Effects).

A multidisciplinary research effort will contribute to a better assessment of the effect of climate change on well-being and health. We expect a huge contributions of large scale studies and registries, particularly in developing countries with an open assessment of different environmental stressors. New technologies such as the different sensors that can measure physical, chemical and physiological features will provide more quantitative data to this field. Obviously having so many data requires good mathematics and statistics to make sense out of such a large amount of observations and figures.

Through the unifying concept of the exposome, we must ultimately invent complex models that can integrate

all the chemical, biological, physical and psychosocial factors to which individuals are exposed over their lifetime. The interaction between different exposures and the cumulative profile of exposures over time is an integral part of this exposome research. In addition, the exposome encompasses also the internal effects of exposures. This can be measured with high-throughput methods such as metabolomics, proteomics, transcriptomics, adductomics and epigenomics and may be of relevance to understand climate change effects.

Analysis of the links between climate and health requires a strongly multidisciplinary approach: ecologists, biologists, epidemiologists, researchers in public health, human and social sciences (sociology, economics, psychology and anthropology), climate science researchers, (atmosphere and ocean), meteorologists, statisticians, computer modellers and integrators, etc. In France, various members of Aviesan are devoting extensive studies to this domain—e.g. the Institute for Development Research (IRD), Inserm, the Institut Pasteur, and the French National Centre for Scientific Research (CNRS), with their university and hospital partners.

The indirect effects of climate change are also of concern for the stability of health systems and the vulnerability of populations. One of the expected outcomes of climate change is the increase in inequalities across the globe and within countries. Social systems of the poorest countries may collapse in the face of the unforeseen, as we have seen in the Ebola outbreak or other crises. These countries are also the most fragile when confronted to indirect consequences of climate change like famine migrations or socio-political disorder.

Climate change and health offers an intellectually fascinating challenge in many respects, and a crucial challenge from a health point of view. The research is laying the groundwork for new methodologies.

Increasing awareness on health effects and on the co-benefits expected from climate change mitigation can lead to a more robust international action. The message of the Montreal Protocol should resonate during the negotiations on climate: we are capable of making informed collective decisions, to protect our environment and our health. Such a large scale vision has been called “one health”, “global health” or “planetary health”. However you call it, it basically states that it is no longer possible to ignore global and local environmental changes if one wants to assess current and predict future human well-being and health.

ASHRAE and UNEP: Making Connections

Prof David Underwood, President, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

As Nietzsche observed, human connections are the "invisible threads that are the strongest ties." Forging stronger connections amongst people working in the built environment is a priority for me. As president of ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), my theme this year focuses on "Making Connections".

ASHRAE's mission is to advance the arts and sciences of heating, ventilating, air conditioning and refrigerating to serve humanity and promote a sustainable world. We have to build connections to succeed. UNEP is one of our strong connections.

Our relationship with UNEP was formalized in 2007 with the signing of a global cooperation agreement. Since that time, we have launched four biennial work plans, with the most recent approved in January 2015.

The ASHRAE-UNEP cooperation agreement was developed to achieve several international goals, including the sustainable phase-out of ozone depleting substances (ODS) in refrigeration and air-conditioning applications; maximizing the climate benefits of using low-global warming potential alternatives including aspects of energy saving in buildings; as well as facilitating the transfer and adoption of sustainable and feasible technologies to developing countries.

The new work plan covers the 2015-2016 timeframe with an objective of increasing cooperation between ASHRAE and UNEP by transferring relevant technologies amongst different regions. The plan is prepared based on success achieved and lessons learnt from the implementation of three previous work plans.

The new work plan includes two main goals and several action items. The first goal addresses emissions reduction, long-term refrigerants and energy efficiency. The main actions addressed are: building bridges between industry and policy-makers in developing countries, sharing results of relevant research on long-term refrigerants, exploring opportunities to promote responsible and sound management of refrigerants and cooperating and coordinating efforts related to energy efficiency in the buildings sector.

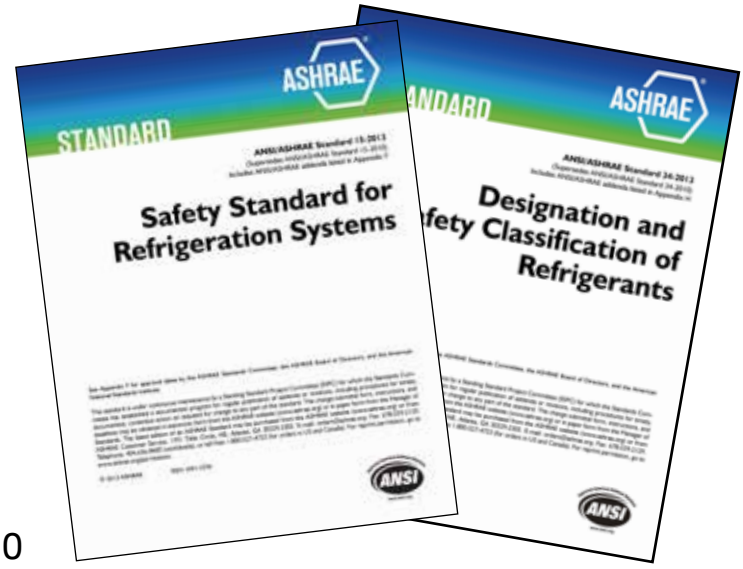
The second goal aims at promoting expertise and technological information exchange amongst governments and specialists dealing with ASHRAE and UNEP.

ASHRAE has several efforts underway related to alternative refrigerants. Existing standards and guidelines are being revised and publications being developed, all of which will help guide the industry. Also many research projects are underway to expand our technical knowledge. ASHRAE continues to work on standards that allow a wider use of A2L refrigerants that have mild flammability. In 2013, we published updated versions of Standard 15, Safety Standard for Refrigeration 'Systems, and Standard 34, Designation and Safety Classification of Refrigerants'.

The imaginations of people in our industry are literally changing the world. We've made decisions to invest in top talent – and big, bold ideas. Imagine improving the quality of life for everyone.

John Lennon said "A dream you dream alone is only a dream. A dream you dream together is reality." Our reality at ASHRAE is making connections that advance our world through viable, affordable, green technology.

We must all work together to realize our dream for a sustainable future. ASHRAE cannot do its job without the creativity and passion from all its members, connecting colleagues within our industry and beyond. We look forward to many more years of working with UNEP.



Quest for Refrigerants that Protect Ozone and Climate

Stephen Yurek, President and CEO, Air-Conditioning, Heating, and Refrigeration Institute (AHRI)

From our morning shower and safely refrigerated foods and medicines to the perfect temperature in our bedrooms at night, no industry touches the lives of people every day more than the heating, ventilating, air-conditioning and refrigeration (HVACR) industry.

While the products and equipment our member companies make provide comfort, increase productivity, keep foods and medicines safe, and heat our water, they also use energy and impact our environment. Energy use and environmental stewardship are, therefore, an important component of our work.

Air-Conditioning, Heating, and Refrigeration Institute (AHRI) is proud to have partnered with UNEP for many energy-related endeavors. Most recently, AHRI joined with UNEP to develop a *Refrigerant Driving License* (RDL) that will ensure that technicians and anyone handling refrigerants has the basic knowledge of the characteristics of that refrigerant, its appropriate applications for use, what material and components it can be used with, and how it should be handled during service and installation. This is a vital step toward the safe use of alternative refrigerants, which will be required as the industry grows and refrigerant regulations change.

In the 1990s, AHRI spearheaded the *Alternative Refrigerants Evaluation Program* to research potential alternatives to HCFCs. It resulted in HFCs, which are widely used today. And now we are hosting a similar – and even larger – research initiative to find more environmentally friendly alternatives to refrigerants with high global warming potential (GWP).

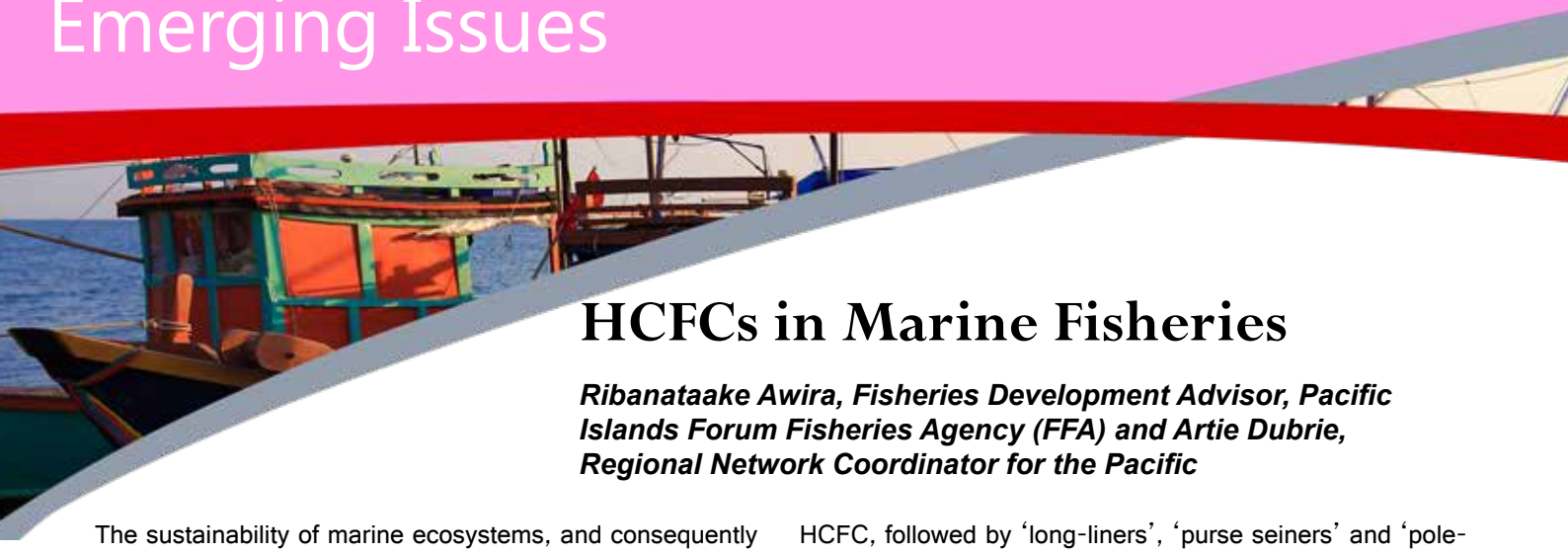
Now in its fourth year, the Low GWP Alternative Refrigerants Evaluation Program (Low GWP AREP) is testing 15 new candidates. The reports from this research will be shared at a conference held one day before the ASHRAE Winter Conference in Orlando, Florida, on January 21, 2016.

We learned a long time ago that there is no magic replacement for HFCs – it is not a matter of just swapping out one for another. There are tradeoffs that must be considered with respect to availability, cost, and efficiency, etc. That is why we have always believed that decisions regarding which alternatives to use for each application cannot involve just the GWP of that particular refrigerant. The choices must also take into account the life-cycle cost performance of each refrigerant, so as to avoid such unintended consequences as when a low-GWP refrigerant is less energy efficient, resulting in higher energy use from power plants that emit greenhouse gases.

There are other issues as well. Some proposed alternatives are at least mildly flammable, or classified as 2L refrigerants as per ASHRAE Standard 34. In the United States, as in some other parts of the world, use of these refrigerants is restricted by building codes. That means that research into how to use these refrigerants safely must also be undertaken.

To help determine the appropriateness and safety of their potential use, AHRI established a Flammable Refrigerants Subcommittee that will determine gaps in research on existing flammable refrigerants. It is to develop a roadmap with priorities and a timeline for how to complete the necessary research toward the safe use of flammable refrigerants.

Working together with UNEP, governments, and NGOs we can evolve to protect the environment while continuing to provide comfort, productivity and safety for everyone.



HCFCs in Marine Fisheries

Ribanataake Awira, Fisheries Development Advisor, Pacific Islands Forum Fisheries Agency (FFA) and Artie Dubrie, Regional Network Coordinator for the Pacific

The sustainability of marine ecosystems, and consequently the fisheries sector, depends on a healthy ozone layer. The use of refrigeration technology, which is reliant in most cases on ozone depleting substances, is an essential requirement at all stages of the fisheries industry: from catch, through processing, to the dinner plate . One of the most common refrigerants used in the fishing industry is a particular hydrochlorofluorocarbon - HCFC-22 - a controlled ozone depleting substance (ODS) under the Montreal Protocol on Substances that Deplete the Ozone Layer (MP).

Given the complexity of refrigerant supply, use and demand in the fisheries sector it is important that all HCFC used in this sector are properly documented to determine accurately their levels of usage. The question of how MP parties report on the acquisition and use of HCFC refrigerants in vessels working in international waters or under various fishing licensing agreements, need also to be considered.

For fisheries facilities that are land-based, ODS usage is documented and reported as recorded through customs' procedures and national licencing systems. For the international marine fishing sector, customs' procedures will not normally be involved in the control of supply to fishing vessels. There is no agreed system nor uniformity in the monitoring and reporting by vessel owners and flagged states.

In the Pacific region, the level of demand and market supply routes for HCFC-22 refrigerant and refrigerant servicing in the marine fishing sector are not fully known. A study is currently being undertaken by the Pacific Islands Forum Fisheries Agency (FFA) to look into the use of HCFC by vessels flagged in Article 5 countries that are also member countries of the FFA. This study, which seeks to determine the level of refrigerant usage in fishing vessels, information that has been elusive for the last 30 years, will have important socio-economic implications, as well as potential implications for the reported HCFC consumption levels for countries in the region.

The initial study data show that fishing vessels flagged in FFA member countries use a total of 552.2 metric tonnes of HCFC-22 annually as refrigerants (Fig 1). Of the main types of fishing vessels used, 'fish carriers' use the most HCFC, followed by 'long-liners', 'purse seiners' and 'pole-and-line' fishing vessels (Fig.2).

The report shows that the volume of HCFC-22 used on vessels flagged in nine FFA countries operating Article 5 of the MP, is more than 103% of the total of the MP baseline for 14 Pacific Islands countries. This usage and demand in the context of MP compliance will necessitate that countries need to be alerted about this massive difference if they are to meet their treaty obligations and also sustain the fisheries industry. To balance these two interests, it is recommended that a more in-depth study of HCFC usage by the fishing sector at the national, regional and international level be undertaken.

The current study only covers fishing vessels that are flagged in FFA member countries. So how much more HCFC do the other fishing vessels of other nations use? The FFA Good Standing Register listed 1270 vessels for March 2015. From this, 288 vessels were flagged in FFA member countries.

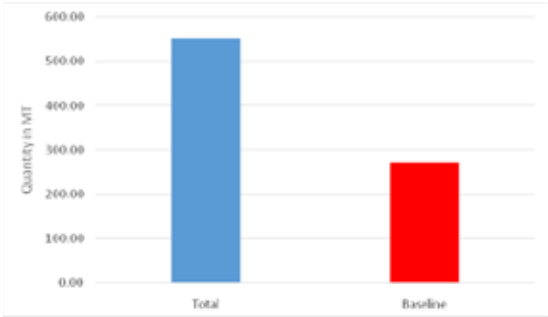


Figure 1. Estimated total amount of HCFC used by vessels flagged in FFA member countries as compared to the total allocated baselines for all Pacific Island Countries

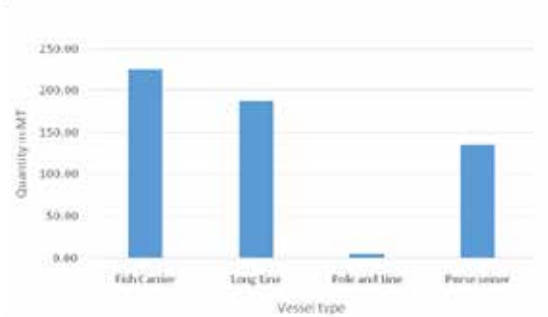


Figure 2. The use of HCFC-22 by different types of fishing vessels flagged in FFA member countries

Training and Certification in the Safe and Efficient Use of Refrigerants

Marco Buoni, Vice President of Air conditioning and Refrigeration European Association (AREA) and Director of Centro Studi Galileo

This article is an extract from: National Certification Shemes for Refrigeration and Air-Conditioning Service Technicians. Available at: www.unep.org/ozonaction

It is expected that in the near future there will be a considerably higher uptake around the world -- and particular in developing countries -- of 'alternative refrigerants' such as hydrocarbons, ammonia, carbon dioxide, unsaturated hydrofluorocarbons (HFCs) - or HFOs - and HFOs mixtures.

The refrigeration and air-conditioning industries will have to adapt to both the technical and safety issues concerning these refrigerants. Many alternative refrigerants have specific characteristics regarding toxicity, flammability and high pressure which are different from CFCs, HCFCs and even HFCs.

During the installation, maintenance, repair and dismantling of refrigeration and air-conditioning equipment containing such alternatives, safety and technical issues need to be carefully considered. Certification is the best practical method to verify the competence of personnel handling refrigerants. This is all the more important when servicing technicians have to deal with refrigerants with properties that they were previously not familiar with.

Certification is the means by which a person (or enterprise) -- as a result of training, education, external review and assessment -- receives official approval of being able to competently complete a task. Certification can be a legal requirement or a measure undertaken voluntarily for professional advantage. Certification schemes which are mandatory by law provide a strong incentive for compliance.

Assessment for certification needs to be both practical and theoretical. Many servicing technicians tend to prefer practical components, but the theory is also important to fully understand the reasons for the particular methods and techniques.

Training is important as the method to transfer knowledge to service technicians, but training by itself does not verify the level of comprehension, competence and skills of a trainee.

For example, a certificate of participation given at the end of a training course cannot replace certification based on a comprehensive assessment of knowledge and skills. Certification schemes often include training but it is best to make the two phases independent for the impartiality of the Certification. A third party should verify periodically and participate directly during the assessment to confirm the validity of procedures.

REAL Alternatives

REAL Alternatives (www.realalternatives.eu) is a learning programme for technicians working in the refrigeration, air-conditioning and heat pump sectors designed to improve skills and knowledge in safety, efficiency, reliability and containment of alternative refrigerants.

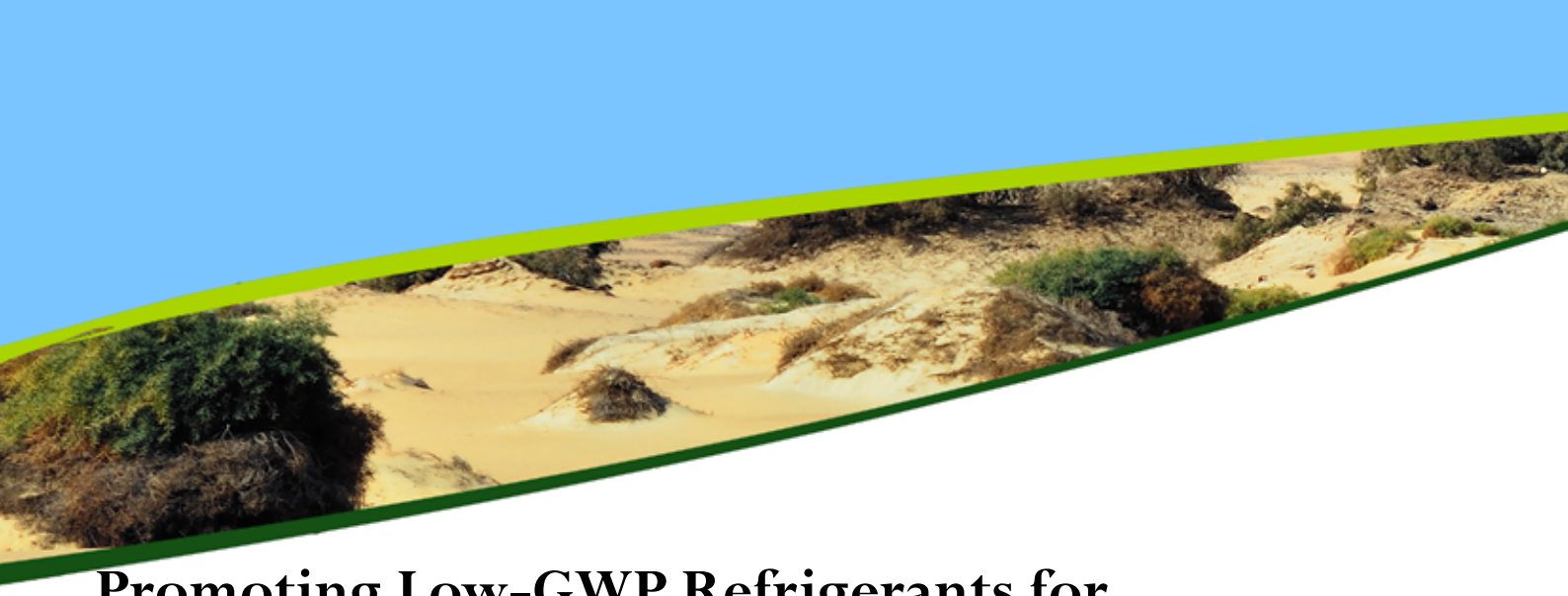
The programme provides a mix of interactive e-learning, printed training guides, tools, assessments for use by training providers and an e-library of more than a 100 additional resources highlighted by users. Developed by independent specialist associations and training bodies from across Europe, this two year project was led by a consortium of six partners and co-funded by the EU Lifelong Learning Programme.

REAL Alternatives is a free learning programme focusing on low GWP alternative refrigerants:

- carbon dioxide
- ammonia
- hydrocarbons
- mildly flammable refrigerants such as HFO & R32

It covers design, installation, service and maintenance of equipment. It addresses concerns voiced by industry stakeholders using alternative refrigerants. It also provides a consistent approach across users in different countries and a bridge between technicians and manufacturers. It is easily and readily updated to accommodate industry and government (i.e. Article 5 countries) changes.

The material is available free to anyone who registers through the website www.realalternatives.eu and is currently available in English, French, German, Italian, Polish and Dutch (Spanish under consideration).



Promoting Low-GWP Refrigerants for Air-Conditioning Industry in High Ambient Countries: Potentials and Challenges

Ole Reinholdt Nielsen, Chief, Montreal Protocol Unit, UNIDO, and
Ayman Eltalouny, HPMP Officer, UNEP Regional Office for West Asia

The Montreal Protocol Adjustment of September 2007 not only accelerated the phase-out schedule for hydrochlorofluorocarbons (HCFCs) but also led to continuous, but healthy, technical and political debates about alternatives to HCFCs and their feasibility, in particular in high-ambient operating conditions.

While hydrofluorocarbons (HFCs) are, at this time, the primary commercially available alternative to HCFCs, they are unlikely to continue playing the same role given their contribution to global warming. Most of the HFC refrigerants with a high or higher global warming potential (GWP) have been less welcomed or accepted in recent years. Many countries have started legislative actions to reduce dependency on HFCs.

Countries with high-ambient temperature characteristics and high dependency on refrigeration and air-conditioning applications are mainly located in the Middle East and particularly in the Gulf region. These countries have traditionally been recipients of globally proven refrigeration technologies. This trend is witnessing a change lately with movement of the regional industry to enhance their research and selection capacities, but it still relies on what is commercially available worldwide in terms of raw materials and components.

Additionally, most governments in these countries have started to apply new energy-efficiency requirements for air-conditioning equipment. Known as MEPS (Minimum Energy Performance Standards), these standards will certainly impact on the choice of refrigerant as well as design and operating characteristics of air-conditioning units. Meeting those conditions for high-ambient climates is another challenge for countries where air-conditioning consumes more than around 60 per cent of the domestic power supply.

As a response to these issues, UNEP and UNIDO designed and launched a regional project to assess the feasibility of low GWP alternatives for the air-conditioning industry in high-ambient countries (known as PRAHA).

The project involves a partnership of 13 international/regional technology providers and equipment manufacturers, aiming to independently assess and evaluate the techno-economic feasibility of low-GWP refrigerants in comparison with existing commercially available refrigerants i.e. HCFC-22 and HFC-410A for different domestic and medium size commercial air-conditioning applications.

The PRAHA project went beyond building and testing prototypes with alternative refrigerants, it examined other important and vital aspects of the deployment of alternatives in developing countries and mainly those with high-ambient temperatures. These aspects include: the impact of relevant Energy Efficiency (EE) standards on the process of refrigerant selection; examining the economic factors that could affect the decision of adopting low-GWP alternatives; understanding barriers to ease the technology transfer; and facilitate transferring the sound use of alternatives in the air-conditioning industry.

Other global efforts to examine alternatives in high-ambient operating conditions, also offered through

the second phase of Air-Conditioning, Heating, and Refrigeration Institute (AHRI) project on "Low-GWP Alternative Refrigerants Evaluation Program" known as AREP II and the project of the US government of «Alternative Refrigerants Evaluation for High Ambient Environments» led by US Department of Energy.

UNEP and UNIDO also started work on assessing low-GWP refrigerants in lower climatic conditions through the project "Egyptian Program for Promoting Low-GWP Refrigerants Alternatives" (known as EGYPRA).

All the above projects, including PRAHA, are to be completed and their findings published by the end of 2015 or in early 2016. While the US and AREP-II projects are designed for "soft optimization" of existing products to work with new alternatives, PRAHA and EGYPRA are designed to introduce custom-built air-conditioning applications designed to operate with the new alternatives under high- or warmer climatic conditions.

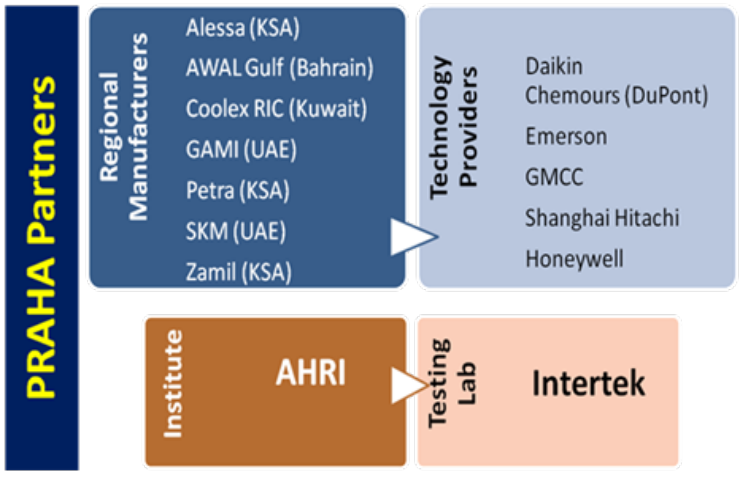
Key findings expected from all projects are likely to complement each other with little room for disagreement. This is normal due the different setup of each project in terms of prototype categories, testing conditions and the tested refrigerants. The projects are expected to draw lines for the potential to leapfrog high-GWP options for the air-conditioning industry in hot-climates with a key message that many of the newly introduced refrigerants can meet expectations. However, some engineering work would be needed in terms of design to ensure that products meet energy efficiency requirements.

The other key message expected from the four projects is that it will reduce the list of options suitable for high-ambient operating conditions in terms of the performance and cooling capacities in comparison with the existing refrigerants i.e. R-22 and R-410A.

At the same time the PRAHA project, through its non-testing components, is expected to raise several issues that would need additional endeavors to reach a state of comprehensive assessment and ease the way toward smooth deployment of low-GWP alternatives in high ambient conditions. The economical implications, the detailed risk assessment in production/installation/servicing practices due to flammability characteristic of the alternatives, the required standards/codes, the training/certification needs and the technology transfer barriers are among the key messages which result from the PRAHA project with specific recommendations and suggested actions about what more can be offered.

In conclusion, the efforts led by the Montreal Protocol and other institutions to seek solutions for suitable refrigerants for high ambient conditions will certainly provide an answer, even an incomplete one, to the question: "Do we have solutions for high-ambient operating conditions?"

It is likely that industry and governments in countries affected by these conditions will be in a good position to make decisions about which way to go in a few years from now. The international assessment work is intended to assist the governments and industry and to lead the way, but it will be their sole decision and responsibility to make this shift happen.

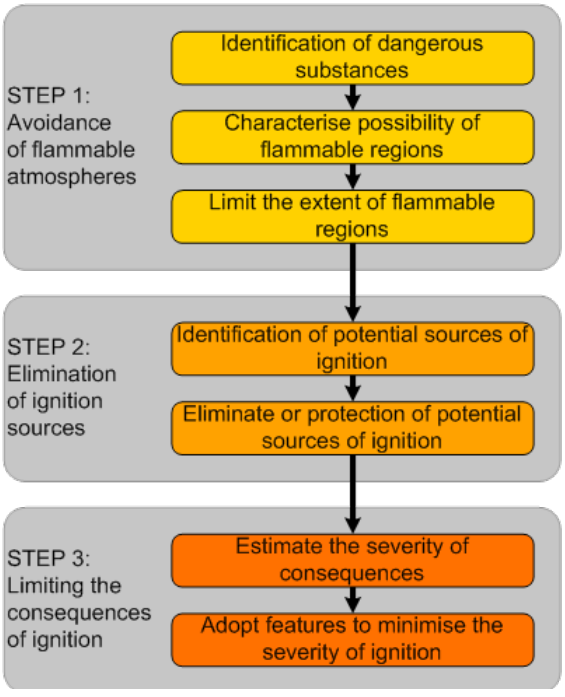


Safety Issues Linked to Alternative Refrigerants

As the phase-out of hydrochlorofluorocarbons (HCFCs) progresses, it is expected that there will be a considerably higher uptake, in particular in developing countries of 'alternative refrigerants', such as hydrocarbons, ammonia, carbon dioxide, unsaturated hydrofluorocarbons (HFCs) –or HFOs. Many of these alternative refrigerants have particular characteristics in terms of toxicity, flammability and high pressure which are different from those used previously such as chlorofluorocarbons (CFCs) and HCFCs. When refrigeration and air-conditioning equipment is installed, serviced, repaired and dismantled, safety issues need to be carefully evaluated and considered particularly when servicing technicians have to deal with refrigerants with properties that they were previously not familiar with. It is therefore important that the refrigeration and air-conditioning industry adapts to both the technical and safety issues concerning these refrigerants.

There are a number of flammable refrigerants – some old and some recently developed. Although there are many flammable refrigerants the extent of their flammability varies quite widely; it can be seen that some substances have relatively low 'lower flammability limits' (LFLs). For example HC-290 has an LFLs of 38 g per m^3. Other refrigerants have significantly higher LFLs, for example HFC-1234yf has an LFL of 289 g per m^3). There are other flammability characteristics such as minimum ignition energy, heat of combustion and burning speed that have an impact of the ease with which a substance can be ignited and the severity of the consequence following ignition.

With all flammable refrigerants, the risk arises with the possible ignition of a flammable concentration. Ignition is caused by an unprotected source of ignition – this could be an electric spark, a naked flame, a very hot surface or some other event that creates sufficient energy. Ignition may occur wherever the refrigerant has leaked and mixed with air in dangerous proportions.



Basic steps for flammability risk assessment

For flammable refrigerants, appropriate design requirements – that are over and above what would normally be required for ordinary refrigerants – can be found in regulations, standards, codes of practice and industry guidelines. The main issues described in these sources to be addressed, include:

- Limiting the quantity of refrigerant to an amount that is unlikely to be ignited (i.e., refrigerant charge limits)
- Designing the system and components for smaller refrigerant charge amounts
- Not installing equipment in vulnerable locations (i.e., where there are an excess of potential sources of ignition)
- Ensuring systems have a high level of leak tightness.
- Constructing the system so that there are no potential sources of ignition that could ignite a refrigerant leak (e.g., no sparking components where a leak of refrigerant could accumulate)
- More frequent use of gas detection and ventilation systems to assist with dispersing any leak of refrigerant
- Applying the necessary warnings to accessible parts of the system to ensure that technicians are aware of the hazard (e.g., flammable gas stickers near charging points)
- Including the necessary information relating to flammability in installation and operating documentation

Standards such as EN 1127-1 are useful for assisting with the design considerations of systems use flammable refrigerants.

For technicians and engineers that are working directly with flammable refrigerants, it is essential that workers have available and use the appropriate tools and equipment. Whilst it is often the case that certain tools and equipment are equally applicable to most refrigerants, there are some that may ordinarily compromise safety and some specialised equipment is required.

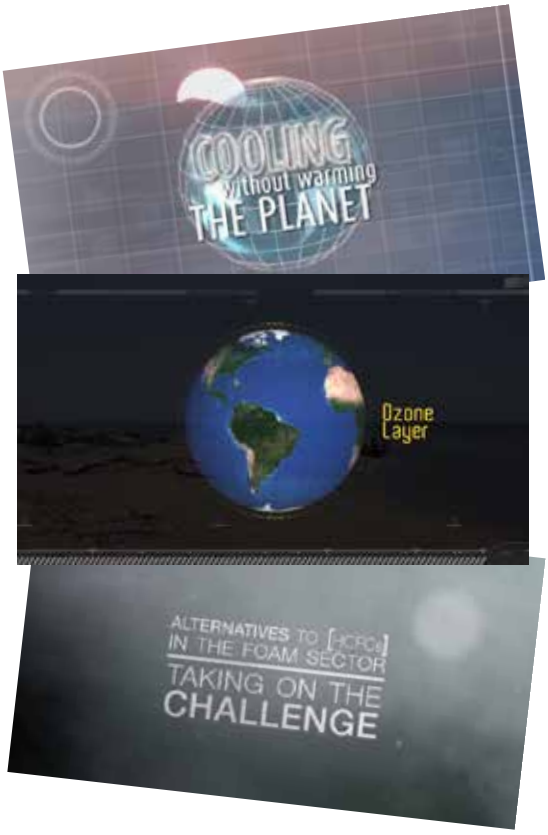
For more information: Safe Use of HCFC Alternatives in Refrigeration and Air-conditioning, www.unep.org/ozonaction

Flammable gas warning sign that must be on flammable refrigerant
recovery cylinders

© Mastercool

Electronic manifold gauge set that can be used with flammable refrigerants

OzonAction Outreach Tools



Cooling Without Warming the Planet. Produced by UNEP OzonAction ROLAC and the Colombian NOU (English, Spanish and Portuguese, aprox. 30 minutes). This film unveils successful alternative cooling experiences with natural refrigerants for domestic and industrial applications in five Latin American and Caribbean countries. These technologies have been taken up as energy-efficient and low-GWP alternatives in HCFC-based equipment.

Genesis. This short video developed by UNEP OzonAction describes that in the not too distant future a young woman looks back at the positive efforts made to protect the ozone layer. With the help of her robot companion she explores the threats to the ozone layer and what humankind did to address these threats, in particular she learns about the importance of hydrocarbons and their contribution to ozone layer protection.

Alternatives to HCFCs in the Foam Sector: Taking on the Challenge. A 15 minutes short documentary developed by UNEP OzonAction that seeks out answers from the technical and scientific experts closest to the issue and showcases some inspiring conversion projects. With financial assistance and technology transfer facilitated by the Montreal Protocol's Multilateral Fund, developing countries are already taking on this uphill battle, thus paving the way for the adoption of ozone and climate friendly alternatives to HCFCs.

New Posters 2015:

You can find OzonAction on the Internet here:

The OzonAction Website: http://www.unep.org/ozonaction/

New Publications

Phasing-out GCFC in Small and Medium-sized Foam Enterprises.

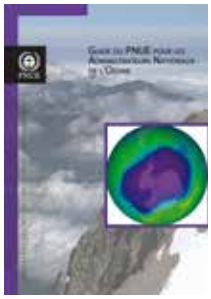
This booklet aims to assist foam enterprises, especially SMEs, to better understand policies on HCFC phase-out, access to assistance from the Multilateral Fund for the Implementation of the Montreal Protocol and access to alternative technologies in different foam applications taking into account challenges in converting to alternative technology. It also discusses some tips on how to identify enterprises that may use HCFCs and verify the HCFCs consumption of enterprises.

Normas Internacionales de refrigeracion y aire acondicionado.

La presente guía ofrece una introducción y sencilla sinopsis de las cuestiones relativas a las normas internacionales en el sector de la refrigeración y el aire acondicionado y de cómo dichas normas pueden ser útiles en el contexto de la eliminación de hidroclorofluorocarbonos (HCFC) en los países en desarrollo, de conformidad con el Protocolo de Montreal relativo a las Sustancias que Agotan la Capa de Ozono.
(English and French available)

Good Servicing Practices: Phasing out HCFCs in the Refrigeration and Air-conditioning Sector.

The main purpose of this Guide on Good Practices: Phasing-out HCFCs in the Refrigeration and Air-conditioning Servicing Sector is to provide National Ozone Units and refrigeration and airconditioning training institutes with a standardised module for delivering training programmes under HCFC Phaseout Management Plans. It can be used together with web-based slides and an interactive animated exercise. The publication can serve as a guide for other multilateral environmental agreements to also think globally and act locally.

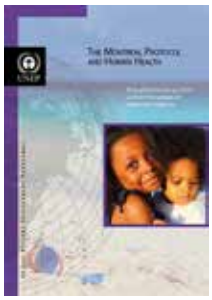


Guide du PNUE pour les administrateurs de l'Ozone.

Ce guide présente et résume les questions importantes concernant le Protocole de Montréal relatif aux substances qui appauvrissent la couche d'ozone que les administrateurs nationaux chargés de l'ozone (BNO) doivent connaîtrepour pouvoir être efficaces dans leur travail. Présenté sous une forme claire et simple, il est conçu pour apporter aux nouveaux NOO et à leurs collaborateurs les connaissances essentielles requises pour comprendre rapidement le fonctionnement du Protocole de Montréal ainsi que les obligations de leur pays dans le cadre du Protocole.
(English available)

Informal Prior-informed Consent (iPIC).

The iPIC mechanism is a voluntary and informal system of information exchange on intended trade between the authorities in importing and exporting countries that are responsible for issuing ODS trade licenses.
The designated authorities in charge of issuing import / export licenses are encouraged to consult the iPIC info sheets of their respective trade partners before issuing any license.



The Montreal Protocol and Human Health

This booklet summarises how the successful implementation of the Montreal Protocol has protected human health. It describes how ozone depletion would have led to increases in UV radiation and, based on current understanding of the mechanisms by which UV affects biological processes, how that would have led to a dramatic increase in skin cancers, cataracts and affected human health in other ways. It also covers recent progress in understanding the 'World Avoided' - that is the world we would have lived in without a successful Montreal Protocol.

Safe Use of HCFC Alternatives in Refrigeration and Air-conditioning.

Many of the alternative refrigerants to hydrochlorofluorocarbons (HCFCs) have particular characteristics in terms of toxicity, flammability and high pressure which are different from those used previously. It is therefore important that the refrigeration and air-conditioning industry adapts to both the technical and safety issues concerning these refrigerants. This publication provides an overview of the alternatives, their general characteristics and their application in the context of the safety issues.

National Certification Schemes for Refrigeration and Air Conditioning Service Technicians

This publication provides a simple overview and examples of the design and implementation of certification schemes for technicians and enterprises in the refrigeration and air-conditioning servicing sector.

Acknowledgements

The OzonAction Special Issue (OASI) is published once a year in English.

OASI is available online at http://www.unep.org/ozonaction/News/OzonActionNewsletter

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