OzoNews

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In this issue

UNEP

Multilateral Fund for the Implementation of the Montreal Protocol

A fortnightly electronic news update on ozone and climate protection and the implementation of the Montreal Protocol

GLOBAL

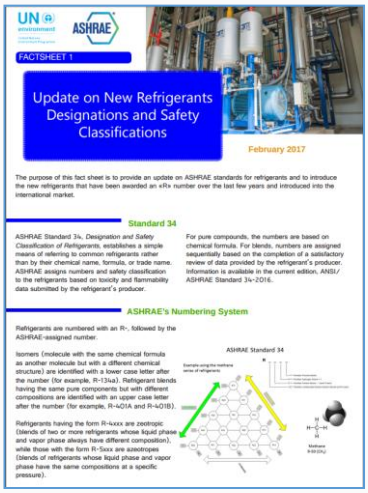
1. General Trust Fund for Financing Activities on Research and Systematic Observations Relevant to the Vienna Convention

Introduction

1. The present note provides an overview of issues related to the General Trust Fund for Financing Activities on Research and Systematic Observations Relevant to the Vienna Convention for the Protection of the Ozone Layer (hereinafter the "Trust Fund"). It presents background information on the establishment and institutional arrangements of the Trust Fund and provides an update on the current status of the Trust Fund and the activities under its purview. The note also highlights other key issues addressed by the Conference of the Parties to the Vienna Convention at its tenth meeting, which was held jointly with the Twenty-Sixth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer in November 2014.
2. The objectives and activities of the Trust Fund pertaining to research and systematic observation are central to the work of the Ozone Research Managers of the Parties to the Vienna Convention, not only to their mandate under the Vienna Convention, but also to their domestic responsibilities. The Ozone Research Managers may therefore wish to consider the present note and make appropriate recommendations, for further consideration by the eleventh meeting of the Conference of the Parties to the Vienna Convention, to be held jointly with the Twenty-Ninth Meeting of the Parties to the Montreal Protocol, in Montreal, Canada, from 20 to 24 November 2017. [...]

Excerpt from the Note by the Secretariat, the Ozone Research Managers of the Parties to the Vienna Convention for the Protection of the Ozone Layer Tenth meeting, Geneva, 28–30 March 2017

- UN Environment, Ozone Secretariat



2. Fact Sheet: Update on New Refrigerants Designations and Safety Classifications

The purpose of this fact sheet is to provide an update on ASHRAE standards for refrigerants and to introduce the new refrigerants that have been awarded an «R» number over the last few years and introduced into the international market.

- Read/Download from UN Environment, OzonAction

3. Refrigerants: New Rules Reinforce Innovation

Agreed upon in October 2016 after negotiations from over 170 nations, the Kigali Amendment to the Montreal Protocol seeks to phase [down] the use of hydrofluorocarbon (HFC) refrigerants due to their high global-warming potential (GWP), paving the way for newer, low-GWP refrigerant materials to enter the marketplace. Although the Kigali Amendment is certainly the most prominent refrigerant-related ruling in recent years, several other regulations focused on reducing the use of high-GWP chemical refrigerants have been implemented, including major delistings of HFCs in Europe, the U.S. and Japan. This article provides perspective on low-GWP refrigerants and some attendant operational considerations, and also highlights two refrigerant-free cooling

technologies.

GROWTH IN HFOS

Although the Kigali Amendment was not finalized until late last year, the industry has been preparing for an eventual phasedown of HFCs for many years. Manufacturing capacity for low-GWP hydrofluoroolefin (HFO) refrigerants is set to ramp up significantly in the coming years, […]

COMPATIBILITY FACTORS

As industries begin implementing new refrigerants, additional operational considerations must be reviewed, including compatibility with lubricating oils and other auxiliary chemicals. A group from JX Nippon Oil & Energy Corp. (NOE; Tokyo; www.noe.jx-group.co.jp) is developing polyol ester (POE) refrigerant oils specifically for use with HFO refrigerants. "Refrigeration oils are generally required to have good miscibility with the refrigerant, good lubricity and chemical stability under the refrigerant atmospheres. In the case of HFO refrigerants, the chemical stability could be a problem," says Akira Tada, an engineer with NOE's Grease & Refrigeration Oil R&D Group. Tada cites HFOs' double bonds as the source of these instability concerns, as they increase the refrigerants' likelihood of decomposition when compared to HFCs. "If air gets into refrigeration systems using HFOs, the decomposition of HFOs proceeds drastically, and it leads to the formation of hydrogen fluoride," he explains. The presence of hydrogen fluoride not only accelerates the degradation of refrigeration oils, it also can attack the system's materials of construction, resulting in serious operational problems. It is these concerns driving NOE's development of new refrigeration oils for use with HFOs.

New additive formulations have given way to POE oils that have shown high chemical stability under HFO atmospheres, even when contaminated by air. Furthermore, low miscibility of oils with refrigerants can generally lead to separation at low temperatures, which can cause congestion of oil in capillaries and decrease the amount of oil in the compressor. However, these new oils exhibit good miscibility and lubricity with HFOs, and are also compatible with HFCs and HFC-HFO mixtures. Tada's team is currently conducting trials of these oils with clients to evaluate for commercial use.

Potential compatibility problems can be introduced long before systems are running — for instance, the chemistry of metalworking fluids (MWFs) used in fabricating refrigeration equipment can negatively impact operations. Residual MWFs may become mixed into refrigerant and compressor lubricants, causing inefficiencies and premature failures. A team of engineers from Chemtool Inc. (Rockton, Ill.; www.chemtool.com) and CPI Fluid Engineering (Midland, Mich.; www.cpieng.com) has been studying the effects of MWFs on refrigeration systems. "Each MWF and metal-cleaning solution should be evaluated before doing any refrigeration machining, parts washing or even applying metal protective film during manufacture and assembly," explains Richard Butler, Chemtool fluids technical manager. The researchers' findings indicated that some MWFs, such as those containing chlorinated alkanes, could still cause corrosion even after parts are washed, leading the team to recommend the use of functional alternatives. The effects of MWF-derived corrosion in refrigeration processes can be severe, describes Butler: "Increased acid number will cause oxidation and degradation of the compressor lubricant. Similarly, corrosion of ferrous materials will produce abrasive particles, leading to premature compressor failure." For common refrigerants, like R134a and R410A, compatible MWFs and lube oils do exist, says Butler. However, further work remains in the area of next-generation refrigerants. The team's next project will include compatibility tests for the low-GWP refrigerant HFO-1234yf, as well as an expansion to evaluate more metals, including aluminum and copper.

BEYOND THE COMPRESSION CYCLE

A handful of new cooling technologies forgo some of the concerns associated with refrigerants by eliminating them altogether. Oak Ridge National Laboratory (ORNL; Oak Ridge, Tenn.; www.ornl.gov) is developing one such technology, leveraging a thermal phenomenon known as the magnetocaloric effect. The key to magnetocaloric cooling is the precise application of a magnetic field to specialized powdered metallic materials. The magnetocaloric materials can expel and absorb heat through a cycle of being magnetized and de-magnetized. "Studies have shown that these materials have the potential to be 20–25% more efficient than conventional vapor-compression systems," says Ayyoub Momen, lead researcher for ORNL's magnetocaloric refrigeration project, which is working along with GE Appliances toward commercializing the first magnetocaloric refrigerator. "When you put these materials inside of a magnetic field, their temperature suddenly goes up," explains Momen, "but when you remove the magnet, their temperature goes down." The project aims at leveraging this cooling effect in a refrigerator. The critical property for magnetocaloric materials is the temperature at which they lose their magnetism, or the Curie temperature. Researchers at ORNL have fine-tuned cooling performance by layering as many as 15–20 different magnetocaloric materials based on their Curie temperatures to expand the temperature span of the refrigerator, says Momen.

FIGURE 2. The magnetocaloric refrigeration system being developed at ORNL uses a magnetic field to remove heat

Beyond manipulating the magnetocaloric materials to improve their cooling behavior, a second facet of the research is to design the refrigeration machine itself (Figure 2). Inside the refrigeration process, the magnetocaloric materials are periodically magnetized and de-magnetized while a working fluid, such as water or glycol or a mixture of the two, moves into and out of the system. As the fluid passes through the particulate materials, on one side, a cooling effect is generated, while the other side generates a heating effect. Analogous to a vapor-compression refrigeration cycle, here, the cool side acts as the evaporator and the hot side acts as the condenser.

"One of the main challenges, from a performance point of view, is the pressure drop," says Momen. Other design challenges he mentions are the complex valving system required for the process and optimizing the design to bring down system costs. "It is iterative research that we are performing right now," he explains. The system's overall safety is another advantage, since the magnets are shielded, making exposure to the magnetic field unlikely. Also, the use of the innocuous working fluids and solid magnetocaloric "refrigerants" decreases leakage concerns. Additionally, the magnets and the refrigerant materials can be recycled when their service life is up, adds Momen. "The target is to make the system as robust as a conventional refrigerator with a lifetime of around ten to fifteen years," he explains. In addition to investigating magnetocaloric cooling for refrigerator applications, the ORNL team is also looking into scaling the system into a small air-conditioning unit.

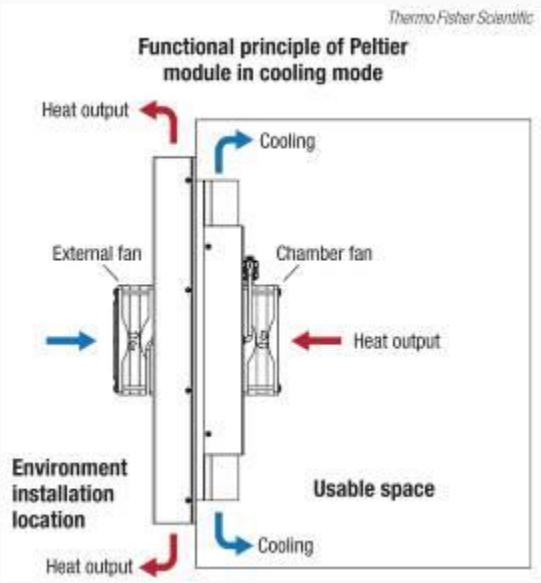


FIGURE 3. Based on Peltier thermoelectric technology, this refrigerated incubator consumes much less energy than a traditional compressor-based cooling system

Thermoelectric devices — those that leverage the heat flux between two materials of differing conductivity and require no refrigerant chemicals — are also being increasingly considered for cooling applications. A new refrigerated incubation system from Thermo Fisher Scientific Inc. (Waltham, Mass.; www.thermofisher.com) is based on the thermoelectric Peltier effect, providing both cooling and heating in a single module. The company developed the Peltier-based Heratherm incubator (Figure 3) in order to overcome some of the disadvantages of traditional compressor-based cooling processes used in similar products, explains Konrad Knauss, global product manager of Thermo Fisher's constant temperature products. Compressor-based systems are especially energy consuming when systems must regulate temperatures near ambient, because both the compressor and heating element run simultaneously to stabilize temperature. In tests conducted by Thermo Fisher, the Peltier units consumed a fifth of the energy required for running a compressor-based cooling system.

Unlike compressor systems, the Peltier system generates no vibrations. Another advantage is that the Peltier system generates very little heat exhaust, so its operation will not impact a laboratory's ambient conditions.

Within the Peltier element, the connection between two metals with different electric conductivities promotes heating on one side and cooling on the other side. "In the refrigerated incubator, we switch the sides when we need cooling or heating — the cool side is on the inside, and the hot side is on the outside, and vice versa," explains Knauss. While the Peltier effect is extremely efficient in the near-ambient range, there are efficiency disadvantages when operating at extremely high or low temperatures, says Knauss.

Although Peltier cooling systems are available commercially for small-scale applications like household wine coolers, Knauss says refrigerated incubation is the first commercial application of the technology in the industrial science sector. Peltier Heratherm incubators are currently available in a 178-L benchtop model and a 381-L floor model, but with the addition of more internal Peltier elements, the system could effectively be expanded for higher capacities. According to Knauss, the company plans to eventually scale up the system for a larger offering, but there are several challenges to overcome with regard to cost and ease of operation.

- Chemical Engineering, 1 March 2017, By: Mary Page Bailey

4. Sustainable Management of Refrigeration Technologies in Marine and Off-Shore Fisheries Sectors, 6-8 April 2017, Bangkok, Thailand

Pre-registration is now open

Organized by the UN Environment (UNEP), ASHRAE, the International Institute of Refrigeration (IIR), and the United Nations Industrial Development Organisation (UNIDO), with the kind support of the Government of the Kingdom of Thailand and the Department of Industrial Works, the Sustainable Management of Refrigeration Technologies in Marine and Off-Shore Fisheries Sectors Conference takes place April 6-8, 2017, in Bangkok, Thailand.

Refrigeration technologies are essential for the cold food chain management both on land and in marine applications. The Montreal Protocol (Protocol) Technology and Economic Assessment Panel (TEAP) reported that 80% of mobile marine refrigerated systems use hydrochlorofluorocarbons-22 (HCFC-22) refrigerants. HCFC-22 is currently being phased-out worldwide under the Montreal Protocol on Substances that Deplete the Ozone Layer.

RAC technology management in the mobile marine and fisheries sector has a critical role in meeting the phase out targets specified by the Meeting of the Parties (MOP) to the Protocol and ensuring sustainable environmental practices in their RAC applications. Refrigeration, freezing, ice making and air-conditioning equipment are fundamental for mobile marine and fishery operations as well as sustaining economic livelihoods.

This international conference will focus on the practices of this industry in the management of existing systems, longer term energy efficient systems, advancement and selection of related refrigeration and air-conditioning (RAC) technologies. In keeping with the ongoing developments of the Montreal Protocol, the conference will address the different aspects, mentioned earlier, in conjunction with eliminating/minimizing the use of either hydrochlorofluorocarbons (HCFC) or high-GWP hydrofluorocarbons (HFC), as refrigerants, and the relevant obligations under the Montreal Protocol as well as other international policies and governing treaties.

Learn more

On-line pre-registration is now open:

1, Go to page: https://www.ashrae.org/membership--conferences/conferences/ashrae-conferences/marine-2017

2. Scan down and you will see: Registration Application: https://fs12.formsite.com/ashrae/form32/index.html

ASIA PACIFIC

5. Pakistan and UN Environment Organize the "Ozone2Climate" Technology Roadshow and Industry Roundtable

Lahore, 16-17 March 2017 - The first ever "Ozone2Climate" Technology Roadshow and Industry Roundtable under the HCFC Phase out Management Plan project was organized by the Ministry of Climate Change, Government of Pakistan, UN Environment Compliance Assistance Programme (CAP) Asia and Pacific Office AP team in association with UNIDO and the Pakistan Refrigeration and Air-Conditioning Industry Association. The Technology Roadshow and one-day Roundtable was organized as a part of the launch of the recently approved Stage 2 project for HCFC phase out and helped the participants understand the implications of the recently agreed Kigali Amendment to the Montreal Protocol for the phase down of HFCs.

The Technology Roadshow was inaugurated by Honourable Minister of Environment of Punjab Government Ms. Zakia Shahnawaz. Speaking on the occasion congratulated the Pakistan industry for adopting the latest technologies available globally and keeping pace with the global market change, the Honourable Minister said: "As Pakistan embarked on their HCFC phase-out and achieved their first freeze target by 2013 and 10% reduction in 2015, there are excellent opportunities for the refrigeration and air conditioning industry to introduce zero-ODP, energy-efficient, zero- or lower-GWP alternatives and technologies to achieve more socio-economic and

environmental benefits. Roadshows like this will play a big role in guiding the industry and this unique initiative of the Ministry of Climate Change and UN Environment should be organized every year to keep abreast with latest technological advancements."

The "Ozone2Climate Technology Roadshow" had more than 20 exhibitors that promoted ozone and climate-friendly alternative technologies to HCFCs in the refrigeration and air-conditioning sector. The opening was attended by about 200 participants from the RAC industry, importers of refrigerants, academia, students, CSO and media. This was the first time the Ozone2Climate Technology Roadshow was organized in Pakistan.

The Ministry of Climate Change and UN Environment also organized the Ozone2Climate Industry Roundtable on 16 March 2017. The Industry Roundtable was attended by leading ozone and climate global technology providers and industry representatives. Various industry networks participated in the roundtable discussions. Fifty key national stakeholders and participants attended the Industry Roundtable with industry representatives. They had a one-day discussion on current policy and technology updates on ozone and climate friendly alternatives to HCFCs and implications of the Kigali Amendment on the recently approved HPMP Stage 2. Dr. Zaigham Abbas, Deputy Director/National Programme Manager, Ministry of Climate Change remarked: "Due to the Montreal Protocol amendment, rapidly growing countries such as Pakistan would be able to curtail unabated use of refrigerants, which might otherwise have resulted in severe negative environmental impacts (high global warming potential, or GWP; and direct and indirect CO_2-eq emissions), avoiding dangerous effects of global warming." Speaking on the occasion, Mr. Atul Bagai, Senior Regional Coordinator with the UN Environment OzonAction highlighted that "a Montreal Protocol led phase down of HFCs will help facilitate transition towards new technologies, and create opportunities for industry to increase efficiency of the new generation of products and appliances in the years ahead." Attending the roundtable, Mr. Milan Demko of UNIDO said that the "global markets are already shifting away from HFCs. European Union, Japan, United States, China and several other countries are taking steps to phase down use. Products using alternative technologies are already available in Pakistan."

Contact:

Dr. Zaigham Abbas, National Programme Manager, Ozone Unit, Ministry of Climate Change, Lahore, Pakistan

Atul Bagai, Senior Regional Network Coordinator, Un Environment, OzonAction, Asia and Pacific Office Bangkok, Thailand

- UN Environment, OzonAction, 16 March 2017

6. China Blowing Agents Market Assessment 2017: Stable Growth in China's Blowing Agent Market in 2016

The study finds that the market has slowly recovered from past years of lackluster performance. In 2016, the China market for blowing agent is valued at RMB 6.3 Bn and around 400,000 tons of blowing agents are sold. The domestic market is expected to maintain stable growth rates through to 2021.

Because of the Montreal Protocol, China will be reducing its HCFC production and consumption to 35% of baseline level in 2020. This will mean that many downstream users in the building materials market especially those making PU and XPS foams will have to switch to other blowing agents by then. This change is by no means a small one, as HCFC is still the second largest segment in 2016. With the phase out of HCFC, there will be more users switching to hydrocarbon (HC), HFC and HFO blowing agents. Through a comprehensive study of the market, this report will identify the possible opportunities available for existing and potential players looking to capitalize on this development.

Blowing agents are currently used in China for the production of many different end products. Going forward, we expect demand from downstream users to slowing recover as the Chinese economy shifts from an export led to a

consumption driven model. This, coupled with a growing middle class and growing awareness of environmental issues, will drive the growth of products that are more environmentally friendly.

The report provides an in-depth analysis on the production, sales, distribution and applications of six distinct blowing agent product segments in the Chinese market. The report provides a detailed analysis on the ADC, HCFC, HFC, HC, OBSH and DPT product segments and its application in end markets like, building materials, footwear & apparel, home appliance, packaging, automotive, consumer goods, etc. We find that the market is currently dominated by domestic suppliers, who are mainly large scale low cost chemical producers. In some segments, domestic suppliers are sometimes cost competitive enough to compete head on with technically superior foreign rivals.

The study also reports on suppliers' output as compared to capacity and reveals that companies in this industry still have some excess capacity, and most suppliers are not looking to expand production in the near term. Prices in some segments are expected to increase due to higher raw materials cost. […]

- Research and Markets, February 2017

7. China Fluoride Materials Monthly Report 1701

[…] The 2017 HCFCs production / use quotas were released. Specifically, the production quotas are equal to that in 2016. The use quotas involve 5 industries in: use quotas for the remaining 3 businesses have been decreased, except PU foaming and room air conditioning industries. This is an indication that the Chinese government is increasing the application limitations, with an intention to force manufacturers to step up the eliminations, develop substitutes and achieve business transformation and upgrade.

[…]- II Substitution of fluorine-enriched refrigerants

In Jan. 2016, production / consumption quotas for hydrochlorofluorocarbons (HCFCs) for that year were released. Unlike in 2015, when a YoY [year on year] reduction of 10% was witnessed, the HCFC production quota was not decreased, remaining the same as in 2015. Specifically, annual quotas for HCFC-22, HCFC-141b and HCFC-142b were 274,279 tonnes, 66,313 tonnes and 22,845 tonnes respectively.

However, consumption quotas for the refrigeration and air-conditioning and PU foaming segments in particular, were decreased. Refrigeration and air-conditioning: HCFC-22 quota down by 8.83% YoY to 67,059 tonnes PU foaming: HCFC-141b quota down by by 27.25% YoY to 2,665 tonnes

The year marked the beginning of the 2nd phase of HCFC elimination in China. The Chinese government is planning to phase out 35% of the average 2009-2010 output between 2016 and 2020. The lack of change in production quotas in 2016 from the previous year was not indicative of a trend, and it is forseeable that they will be reduced in the future.

At the end of Aug., the Foreign Economic Cooperation Office, Ministry of Environmental Protection released an exposure draft about the latest First Catalogue of Recommended Substitutes for HCFCs. The exposure draft included natural refrigerants, which CCM believes will play a dominant role in future substitution, including propane (R290), isobutene (R600a), carbon dioxide (R477), ammonia (R717) and cyclopentane.

On 10 Oct., the 28th conference of the parties of the Montreal Protocol on Substances that Deplete the Ozone Layer was held in Kigali, Ruanda. Nearly 200 countries / regions attended the meeting, during which they passed an amendment to the protocol in a bid to reduce the use of hydrofluorocarbons (HFCs).

This amendment is a warning to China's HFC industry, according to analyst CCM: "It is necessary for domestic HFCs manufacturers to accelerate production optimisation (repurposing facilities for premium marketed products) and phase out obsolete production capacity (so as to achieve cost reductions and increase profit), and to increase investment in the R & D of new substitutes, hydrofluoroolefins (HFOs)." Meanwhile, natural refrigerants are expected to capture some of the market share lost by HFCs in the coming years.

On 27 Nov., the 77th meeting of the Multilateral Fund Executive Committee of the Montreal Protocol on Substances that Deplete the Ozone Layer was held in Montreal, Canada. The plan for China's 2nd phase of HCFC elimination, which is targeted at 4 key industries, commercial refrigeration and air conditioning, room air conditioners, polyurethane foam and extrusion polystyrene foam, was examined and passed.

So far, this 2nd phase plan has obtained funding of over USD500 million, including funding from the refrigeration maintenance industry plan and the cleaning industry plan. […]

- China Fluoride Materials Monthly Report 1701, Jan 2017 • By CCM Information Science & Technology

Co., Ltd • 26 pages

LATIN AMERICA AND CARIBBEAN

8. MARN Presenta resultados de-acciones para protección de la capa de ozono (El Salvador)

Disminuir el uso de gases que dañan la delgada capa de ozono y capacitar a 440 personas, entre técnicos, profesores e importadores de sustancias empleadas en refrigeración y aires acondicionados sobre el manejo de gases naturales, fue objetivo de varios talleres de capacitación que realizaron especialistas de la Unidad de Materiales Peligrosos del Ministerio de Medio Ambiente y Recursos Naturales MARN en 2016.

La inversión total realizada para la capacitación masiva ascendió a $58 mil dólares, con fondos provenientes del Fondo Multilateral del Protocolo de Montreal y administrados por el Programa de las Naciones Unidas para el Desarrollo (PNUD), quien acompaña la implementación de estos proyectos coordinados por el MARN.

La ministra de MARN, Lina Pohl, agradeció al representante Residente Adjunto del PNUD en El Salvador, Stefano Pettinato, el apoyo brindado al país y destacó que entre las novedades de este año, fue la capacitación en el uso de gas natural conocido como refrigerante hidrocarburo R-600a , que no daña la capa de ozono y no tiene repercusiones en el clima.

En la actualidad, este gas natural se está incorporando en productos de refrigeración. En El Salvador todos los almacenes de electrodomésticos ya tienen refrigeradoras con gas natural y son promovidos por su bajo consumo eléctrico. Se espera que en próximos años este tipo de sustancias refrigerantes naturales ingrese como sustancia para dar mantenimiento a estas refrigeradoras, por lo que se considera importante que los técnicos e importadores conozcan por adelantado el manejo de este tipo de gas.

Otro punto importante es que se logró reducir la emisión de 20,500 toneladas de dióxido de carbono, y con ésta cifra, el país cumple con la cuota de consumo de Hidroclorofluorocarbonos (HCFC), considerado como uno de los gases que impactan al ozono y el clima y que por lo general, se encuentran en refrigeradores y aires acondicionados de fabricación antigua.

Durante este año se logró cumplir la cuota establecida en el calendario de reducción de importaciones de Sustancias Agotadoras del Ozono (SAO), que evitó la emisión a la atmosfera 4.68 toneladas de Potencial Agotamiento Ozono (PAO). Esto como resultado de las buenas prácticas en la recuperación y reutilización por parte de los usuarios finales, demostrando la sensibilización y aplicación de las capacitaciones impartidas por el MARN, especialmente a los sectores de aire acondicionado y refrigeración. Finalmente se logró la no emisión del equivalente a 54 mil toneladas anuales de CO_2 con la no importación y consumo de la SAO HCFC-141b, que era utilizada en la manufactura de espumas rígidas que son utilizadas como aislantes de calor.Gracias a este esfuerzo el Fondo Multilateral del Protocolo de Montreal aprobó el tercer tramo del Plan de Manejo para la Eliminación de los Hidrofluorocarbonos (HFC), para su ejecución en el 2017 y 2018, por un valor de $265,000 mil dólares.

En el evento se presentó además el Estudio de Mercado sobre las importaciones y consumo de HFC originado en los sectores de la Refrigeración Doméstica, Comercio e Industria, Aire Acondicionado Estacionario y Móvil que permitirá establecer insumos para la línea de importación y consumo para futuras regulaciones de los HFC en el marco del Protocolo de Montreal.

- Ministerio de Medio Ambiente y Recursos Naturales (MARN), Diciembre, 2016

NORTH AMERICA

9. Air Conditioning Faces Flammable Future

USA: A search of more than 60 million chemicals to find a replacement for R410A in air conditioning systems has found just 27 suitably-efficient fluids – but all are at least slightly flammable.

The multi-year study was carried out by researchers at the US National Institute of Standards and Technology (NIST) to identify the best candidates for future use as air conditioning refrigerants that will have the lowest impact on the climate.

The study found no ideal refrigerant that combined low GWP with other desirable performance and safety features such as being both non-flammable and non-toxic. All 27 fluids NIST identified as the best from a performance viewpoint are, at best, slightly flammable, which is not allowed under US safety codes for most end uses. And several fluids among the list of refrigerants are highly flammable.

Name	ASHRAE designation	GWP_{100}	COP compared to R410A in basic cycle	Capacity compared to R410A in basic cycle
Ethane	R170	6	–	–
Propene (propylene)	R1270	2	1.033	0.689
Propane	R290	3	1.014	0.571
Methoxymethane (dimethylether)	R-E170	1	0.996	0.392
Cyclopropane	R-C270	86	1.018	0.472
Fluoromethane	R41	116		
Difluoromethane	R32	677	1.038	1.084
Fluoroethane	R161	4	1.026	0.601
1,1-Difluoroethane	R152a	138	0.981	0.399
1,1,2,2-Tetrafluoroethane	R134	1120	0.967	0.348
Fluoroethene	R1141	<1	0.968	1.346
1,1,2-Trifluoroethene	R1123	3	0.956	1.054
3,3,3-Trifluoroprop-1-yne	–	1.4	0.988	0.545
2,3,3,3-Tetrafluoroprop-1-ene	R1234yf	<1	0.954	0.414
(E)-1,2-difluoroethene	R1132(E)	1	1.016	0.591
3,3,3-Trifluoroprop-1-ene	R1243zf	<1	0.964	0.372
1,2-Difluoroprop-1-ene	R1252ye	2	0.973	0.355
(E)-1,3,3,3-tetrafluoroprop-1-ene	R1234ze(E)	<1	0.939	0.320
(Z)-1,2,3,3,3-pentafluoro-prop-1-ene	R1225ye(Z)	<1	0.922	0.273
1-Fluoroprop-1-ene	R1261ze	1	0.975	0.353
Trifluoro(methoxy)methane	R-E143a	523	0.957	0.366
2,2,4,5-Tetrafluoro-1,3-dioxole	–	1	0.936	0.337
N,N,1,1-tetrafluormethaneamine	–	20	0.965	0.807
Difluoromethanethiol	–	1	1.010	0.582
Trifluoromethanethiol	–	1	0.977	0.418
Carbon dioxide	R744	1	–	–
Ammonia	R717	<1	1.055	0.746

An abbreviated list of the 27 fluids identified. Refrigerants like ethane, fluoromethane and CO2 were not simulated as they would be near-critical or supercritical in the condenser

The authors of the report, published in *Nature Communications*, maintains that the 27 fluids are the 'best' low-GWP fluids allowed by chemistry.

"It is highly unlikely that any better-performing fluids will be found, and unknown risks associated with the lesser-known fluids may further reduce the list," the authors say.

"The takeaway is there is no perfect, easy replacement for current refrigerants," NIST chemical engineer Mark McLinden said. "Going into the study, we thought surely there has to be something else. Turns out, not so much. So it was a bit surprising, a bit disappointing," he said.

The recent global decision to phase-down HFCs under the Montreal Protocol, added to the pre-existing European F-gas phase-down has prompted regulations which will see the elimination of many of the highest GWP refrigerants from certain applications. These include common refrigerants like R404A and R134a where suitable alternatives are known to exist.

R410A, a blend of R32 and R125, and currently the dominant refrigerant in small air conditioning systems, stands somewhat exposed with its relatively high GWP of around 2000 – 50% higher than R134a. Many feel that a replacement for R410A will need to be found if the global phase-down targets are to be achieved.

R32 has been introduced by Daikin and others for use in small splits and propane is also being considered in similar applications in some Far East markets. However, their flammability precludes their use under current national and international safety standards in all but the smaller systems.

"The path forward will involve tradeoffs," said Mark McLinden. "Safety codes could be revised to allow the use

of slightly flammable refrigerants. Blends of two or more fluids could yield a non-flammable refrigerant, but at a higher GWP. Carbon dioxide is nonflammable, but would require a complete redesign of AC equipment."

Because all current refrigerants are small molecules, the NIST search was limited to molecules with 18 or fewer atoms and only eight elements that form compounds volatile enough to serve as refrigerants. This initial screen resulted in 184,000 molecules to be considered further.

Screening for energy properties corresponding to fluids usable in small AC systems and GWP of less than 1,000 yielded 138 fluids. This included the new low GWP HFOs R1234yf and 1234ze amongst an incredible number of 45 HFOs.

The researchers then simulated the performance of these 138 compounds in air conditioners. Further screening to rule out chemically unstable or very toxic compounds or those with low energy efficiency resulted in the final list of 27 low-GWP fluids.

The report focuses on single-component refrigerants (pure fluids) but recognises that refrigerant blends offer additional possibilities, although the trade-off to reducing flammability will be higher GWPs.

"We do not consider blends explicitly but, for the sake of completeness, do include several fluids that would not be suitable low-GWP fluids in their own right but that might be useful as a blend component," the report says.

"Looking forward, the NIST study's conclusions indicate the need to recognise and deal with trade-offs in planning for the future," McLinden said.

"For example, how should safety codes be changed to ensure that flammable refrigerants can be used safely? Blends of different refrigerants may offer a compromise between safety and GWP. For example, a low GWP but flammable fluid blended with a nonflammable but high-GWP fluid could result in a nonflammable fluid with a moderate value of GWP, McLinden noted.

- CoolingPost, 18 February 2017

10. USDA Announces $1.8 Million for Research on Next Generation Pesticides

WASHINGTON, D.C. - The U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA) today announced $1.8 million in available funding to research new, environmentally friendly pesticides and innovative tools and strategies to replace an older treatment, methyl bromide. Funding is made through NIFA's Methyl Bromide Transition Program.

"These policy changes were based on sound science in the interest of public health," said NIFA Director Sonny Ramaswamy. "The next step is more research to find practical, safe alternatives and educate stakeholders on best practices."

The pesticide methyl bromide is being phased out worldwide under an international treaty to protect the Earth's ozone layer by phasing out ozone-depleting chemicals. Methyl bromide has been used for over 50 years for a range of pest management purposes from farming to storage, shipment and quarantine. The Methyl Bromide Transition (MBT) program helps to discover and implement practical and safer pest management alternatives. Projects may focus on integrated research and extension activities or extension-only projects that promote the adoption of new pest management practices. […]

- The U.S. National Institute of Food and Agriculture (NIFA), 1 March 2017

11. Leak Detection: Tools and Best Practices for Supermarkets: US EPA GreenChill Webinar

Date: Tuesday, March 21, 2017

Time: 2:00 pm to 3:00pm (*Eastern time*)

Description: As the regulatory landscape continues to shift around the commercial refrigeration industry, retailers and contractors are under increasing pressure to reduce — and even eliminate — refrigerant leaks. Do you know where in your facility leaks can occur and how you can use detection technologies more effectively? Join John Wallace from Emerson Climate Technologies as he discusses: what an effective leak detection program looks like and the benefits of putting such a program in place; an overview of the regulatory environment related to leak detection; and how to apply various leak detection technologies, including tips on interpreting results.

To join the webinar:

1. Go to http://epawebconferencing.acms.com/leak-detection/

2. Select "Enter as a Guest". It is important that you select the option to enter as a guest.

3. Enter your name.

4. Click "Enter Room".

5. Click "OK".

For audio:

1. Call the toll free call-in number: 1-866-299-3188 (706-758-1822 from outside the U.S.)

2. Use Conference Code: 202 343 9185#

- US EPA GreenChill, March 2017

EUROPE & CENTRAL ASIA

12. Representatives of Refrigeration Associations of Armenia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, and Ukraine as well as Working Groups from Azerbaijan and Turkmenistan Meeting 27 February – 2 March 2017 in Moscow

Since February 27 till March 2, 2017, a meeting of representatives of refrigeration associations of Armenia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, and Ukraine as well as working groups from Azerbaijan and Turkmenistan took place in Moscow. It resulted in establishing the Interstate technical committee which will help specialists in refrigeration solve their common problems.

The idea of establishing such an organization arose at a Kishinev meeting organized by UNEP, UNIDO and UNDP in November 2016. Then the heads of associations recognized it is vital to cooperate in areas related to training and certification of specialists, legal framework, refrigerants, development of the refrigeration industry, information cooperation, on a permanent basis. It was resolved to establish a Technical committee and time its first meeting to coincide with Climate World exhibition in Moscow.

For three days participants acquainted with key manufacturing and training sites of Moscow, demo projects based on climate safe technologies. On the fourth day they agreed the constant form of cooperation. […]

- Learn more English Russian
- ECAcool, March 2017

13. Conference Focus on NH_3 and CO_2

Macedonia - Over 40 papers on alternatives have already been submitted for presentation at the next CO_2 and Ammonia Refrigeration Technologies conference in Ohrid in May.

The three-day conference, from May 11-13, will cover a range of topics including ammonia system designs and technological innovation; the design of CO_2 refrigeration and heat pump systems; new innovative components; applications and energy efficiency; absorption machines; technical and safety issues; guidelines and training materials; public awareness of the image and benefits of natural refrigerants. […]

Organised by the International Institute of Refrigeration and the Faculty of Mechanical Engineering – Skopje, this biennial event is sponsored by Eurammon and the International Institute of Ammonia Refrigeration.

- Learn more about the conference
- CoolingPost, 7 March 2017

14. Publish Your PhD Thesis Dedicated to Refrigeration in the International Institute of Refrigeration Fridoc Database

The International Institute of Refrigeration (IIR) references and makes available in open access on its website, PhD theses dedicated to refrigeration.

If you have authored a PhD thesis dedicated to refrigeration, the IIR can reference it and make it available in open access on its website via its refrigeration database, Fridoc.

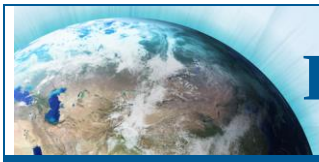
Dissertations presented for a Master's or a Bachelor's degree may also be included provided the content is of broad interest and high quality.

With over 100,000 documents selected from scientific and technical publications from across the globe in all refrigeration spheres, the refrigeration database Fridoc is the most comprehensive refrigeration database in the world.

Fridoc contains documents available in 38 languages by over 80,000 authors from 92 countries, and gives you access to all the articles from the International Journal of Refrigeration as well as to the papers from IIR conferences, congresses and co-sponsored conferences.

Today, the IIR can provide the ideal platform to promote your work to your peers in any chosen field of refrigeration.

- For more information on how to publish a thesis in the Fridoc database, consult the IIR website at www.iifiir.org or send an email to info@iifiir.org



FEATURED

OZONE SECRETARIAT

- - Twenty-Eighth Meeting of the Parties.
- - Resumed 38th meeting of the Open-ended Working Group.
- - 57th meeting of the Implementation Committee.

Final text of the Kigali Amendment to the Montreal Protocol available in all the six official UN languages (A C E F R S)

Click here to access MOP 28 documents, General information …etc.

– Browse through the Ozone Secretariat "In Focus" to learn about latest updates.

- Click here for Montreal Protocol Meetings Dates and Venues

- Methyl Bromide Technical Options Committee 2014 Assessment Report
- Medical Technical Options Committee 2014 Assessment Report

Progress & Quadrennial Assessment Reports:

- Environmental Effect Assessment Panel (EEAP)
- Scientific Assessment Panel (SAP)
- Technology and Economic Assessment Panel (TEAP)

Halon Technical Options Committee Reports:

- Halons Technical Options Committee 2014 Assessment Report (Volume 1)
- Halons Technical Options Committee 2014 Supplementary Report #1 - Civil Aviation (Volume 2)
- Halons Technical Options Committee 2014 Supplementary Report #2 - Global Halon 1211, 1301, and 2402 Banking (Volume 3)
- Technical Note #1- Revision 4 - Fire Protection Alternatives to Halon - 2014
- Technical Note #2 - Revision 2 - Halon Emission Reduction Strategies - 2014
- Technical Note #3 - Revision 2 - Explosion Protection - Halon Use and Alternatives - 2014
- Technical Note #4 - Recommend Practices for Recycling Halon and Halocarbon Alternatives - 2014
- Technical Note #5 - Halon Destruction - 2014

THE MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

Report of the 77th Meeting of the Executive Committee, 28 November - 2 December 2016, Montreal, Canada

See also: Adjusted business plan of the Multilateral Fund for 2017-2019 after the 77th meeting of the Executive Committee

Learn more

OZONACTION

UN Environment, OzonAction highlights

OzonAction Factsheets:

The Kigali Amendment to the Montreal Protocol: HFC Phase-down - The phase-down of HFCs under the Montreal Protocol on Substances that Deplete the Ozone Layer has been under negotiation by the Parties since 2009 and the successful agreement on the Kigali Amendment at the 28th Meeting of the Parties on 15 October 2016 in Kigali, Rwanda to phase-down hydrofluorocarbons (HFCs) continues the historic legacy of the Montreal Protocol. This factsheet summarises and highlights the main elements of the Amendment of particular interest to countries operating under Article 5 of the Protocol (Article 5 Parties).

OzonAction Factsheet: Refrigerant Blends: Calculating Global Warming Potentials (post-Kigali update)

OzonAction Factsheet: Global Warming Potential (GWP) of Refrigerants: Why are Particular Values Used? (post-Kigali update).

OzonAction Factsheet: Tools Commonly used by Refrigeration and Air-Conditioning Technicians

New **OzonAction Multimedia Video Application**: **Refrigeration and Air-conditioning Technician Video Series** - OzonAction has launched an exciting new application which hosts series of short instructional videos on techniques, safety and best practice for refrigeration and air-conditioning technicians. This application, consisting of short instructional videos on techniques, safety and best practice, serves as a complementary training tool for refrigeration and air-conditioning (RAC) sector servicing technicians to help them revise and retain the skills they have acquired during hands-on training. Additional videos will be added regularly.

Please share with your RAC associations, technicians and other interested stakeholders…

Now available in the Android Play Store and Apple Store/iTunes.

(*Just search for 'OzonAction' or scan this QR Code*)

OzonApp eDocs+ launched in Android Play Store and Apple Store - This new application launched by OzonAction on February 12, includes publications, videos, fact sheets and other awareness materials to help National Ozone Units (NOUs) and other stakeholders to build their capacity to implement the Montreal Protocol in a sustainable manner and at the same time to derive climate benefits. Now available in the Android Play Store and Apple Store/iTunes.

(*Just search for "OzonAction", or scan this QR code*)

OzonAction News Drops - UNEP OzonAction is presenting a series of short video "**News Drops**" which focus on ozone layer protection, climate change and the importance of continuing ozone observations.

Regional News Drops

The Regional Networks of National Ozone Units (NOUs) under the Multilateral Fund are a path-breaking mechanism for North-South and South-South cooperation. Networking provides a platform for NOUs from Article 5 countries to exchange experiences, develop their skills and tap the expertise of their peers in both developing and developed countries. Conducted at the regional level, the Networking activity builds the Ozone Officers' skills for implementing and managing their national ODS phase-out activities. During 2016 these videos were filmed at the regional network meetings around the world.

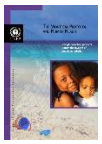
The NOUs were asked about their success stories, alternative refrigerants selected and their personal messages for national ozone celebrations…

Click here to access the News Drops

OzonAction Recent Publications:

Lower-GWP Alternatives in Commercial and Transport Refrigeration: An expanded compilation of propane, CO_2, ammonia and HFO case studies - This booklet presents an expanded compilation of case studies on lower-GWP alternatives in commercial and transport refrigeration and provides an update to the first set of case studies which was published in 2014 by UNEP DTIE OzonAction/CCAC (Low GWP Alternatives in Commercial Refrigeration: Propane, CO_2 and HFO Case Studies.

NATIONAL CERTIFICATION SCHEMES FOR RAC SERVICING TECHNICIANS - This publication aims to provide introductory information for institutions in developing countries to better understand the issue of certification in the field of refrigeration and air conditioning, to assist in the creation of such certification and training schemes and to demonstrate to service technicians and enterprises why it is in their interest to participate. Read/Download



THE MONTREAL PROTOCOL AND HUMAN HEALTH - This booklet summarizes 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. Read/Download

FINANCING THE CLIMATE CO-BENEFITS OF THE HCFC PHASE-OUT - A guide for Low Volume Consuming Countries - Hydrochlorofluorocarbons (HCFCs) are being phased out worldwide under the Montreal Protocol on Substances that Deplete the Ozone Layer. The Parties to this treaty encouraged countries to promote the selection of alternatives to HCFCs that minimise environmental impacts, in particular impacts on climate. The Protocol's Multilateral Fund encourages developing countries to explore potential financial incentives and opportunities for additional resources to maximise the environmental benefits from HCFC Phase out Management Plans (HPMPs). This booklet explains how Ozone Officers in low volume consuming countries can explore such opportunities for climate co-benefits. Read/Download in English | French | Spanish

SAFE USE OF HCFC ALTERNATIVES IN REFRIGERATION AND AIR CONDITIONING - An Overview for Developing Countries - 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. It provides guidance for National Ozone Units (NOUs) and other interested parties in developing countries on how they can advise and assist their national stakeholders in the selection and implementation of alternative refrigerants. Read/Download

PHASING-OUT HCFCS IN SMALL AND MEDIUM-SIZED 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 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. Read/Download

INTERNATIONAL STANDARDS IN REFRIGERATION AND AIR-CONDITIONING - This guide provides an introduction and simple overview of the issues related to international standards in the refrigeration and air-conditioning sector and how they can be useful in the context of the phase-out of hydrochlorofluorocarbons (HCFCs) in developing countries as required by the Montreal Protocol on Substances that Deplete the Ozone Layer. Read/Download in English | French | Spanish

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

Phasing out HCFCs in Small and Medium-sized Foam Enterprises

Demonstrating the feasibility of R-290 based AC manufacturing: China's Midea and Meizhi case

Low-GWP Alternative for Small Rigid PU Foam Enterprises

Learn more about OzonAction publications

EVENTS

2017

Refrigeration Standards Update, Safety and Environmental Requirements, AIRAH and Standards Australia are pleased to present a seminar series on the recently adopted and published refrigeration safety and environmental standards; AS/NZS/ISO 817:2016 Refrigerants – Designation and safety classification which replaces AS/NZS 1677.1:1998 and AS/NZS 5149 Refrigerating systems and heat pumps – Safety and environmental requirements: Parts 1 to 4, which replaces AS/NZS 1677.2:1998. Each of these new adoptions have had major modifications and revisions over the previous AS/NZS1677 series and are critical as we move to low global warming potential refrigerants. AIRAH will be holding the update seminars throughout Australia in February and March 2017 to provide an introduction and overview to the main changes that will affect the HVAC&R industry.

International Ground Source Heat Pump Association (IGSHPA) Technical Conference and Expo, 14-16 March 2017, Denver, USA

AIRAH's Refrigeration 2017 Conference calls for abstracts, 27–28 March 2017, Melbourne, Australia. **The conference committee is now calling for abstracts**.

Sustainable Management of Refrigeration Technologies in Mobile Marine and Fisheries Sectors, co-organized by UNEP, ASHRAE, IIR and UNIDO with the kind support of the Government of the Kingdom of Thailand and the Department of Industrial Works, 6-8 April 2017, Bangkok, Thailand

5th IIR International Conference on Thermophysical Properties and Transfer Processes of Refrigerant, 23-26 April 2017, Seoul, South Korea

7th Conference on Ammonia and CO_2 Refrigeration Technologies, 11-13 May 2017, Ohrid, Macedonia

12th Heat Pump Conference, 15-18 May 2017, Rotterdam, the Netherlands

ATMOsphere America 2017, 5-7 June 2017, San Diego, USA. Interactive workshops bringingtogether decision makers from industry and government to change the future of natural refrigerants.

ATMOsphere Asia 2017 taking place a day before the **Bangkok RHVAC trade show**, 7-9 September, which ranks among the world's best HVAC&R exhibitions and is the second largest in the Asia Pacific region.

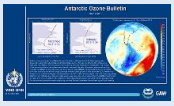
9th International Conference on Compressors and Coolants, 6-8 September 2017, Bratislava, Slovakia

Future of HVAC 2017 – 13–14 September 2017, Sydney, NSW, Australia

READING

Twenty Questions and Answers About the Ozone Layer, presents complex science in a straightforward manner. It complements the 2014 Scientific Assessment Report of Ozone Depletion by WMO and the U.N. Environment Programme.

UNEP and USEPA: Promoting ozone and climate-friendly technologies in public procurement - a scoping study of Asia Pacific



WMO Antarctic Ozone 2016 Bulletins - Containing information on the state of the ozone layer in the Antarctic at roughly two week intervals from August to November. The bulletins are based on data provided by WMO Members which operate ozone monitoring stations in the southern hemisphere and satellites to observe ozone globally.

The EU F-Gas Regulation Handbook, Keeping Ahead of the Curve as Europe Phases Down HFCs - a free online resource for climate media and other concerned parties, published by the London-based Environmental Investigation Agency (EIA).

Alternative Refrigerant Evaluation for High-Ambient-Temperature Environments: R-22 and R-410A Alternatives for Mini-Split Air Conditioners

AREA Guidance on minimum requirements for contractors' training & certification on low GWP Refrigerants - AREA has updated its Guidance on minimum requirements for contractors' training & certification on low GWP Refrigerants.

Free guide to F-gas changes The European contractors association AREA has produced a timely guide to the F-gas regulations which clarifies the new rules, their impact and their practical application…Read more

The recent Alternatives to HCFCs/HFCs in developing countries with a focus on high ambient temperatures" study carried out by Öko-Recherche for the European Commission stresses that the refrigerant and blowing agent demand is expected to triple by 2030 in developing countries as a result of economic growth. A sector by sector analysis shows that a climate-friendly replacement for current and future of HCFCs and high GWP HFCs is possible in most applications …

Primer on Hydrofluorocarbons, Fast action under the Montreal Protocol can limit growth of HFCs, prevent up to 100 billion tonnes of CO_2-eq emissions by 2050, and avoid up to 0.5°C of warming by 2100. IGSD, January 2014, Lead authors: Durwood Zaelke, Nathan Borgford-Parnell, and Danielle Fest Grabiel. Contributing authors: Stephen O. Andersen, Xiaopu Sun, Dennis Clare, Yuzhe Peng Ling, and Alex Milgroom.

Flammable Refrigerants Safety Guide, AIRAH - Many of the refrigerants traditionally used in refrigeration and air conditioning systems in Australia have been non-flammable, non-toxic, synthetic greenhouse gases (SGGs) that have a high global warming potential (GWP). These were typically synthetic refrigerants including CFCs, HCFCs and HFCs. Due to the growing national and international concern regarding the resulting atmospheric effects of SGGs, the use of alternative low GWP refrigerants is increasing. …

Recent Trends in Global Emissions of Hydrochlorofluorocarbons and Hydrofluorocarbons: Reflecting on the 2007 Adjustments to the Montreal Protocol. S. A. Montzka *†, M. McFarland ‡, S. O. Andersen §, B. R. Miller †∥, D. W. Fahey †, B. D. Hall †, L. Hu †∥, C. Siso †∥, and J. W. Elkins †† Earth System Research Laboratory, National Oceanic and Atmospheric Administration, Boulder, Colorado 80305, United States ‡ DuPont

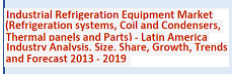
Chemicals & Fluoroproducts, Wilmington, Delaware 19805, United States § Institute for Governance & Sustainable Development, Washington, D.C. 20007, United States‖ Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado 80309, United States

Geothermal Heating and Cooling: Design of Ground-Source Heat Pump Systems- ASHRAE

A first edition, the IIR guide "CO_2 as a Refrigerant" highlights the application of carbon dioxide in supermarkets, industrial freezers, refrigerated transport, and cold stores as well as ice rinks, chillers, air conditioning systems, data centers and heat pumps. This guide is for design and development engineers needing instruction and inspiration as well as non-technical experts seeking background information on a specific topic. Publication, IIR Technical Guide, 2014.

FREE HVAC Optimisation Guide released by AIRAH and the NSW Office of Environment & Heritage outlines 20 HVAC optimisation strategies and how they can be applied to the vast majority of commercial systems, both in older and modern buildings…

Organic Bromine Compounds—another threat to the ozone layer



Latin America Industrial Refrigeration Equipment Market Benefits from Region Flourishing Food and Beverage Production and Processing Market – Trends and forecast 2013-2019.

Solvents & Bio Solvents Market Outlook - Global Trends, Forecast, and Opportunity Assessment (2014-2022)

Chlorofluorocarbon Market: Global Industry Analysis and Forecast 2015 to 2021

Getting The World Off the Chemical Treadmill: A per capita convergence framework for an ambitious phase-down of HFCs under the Montreal Protocol, By: Umang Jalan, Research Associate, Climate Change Programme, Centre for Science and Environment

Global Market for Natural Refrigerants to Reach 1,408.20 Million by 2020, Growing at CAGR of 11.0% by 2020

MOPIA New 2016 Regulatory Compliance Guide summarizes regulatory controls (*Manitoba and Canada*) and provides some other useful links and references...

The Importance of Ambition in the 2016 HFC Phase-Down Agreement. Download the full report here

Update on the Illegal Trade in Ozone-Depleting Substances – The Environmental Investigation Agency (EIA) briefing to the 38th meeting of the Open-Ended Working Group of Parties to the Montreal Protocol, in Vienna, Austria, from July 18-21, 2016.

F-Gas Regulation shaking up the HVAC&R industry. Commissioned by the Greens in the European Parliament, the study provides qualitative and quantitative analysis of the early impacts of the EU F-Gas Regulation on the European industry and evaluates its influences on other countries and regions in designing their own policies to curb HFCs.

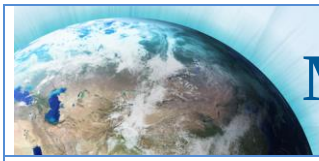
January Edition of Accelerate America! By shecco

"The Road to Competence in Future Green Technologies", the International Special Issue 2016-2017 of Centro Studi Galileo. Read/Download pdf version | E-book

The 2016 editions of ASHRAE's major refrigerants-related standards have been published as a package with 30 new refrigerants and refrigerant blends added.

Quest for climate-friendly refrigerants finds complicated choices, National Institute of Standards and Technology (NIST), 17 February 2017, Summary: Researchers have just completed a multiyear study to identify the 'best' candidates for future use as air conditioning refrigerants that will have the lowest impact on the climate.

The second issue of The Natural Voice magazine, entitled 'Mainstreaming Natural Refrigerants' showcases examples of installations using natural refrigerants around the world, including in the Gambia, Jordan, South Africa, China, Thailand, Tanzania and Saudi Arabia.



MISCELLANEOUS

CLIMATEACTION UNEP

UN knowledge platform launches live-tracking tools to review progress towards SDGs, UN Environment s dynamic online platform designed for sharing contextualized data...

New ***International Journal of Refrigeration*** service for IIR members - As of January 2017, not only will IIR members continue to receive the hard copy of the journal but IIR membership will now also give members access to the complete archives of the *International Journal of Refrigeration (IJR)* online. Designed with IIR members in mind, this new and practical electronic subscription gives members substantial advantages:

- Immediate and permanent access to the latest research and to IJR archive
- Access the latest articles as soon as they become available online.
- Browse, search and read each one of the nearly 4,500 papers since Volume 1, Issue 1.
- Unlimited access to seminal contributions to the field of refrigeration dating back to 1978.
- Keep up-to-date with subscriptions to customized e-alerts on New Volumes, Topics and saved Searches.

Enhanced content and functions

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To access this new service, click "activate my e-IJR subscription now" and follow the instructions.

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

GIZ first Cool Training 2017 will take place from 27 March to 7 April 2017 in Maintal, Germany. This two-week Cool Training deals with the safe application of the natural refrigerants propane, CO_2, and ammonia. It is composed of 30% theoretical and 70% practical work. It is carried out in cooperation with the Bundesfachschule Kälte Klima Technik (BFS) in Maintal, an international vocational training center in Germany that specializes on cooling technologies. Participants are required to have extensive experience in the RAC field and the capability to act as a multiplier of the acquired knowledge in the training. Furthermore, the training requires that participants are physically fit and able to work in English.

The two-week training package is offered for 3200 EUR and includes the following: course fee, training materials, protective clothing, safety equipment, airport pick up, hotel accommodation (with breakfast), and lunch on training days (i.e. weekdays). Not included in this package are the following: international flights, per diem allowance (as applies per your regulations), and insurance.

Registration and reservation of slots are now ongoing and should be sent to Cool.training@giz.de along with the CV of the proposed participant. Please be reminded that qualified participants are accommodated on a first come first serve basis.

International Observers - New AREA membership category - Due to the significant worldwide interest in European legislative developments and the increase in competence of personnel who handle new refrigerants, AREA is pleased to introduce its brand new "International Observer" membership category. This provides a fantastic opportunity for non-European RACHP installer bodies the world, to benefit from the expertise and discussions within Europe through access to AREA. Contact: info@area-eur.be

TRAINING AVAILABILITY - The UEE32211 Certificate III in Air-conditioning and Refrigeration is conducted at the APTC Suva Campus in Fiji.

COURSE DURATION - Course duration is 22 weeks full time including a 1 week mid semester break. Students will attend classes for a minimum of 5 days per week. Training will be delivered face to face. Training will be delivered in English incorporating language, literacy and numeracy (LLN) support and a work skills facilitation program. Additional out-of-hours study time will be required.

ENTRY REQUIREMENTS - Applicants must be a citizen of a Pacific Island Forum country. Individuals are required to have a minimum equivalent of one year full time recent industry experience and hold a relevant local qualification. Applicants will be asked to complete the Literacy and Numeracy Assessment and Vocational Knowledge Assessment. Applicants may apply for recognition of prior learning. For further information visit: http://www.aptc.edu.au/index.php/recognition of-prior-learning.

COURSE FEE - The course fee is FJD 3,500. The fee includes personal protective equipment, stationery and uniform. The Australian Government subsidises the cost of the course including materials and consumables. Course fees are subject to change without prior notification.

For current fees visit: http://www.aptc.edu.au/index.php/course-fees

**Courses offered, course dates and fees may vary depending upon student and industry demand*.

The recently launched new ASHRAE Technology Portal gives ASHRAE members an easy, fast method of connecting to the latest information generated by ASHRAE's research program. It serves a central body of knowledge for ASHRAE technology and research products. It provides access to more than 1,700 Journal articles published since 1997 and more than 600 final reports from ASHRAE research projects.

Belarusian polar explorers send congratulations on International Women's Day 8 March 2017 - Belarusian polar explorers have traditionally joined International Women's Day celebrations by sending greetings in the form of a romantic song. Alexei Gaidashov's team is currently in the Antarctic. In late January, the team divided into two groups: three scientists are working on board the Akademik Fedorov research vessel and the second group, including Gaidashov, made a complicated flight from the Belarusian station at Mount Vechernyaya to the Russian Novolazarevskaya Station to explore the ozone layer and ultraviolet radiation and collect terrestrial and aquatic plant samples. The expedition's return to Minsk is planned for late April.

NASA has launched an ozone sensor to help monitor long-term change in the ozone layer. This sensor, called SAGE III, will be installed on the International Space Station in 2017.

Watch the ScienceCast Video

UL is running a series of 4 webinars on flammable refrigerants in spring. The webinars are:

- Session 1: An Introduction of the 2017 updates to the White Paper: Revisiting Flammable Refrigerants, Wednesday, February 22, 2017 at 2:00 p.m. EST
- Session 2: An Overview of Codes and Standards Activities, Wednesday, March 29th at 2:00 p.m. EDT
- Session 3: An Overview of the Science of Flammable Refrigerants, Wednesday, April 26th at 2:00 p.m. EDT
- Session 4: Panel Discussion – Uncertainty, Gaps, and What's Needed to Continue the Implementation, Wednesday, May 17th at 2:00 p.m. EDT

Session 1: **An Introduction of the 2017 updates to the White Paper: Revisiting Flammable Refrigerants**
For your convenience, you can view the recorded version online. Link to the recorded webinar

More information available here

The Montreal Protocol Who's who
See the latest nominations /

Nominate Ozone Layer Protection Champion

From Your Country /Region >>

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