# *VATIS Update Ozone Layer Protection . Jan-Feb 2007*

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- Sulphuryl fluoride discussed as methyl bromide alternative

TECH EVENTS

# THE SCIENCE OF OZONE LAYER

## Antarctic ozone depletion exceeds that of Arctic

A new study comparing ozone depletion between the poles shows that the Antarctic is experiencing the most severe depletion of the ozone layer. Dr. Susan Solomon at the Earth System Research Laboratory of National Oceanic and Atmospheric Administration (NOAA) in Colorado, the United States, and colleagues found that ozone loss peaks as winter ends, when spring temperatures are at the coldest levels.

In the Antarctic, the researchers found that local ozone depletion at some altitudes often exceeded 90 per cent and reached up to 99 per cent during a typical Antarctic winter. Ozone depletion was lower in the Arctic, where losses only occasionally peaking at 70 per cent. In October, scientists from NASA and NOAA said that ozone loss in Antarctica hit a record in 2006. The agencies reported that the ozone hole was the largest and deepest ever recorded, exceeding the previous record set in 2000.

Scientists from NASA and other agencies believe that the ozone hole over the Antarctic will recover around 2068, nearly 20 years later than estimated in the late 1990s.

Website: www.news.mongabay.com

## Cloud research indicates faster destruction of ozone

Scientists in Finland and the United States report that the greenhouse effect may be happening much faster than previously believed. Mr. Anatoli Bogdan and his colleagues at the University of Helsinki reached that conclusion from laboratory studies of the low-temperature sub-visible cirrus (SVC) clouds that have such a powerful impact on climate.

SVCs cover about one-third of the planet and affect global temperatures by reflecting sunlight back into space and preventing terrestrial heat from escaping into space. Further, ice particles in SVCs have a drying or dehydrating effect on the upper troposphere. The researchers say that these small ice particles are not completely solid, as is commonly believed, but are coated with a sulphuric acid/water overlayer, which reduces the rate at which ice particles grow and remove water vapour a key greenhouse gas from the upper troposphere. That leaves more water vapour to contribute to the greenhouse effect. The coating further affects greenhouse warming by slightly increasing reflection of sunlight back into space and reducing the escape of terrestrial heat.

Website: www.pollutiononline.com

# Ozone hole repair could take decades

There are indications that the hole in the ozone layer is being repaired, but the recovery process will take decades, according to a report published by the Institute of Physics, the United Kingdom. The report, which aims to renew action on ozone, looks at the progress made in preventing the loss of good ozone that protects us from harmful ultraviolet radiation. It also highlights the fact that levels of bad ozone near the ground are rising, which it says will cause significant impact on humans such as respiratory and cardiovascular disease as early as 2030.

In his report The Rise of Ozone Research, Dr. Peter Hodgson says that despite legislation, it will be decades before the ozone layer is restored to levels that existed before the 1970s. The ozone holes over the polar regions are currently as deep and persistent as ever observed, leading to elevated levels of damaging ultraviolet radiation at the earths surface and a rise in the incidence of skin and eye diseases.

Dr. Hodgson, a specialist working with independent consultants Sci-Fact, warns that the ozone layer is still under threat from ozone-depleting substances (ODS), especially rising levels of CFC replacement compounds, which can undermine the progress made in controlling damaging emissions through legislation. He warns against complacency and calls for further international efforts to strengthen and extend the Montreal Protocol. He says Although 180 countries have signed up, only a couple of dozen have actually ratified it and the amendments that came along a few years later. The pressure needs to be kept up on the other countries to ratify it and other substances need to be brought under the Montreal umbrella.

Evidence suggests that while the level of ozone-depleting chlorine is at or near its peak, levels of other ODS, such as bromine, is continuing to rise, the report says. There is uncertainty about the effects of some compounds designed to replace CFCs and for some damaging compounds, such as methyl bromide, there is currently no suitable replacement.

The subtle interactions between global warming, ozone depletion and exposure to ultraviolet radiation are poorly understood and require further research, Dr. Hodgson says. The report explains that the total zone in the stratosphere is still declining, though at a slower rate than previously, but emphasises that the protective ozone layer remains under threat.

Website: www.engineerlive.com

# Ozone Depleting Gas Index

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Website: www.engineerlive.com

## Volcanic eruptions found to poke holes in ozone layer

A new research, spearheaded by Dr. Genevieve Millard at the Department of Earth Sciences, University of Cambridge, the United Kingdom, has discovered that gases released during volcanic eruptions accelerate reactions that lead to ozone destruction in the stratosphere. The researchers found that even relatively small volcanic eruptions can destroy ozone and create localized holes in the stratospheric ozone layer.

Previously, scientists had concentrated on the climatic effects of the tiny particles of volcanic sulphate created from the sulphur dioxide gas emitted during an eruption. Analysing data from a 2000 eruption of the Hekla volcano, Iceland, for the first time, the researchers discovered that volcanic gases may also lead to the formation of ice and nitric acid particles. This is a critical finding, as these particles switch on volcanic chorine gases, accelerating reactions that lead to ozone destruction. The ozone losses due to the small eruption at Hekla lasted for about two weeks, and eventually returned to normal levels. This is the first time that scientists have observed the complete removal of local ozone following a volcanic eruption.

Website: www.physorg.com

# ODS PHASE-OUT IN INDIA

## India to seek alternative for CFC-based MDI

After successfully phasing out ozone-depleting chlorofluorocarbons (CFC) from air-conditioners, refrigerators and hairsprays, India is facing the next critical challenge of phasing out CFC-containing metered dose inhalers (MDIs), used by asthma and bronchitis patients. When the world agreed on the Montreal Protocol in 1992, CFCs in asthma inhalers were the last ones left for phase-out, as these were considered an essential drug. All countries had agreed to 2010 as the deadline for a 100 per cent CFC-free world.

India along with countries like China, Sri Lanka, Pakistan and Bangladesh says it cannot meet the deadline unless conditions are made easier for the requisite technology transfer. For India, with an estimated 22-25 million asthma and bronchitis patients dependent on inhalers, the change to non-CFC alternatives will be expensive and difficult. Till date, neither economically viable nor well-adaptable technology has been evolved nor suitable guidelines for financial support for developing countries have been developed to meet the incremental cost of phase-out of CFC in the inhaler sector, said Mr. A. Raja, Minister of Environment and Forests.

In India, Cipla is the only company that has developed a non-CFC version for two formulations. Imported inhalers, after a lengthy approval and registration process, are expected to cost nearly Rs 150 (US$3.40) more than CFC-based ones.

The guidelines of the Multilateral Fund, the mechanism that facilitates phase-outs, for approving projects do not allow funds for projects relating to companies set up post-1995. In the developing world, however, most of the industries that manufacture inhalers were set up after 1995. India is now working with UNDP to prepare a strategy for the transition to CFC-free inhalers. For now, all developing countries are on one side of the table, and Indian and 12 of these countries are meeting in Sri Lanka in December 2006 to develop a regional strategy to address this issue.

Website: www.indianexpress.com

## No early replacement of AC coaches in the Railways

There will be no premature replacement of AC coaches in the Indian Railways as a result of Montreal Protocol, said Mr. R. Velu, Minister of State for Railways. Indian Railways have got about 4,200 coaches at present, out of which 780 AC coaches manufactured before 1994 have R-12 refrigerant. In 1994, Indian Railways had switched over to manufacturing AC coaches with environment-friendly refrigerants.

R-12 refrigerant has to be phased out by 2010. About 300 coaches out of 780 would complete their service life by year 2010 and will be phased out in normal course. The balance 480 coaches will be converted by the year 2010 with an environmentally friendly gas. Work is this direction has already been taken up.

Website: www.pib.nic.in

## ODS phase-out by ITC Ltd.

India, one of the signatories to Montreal Protocol, has formulated rules and committed a schedule to phase out ODS production and use in India. In consonance with this, ITC Limited has adopted guidelines for CFC phase-out.

ITC guidelines require that:

All newly purchased equipment is free of chlorofluorocarbons (CFC), methyl chloroform (MCF) and Halons.

Units should monitor and reduce consumption of ODS.

Units should plan replacement of all the affected existing equipment well before ODS Rules deadlines.

ODS should be recovered from all the replaced equipment for recycling or safe disposal.
ITCs Corporate Environmental Health and Safety Department audits the implementation of these guidelines in all the units. Total consumption of ODS (CFC-11 equivalent) in 2005-06 was 198 kg, down 72.3 per cent from 716 kg last year.

Website: www.itcportal.com

# IN THE NEWS

## Kyoto deal on HFC funding delayed to 2007

Delegates at a United Nations-backed climate change conference have deferred a deal to allow new refrigerant plants in China and India to get lucrative funding under the Kyoto global warming pact, a United Nations official said. China, Brazil, Argentina and the European Union could not reach agreement, the official said, adding the next conference in 2007 would take up the issue.

Existing refrigerant plants produce HFC 23, the super greenhouse gas, as a by-product. Under Kyoto carbon trading rules, factory owners can sell lucrative carbon credits by destroying this gas. It was the extension of these rules to new plants that delegates at the 189-country climate change conference in Nairobi could not agree on.

Kyoto sets industrialized countries limits on emissions of greenhouse gases, but allows them to meet these targets by funding cuts in developing countries, spawning a carbon trade worth US$5 billion in the last 20 months.

The destruction of HFC 23 has been by far the most lucrative of such trades. For example, the World Bank pocketed some 25 million (US$32 million) in management fees alone this summer for arranging two landmark HFC 23 deals in China, where factories pledged to destroy some 130 million tonnes of greenhouse gases in an 800 million deal. The sticking point on a deal for new plants was that these factories also produce HCFC 22, a gas that damages the earths ozone layer, something which a separate pact, the Montreal Protocol, is meant to stop.

Some delegates felt that Kyoto should not effectively give factories incentives to produce HCFC 22 by funding HFC 23 destruction.

Website: www.today.reuters.com

## Republic of Korea to curtail use of ODS

The Republic of Korea aims to drastically cut the production and use of ozone-depleting substances (ODS) next year, the government has stated. The country will cut its production and use of such substances as Freon and Halons by 85 per cent and 70 per cent, respectively, next year, in line with the Montreal Protocol. The decision was finalized in a meeting of private sector representatives, government and environmental experts, the Ministry of Commerce, Industry and Energy said.

The country is obliged to reduce such substances by 85 per cent as of 2007, according to the international treaty. The Ministry also said it plans to invest about US$9 million in 2007 to aid domestic industries in developing alternative industrial substances and curtailing the use of chemicals that are not environmentally friendly. Domestic consumption of such substances made up about 8.5 per cent of the worlds total consumption in 2004, and the government plans to impose a total ban on the additional production and import of Freon and Halons starting in 2010, according to the Ministry.

Website: www.english.yonhapnews.co.kr

## Ozone-friendly inhalers for South Asian consumers

A strategic approach to the phase-out of inhalers that use ozone depleting substances (ODS) and actions that South Asian countries can take, discussed at a meeting held in Colombo, Sri Lanka, 3-6 December, is expected to help asthma sufferers across Asia to get the benefits of a treatment that is not only good for their health, but also good for the environment. The meeting was organized by the Sri Lankan National Ozone Unit and Ministry of Environment and attended by environment and health officials and industry representatives.

Metered dose inhalers (MDIs) are used for the treatment of asthma and chronic obstructive pulmonary disease (COPD), two very common lung diseases that affect an estimated 300 million people worldwide. The propellants used in MDIs are chlorofluorocarbons (CFCs), an ODS controlled under the Montreal Protocol. The phase-out of CFCs in MDI was discussed also at the recent Meeting of Parties to the Montreal Protocol, where the countries unanimously endorsed the need to support developing countries in their transition to ozone-friendly inhalers.

Given the prevalence of these diseases and evidence of their increasing numbers in developing countries, and the fact that they have committed to phase-out of CFCs under the Montreal Protocol, it is important that governments as well as the industries work towards not only CFC-friendly inhalers, but ensure that they are within the reach of the people who need them, said Mr. Nimal Siripala De Silva, Sri Lankan Minister of Health Care and Nutrition.

Website: www.unep.org

## Honeywell certified R410A customer programme in China

Honeywell, the Unites states, has announced a new certification programme for Chinese manufacturers of air-conditioners that identifies them as users of R410A refrigerant purchased from licensed suppliers. As part of the certification, Honeywell will recommend these Chinese equipment makers to key buyers in Europe. Haier Group and Hisense Company Ltd., the leading Chinese appliance manufacturers, have already agreed to join the programme.

The new programme enables our customers and our customers customers to achieve peace-of-mind, knowing they are using our patented energy-efficient HFC technologies, said Mr. David Lu, Asia Commercial Director for Honeywells Fluorine Products business.

They also can gain other strategic benefits and advantages such as co-marketing opportunities, he added. The new programme supports Honeywells continued effort to combat patent infringements worldwide. Air-conditioners using unlicensed infringing refrigerants that are imported into the European Union are increasingly being investigated by government bodies and scrutinized by European clients who want to avoid business interruptions.

Website: www.jarn.co.jp

## Malaysias programmes on ODS phase-out

In Phase I (1992 to 2000) of its ozone depleting substances (ODS) phase-out programme, Malaysia eliminated 5,000 tonnes of ODS in the refrigerant, air-conditioning and industrial solvent sectors. Phase II (2002 to 2010) of the programme has its focus on meeting the reduction target of 50 per cent in 2005, 85 per cent in 2007 and complete phase-out in 2010 of ODS such as CFCs and Halons. To support this phase-out schedule, legislations were enacted to control the import and replacement of ODS technologies. Malaysia does not produce ODS and rely fully on imports. So far, reduction has been achieved in the manufacturing sector where users are easily identified.

The greatest challenge, however, lies in the service sector, which entails a large number of small workshops across the country that service domestic refrigerators and mobile air-conditioners (MAC) in cars. Malaysias estimated stock of 3.6 million CFC-12 refrigerators is expected to be retired by 2016, based on 20-year service expectancy. Thus, even after the complete phase-out of CFCs by 2010, there will still be some CFC refrigerators that may need to be retrofitted to CFC-free technologies.

A bigger concern is with MAC: the demand for CFC-12 to service them will be about 823 tonnes in 2007, exceeding the target of 491 tonnes that Malaysia must reach under the Protocol. Under Phase II of the phase-out plan, car importers and manufacturers stopped fitting new vehicles with CFC-dependent air-conditioners in 2004. About US$6 million was spent to help five out of six major MAC manufacturers to adopt CFC-free technologies. Nevertheless, by 2010, an estimated 1.8 million vehicles equipped with CFC-12 MAC would still be in use.

Department of Environment has appointed 30 training centres to train technicians in 3,000 air-conditioner workshops in the conversion of CFC-based equipment to non-CFC alternatives.

Website: www.thestar.com.my

## Philippine aircon shops get free CFC recovery equipment

A dozen air-conditioning service centres in Aklan, Antique, Iloilo City, Roxas City and Bacolod City in the Philippines recently received machines for the recovery of ozone depleting refrigerants for free. The distribution of the recovery equipment was made possible through the NCPP Voucher scheme being

implemented by the Department of Environment and Natural Resources Environmental Management Bureau (DENR-EMB).

The acquisition of the recovery machine, which consists of a tank and a regulator, was funded by the Swedish International Development Assistance. The beneficiaries first underwent a one-week training on the operation of the recovery machine and other codes of practice. DENR-EMB Regional Director Mr. Bienvenido Lipayon said his office will conduct regular monitoring to ensure that the recovery equipment is properly used.

Website: www.thenewstoday.info

## Viet Nam equips service centres with ozone-friendly kit

Viet Nams Ministry of Natural Resources and Environment will supply special tool kits, which will stop leakage of chloroflurocarbons (CFCs), to all service centres that repair refrigerators and automobile air-conditioners. The kit comprising a vacuum pump, gas detector and refrigerant charging cylinder will cost around US$800 and its use will prevent the leakage of CFCs into the air while a refrigerator or air-conditioner is being repaired. The Ministry also plans to provide free training for technical staff from all service agencies that have been in business for at least one year.

Over the last decade, Viet Nam has reduced CFCs emission by an estimated 250 t. All kinds of refrigerators using CFC were banned in 2006. Last year, import of 240 t of CFCs was allowed for manufacturing and repair of refrigerators and automobile air-conditioners, and 1.8 t of Halons for fire-fighting.

Website: www.vietnamnews.vnanet.vn

## Pakistan initiates steps to phase out use of ODS

Pakistans Federal Minister for Environment Mr. Makhdoom Faisal Saleh Hayat said Pakistan has initiated a slew of steps to phase-out the use of ozone depleting substances (ODS). He said that the country, with grants from Multilateral Fund (MLF), has extended to the industries financial and technical assistance to switch over from ODS-based technology to ozone-friendly technology.

The foam sector has already switched over to the ozone-friendly technology whereas the refrigeration sector is at an advance stage of implementation. Referring to illegal trans-boundary movement of ODS with neighbouring countries, the Minister said that, in collaboration with UNIDO, Pakistan has trained customs staff to enhance their capacity in identifying these substances and curbing their illegal trade.

Website: www.pakistantimes.net

# REFRIGRATION/AIR-CONDITIONING

## Cost-effective cooling with new heat and mass exchangers

Delphi Corporation, the United States, has begun producing its Heat and Mass Exchanger (HMX), the engine

behind the new environment-friendly, high-efficiency, water-fuelled air-conditioners that operate at significantly less cost than traditional cooling systems.

The HMX capitalizes on a thermodynamic cycle called the Maisotsenko Cycle or M-Cycle, which harnesses the endless supply of atmospheric energy to drive sensible cooling with excellent efficiency. In the case of HMX, cool air is produced using the water-fuelled M-Cycle without adding a drop of moisture. The hotter it gets outside, the better the Delphi HMX works. The cooling capacity and energy efficiency ratio (EER) of an HMX application increase along with the temperature outside, a feature that dramatically reduces power consumption during peak demand.

HMX systems can always provide fresh, filtered outside air, unlike traditional air-conditioners that rely on re-circulation of the air due to a lower capacity to cool as the outdoor temperatures increases. The modular HMX allows for applications to be sized to any cooling capacity need. Because it employs an evaporative technology, the Delphi HMX is most effective when used in stand-alone cooling solutions in hot, dry climates. HMX applications do not require a compressor or chemical refrigerant and can have an EER well in excess of 40.

In many applications, to do the same job, HMX systems use about four times less electricity than traditional air-conditioners. These units are ideal for applications where there is an obligation to provide some percentage of outside air large retail spaces, for instance regardless of geographic location.

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Website: www.news.thomasnet.com

## Refrigerant recovery system meets stringent norms

The Model 34788 Refrigerant Recovery and Recharging Unit, from Robinair in the United States, provides a recharge accuracy within 28 g (nearly twice the accuracy as any other unit in the market) and is compatible with conventional and hybrid vehicles that use electrically driven compressors. The new unit meets all the stringent requirements of the new mandatory SAE J2788 standard, including new UL shop safety features.

Productivity and safety are the key attributes of the new recovery unit. The unit is equipped with a slot for a Secure Digital memory card to allow easy upgrades of field software with essentially no downtime. Along with safety feature for automatic lockout when 68 kg of refrigerant has been recovered, system also prompts pending filter change at 45 kg of recovery.

Contact: Mr. Brian Berdan, Product Manager, Robinair, SPX/OTC Service Solutions, 655 Eisenhower Drive, Owatonna, MN 55060, United States of America. Tel: +1 (507) 455 7087; Fax: +1 (507) 455 7451

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Website: www.news.thomasnet.com

## Heat recovery unit provides free hot water

Turbotec Products, a leading manufacturer of tube-in-tube heat exchangers in the United States, has introduced Enviro-Pak, a domestic hot water maker and heat recovery unit engineered to reduce water heating equipment load and provide free hot water. It is claimed to have one of the highest efficiencies on the market today and comes with HFC-410a, the zero ozone depleting refrigerant.
Enviro-Pak is designed to work with existing or newly installed air-conditioning or refrigeration systems in the 1.5 t to 5 t range, and is ideally suited for light commercial and residential applications. The Enviro-Pak unit was designed to make hot water from wasted heat that typical air-conditioning condensing units give off from heat of rejection in 1.5 to 5 t applications, said Mr. Floyd Lewis, director of sales and marketing for Turbotec. The Enviro-Pak has a quite operation, and is offered with either a white powder coat paint or stainless steel jacket.

Contact: Turbotec Products Inc., 651 Day Hill Road, Windsor, CT 06095, United States of America. Tel: +1 (860) 683 2005; Fax: +1 (860) 683 2133

E-mail: info@turbotecproducts.com

Website: www.news.thomasnet.com

## Reversible residential aircons and heat pumps using CO2

Since 1997, SINTEF Energy Research and the Norwegian University of Science and Technology have been investigating and developing reversible residential air-conditioners and heat pumps (split-type units) using carbon dioxide (CO2) as their working fluid. A third-generation prototype CO2 split-type unit has recently been constructed and extensively tested in heating and cooling modes. The test results have been used for calculating the seasonal heating and cooling performance for two different climates: Greece (Athens) and Norway (Oslo). These have been compared with manufacturers data with verified rating points for the most energy-efficient Japanese R410A split-type unit available on the market.

Website: www.sherhpa.fiz-karlsruhe.de/en

## Alternative to HFC-134a?

Recent legislations, which are putting pressure on the industry for HFC-134a phase-out, have led refrigerant producers DuPont and Honeywell to develop new alternative refrigerants, in parallel to intensive R&D

currently led on carbon dioxide. Honeywell recently gave further information on the new H-fluid that it is currently testing in co-operation with Valeo. It is an azeotropic blend of a newly created molecule called 1,1,1,2 tetrafluoropropene combined with a recently introduced chemical, trifluoromethyl iodide, with thermodynamic properties (inflammability, boiling point, critical point) very similar to those of HFC-134a. The GWP of H-fluid is about 10. The major advantage would be the ability to replace HFC-134a with minor system modifications. Recent performance tests showed cooling capacity and COP of H-fluid as similar to those with HFC-134a at medium and low thermal loads (ambient temperature of 15-35C) and a little lower at higher loads. Validation programmes (particularly on toxicity) have to be run before a final decision on feasibility expected at the end of next year.

Website: www.iifiir.org/en

# AEROSOLS

## FHC-2000 (HFE-254) blowing agent innovation

The worldwide commercial availability of FHC-2000 (HFE-254) has been announced by Hope Land International Co. Ltd. of China, the trading agent for Fuxin HengTong Fluorine Chemical Co. FHC-2000, a hydrofluoroether, is an ideal substitute blowing agent for HCFC-141b. It is a third generation blowing agent for the polyurethane industry and a component of thermal insulation products used for residential and industrial buildings as well as for storage applications.

FHC-2000 has zero ozone depleting potential, and its thermal conductivity and global warming potential compare favourably with other blowing agents. Foams produced with FHC-2000 have fine cellular structures with good insulating properties and good compressive strength. Tests show that FHC-2000 functions well as a foaming agent and has passed all the necessary toxicological tests. Additional potential uses for FHC-2000 are as a cleaning agent, drying agent, carrier solvent, diluent for fluorinated greases and cooling agent.

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E-mail: Greg@hope-group.com.tw

Website: www.chemspecchina.com

## Melamine resin foam production

Nisshinbo Industries Inc. of Tokyo, Japan, has been granted a United States patent for an invention covering: a melamine resin foam; its production process by foaming a resin composition comprising a melamine/formaldehyde condensate, an isocyanate and a blowing agent; and the melamine/formaldehyde condensate, which is used in the production of the above melamine resin foam, obtained by reacting melamine and formaldehyde in the presence of a silane coupling agent. The melamine resin foam is said to have solved the problem of fragility without impairing the good flame-retardation and low thermal conductivity inherently possessed by melamine resin foams.

The present process of foaming and curing, which uses a small amount of an isocyanate instead of conventional processes that use a large amount of an isocyanate, results in a melamine resin foam that has improved characteristic in terms of fragility particularly compression strain inherently possessed by melamine resin foams and only very small reductions in flame retardation and thermal conductivity, when compared with conventional melamine resin foams. Additional research showed that the use of melamine/formaldehyde condensate, of a silicon containing melamine/formaldehyde obtained by using a silane coupling agent in the synthesis, can produce a melamine resin foam of improved compression stress with other properties being substantially unchanged. The blowing agent added to the above melamine/formaldehyde condensate is preferably a straight chain alkyl hydrocarbon (such as pentane or hexane) or a lower alcohol of up to six carbon atoms.

Website: www.freepatentsonline.com

## Foam premixes with improved processability

Arkema Inc., the United States, has received a United States patent for a method for improving the processability of foam premixes containing HFC and/or pentane-based blowing agents in polyols. The method comprises adding trans-1,2-dichloroethylene to the premix in an amount effective to enhance processability.

The effective amount is dependent on the specific blowing agent and the type of polyols, although the method is especially effective with polyester polyols.

The premixes can be converted into polyurethane foams by conventional techniques. Auxiliary blowing agents (water, hydrochlorocarbons, HCFCs) may also be present with the HFC and/or pentane blowing agents. The blowing agents are distributed between the A and B sides of the foam composition. Blowing agents can also be added at the time of injection or mixing as a third stream. The other components of the premix and foam formulations such as fire retardants, surfactants and polyols may be those that are commonly used. In making the foam, A and B sides are typically mixed together, followed by injection of the catalyst, after which the mixture is poured into a box or mould.

Website: www.freepatentsonline.com

## Foaming thermoplastics with CO2

Carbon dioxide (CO2) is an inexpensive, effective and friendly blowing agent for thermoplastic foams. To expedite its introduction to industrial foaming applications, the fundamentals governing the foaming process need to be understood. Some of the crucial fundamentals are nucleation rate, location of (or time to) onset of nucleation, bubble growth rate/duration, viscosity, surface tension for a given pressure drop and temperature drop profiles. Researchers from the Chemical and Biomolecular Engineering Department of the Ohio State University, the United States, have studied batch foaming of pure polystyrene (PS), pure poly(methyl methacrylate) (PMMA), a PS/PMMA blend and nano-composites of these polymers.

Batch foaming involved soaking the samples with supercritical CO2 at the foaming temperature until equilibrium was reached and quickly releasing the pressure. Cell size and density were obtained using image analysis of cryo-fractured SEM micrographs. The polymer blends were prepared to get varying systems. Foaming these materials using different levels of mixing from a twin-screw extruder was one technique employed, while another involved joining two films to form a bi-layer.

A dynamic method was developed to monitor the macroscopic foam expansion rate, relating to both bubble growth rate and nucleation rate. The initial results indicated that each polymer, if dispersed to a particular domain size, could serve as a CO2 reservoir to increase the foam bubble number. As expected, nanoparticles speeded up the rate at which the foam expanded, though its exact impact on nucleation rate, onset of nucleation and bubble growth rate was not quantified.

Website: www.aiche.confex.com

## Replacement for HCFC-22 in pour-in-place rigid PU foams

For pour-in-place applications, HFC-134a, HFC-245fa and blends of the pentane isomers are the obvious options to replace HCFC-22. However, HFC-134a is difficult to handle due to its low solubility in polyols and this can negatively influence foam quality. Further, higher loadings can produce a thick froth when the foam is dispensed from machines. HFC-245fa is expensive to use not only because of its high raw material cost but also because of its lower blowing effectiveness. Hydrocarbons perform well overall but require significant modifications to existing production equipment and facilities to prevent unsafe situations. These modifications are expensive and may not always be feasible due to existing plant layouts.

A. Wheeler (Akrema Inc., the United States) and Michael J. Cartmell (PU foam applications consultant) have established that a blend of HFC-134a and an additive trans-1,2-dichloroethylene or TDCE (Transcend) can be an HCFC-22 replacement in a generic pour-in-place formulation. In addition to easier handling, as demonstrated by the lower vapour pressures and faster blowing agent addition time to the polyol pre-blend, the formulation containing 25 mole per cent TDCE gave better flow and adhesion under both ideal and non-ideal foaming conditions, besides excellent dimensional stability and acceptable thermal conductivities. The study concluded that the use of a combination of TDCE and HFC-134a can produce foams having at least equivalent, and in some cases superior, overall performance as compared with HCFC-22 and HFC-134a, and offered foam manufacturers a new option.

Website: www.arkema-inc.com

## New spray polyurethane insulating foam

Bay Systems North America, the United States, has launched BaySeal 1/2-pound spray polyurethane insulating foam (SPF) using compatible chemistry. This SPF formulation of the popular 1/2-pound per cubic foot density improves ease of application by eliminating the need for stirring, and is water-blown for added environmental benefits. SPF insulation is widely used in buildings due to its energy efficiency and the environmental gains achieved through reduced use of fossil fuels.

Additional environmental and safety advantages are achieved with this formulation by using water as the blowing agent in place of the more common fluorocarbon- or cyclopentane-based agents. Most notably, the use of compatible chemistry ensures ease of use by keeping the product in suspension without constant stirring or agitation, while the absence of ozone depleting chemicals adds to its environmental benefits.

Website: www.e-composites.com

# HALONS

## NAF S 125 (HFC 125) fire suppression system

NAF S 125 is a blend of HFC 125 and a patented detoxifying additive that reduces the amount of decomposition by-products. It is an extinguishing agent (EX 5694) recognized by Underwriters Laboratory (UL) and listed under SNAP list of the United States Environmental Protection Agency (EPA) for normally occupied spaces.

The design concentration for most common fuels (Class A/C hazards) is 8.0 per cent. This concentration includes a 20 per cent safety factor and corresponds to 441 g/m3 at 20C. NAF S 125 cylinder assemblies (42 bar pressure) can be used to retrofit existing Halon systems, saving pipes and disruption times.

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## New fire extinguishing system for the aircraft industry

An environment-friendly fire extinguishing system, developed by Airbus SAS specifically for aircraft engines and auxiliary power units, may become the new industry standard by the end of the decade. The system designed to replace the use Halon 1301 is the result of Airbus Extinguishing concept lowering ozone depletion and greenhouse effect (ECOLOG) research project.

Halons, in spite of their adverse effects on the environment, have been exempted for certain applications such as aircraft engines because of the lack of a viable substitute. Airbus new Halon-free system is, therefore, a major breakthrough for the environment. The system, designed and manufactured jointly with a Siemens subsidiary company and SNPE, uses a chemical extinguishing agent known as Novec 1230 invented by 3M. Novec 1230 causes no damage to humans and engine components and has little or no environmental impact on ozone and global warming.

Because of its higher density, Novec 1230 was not easily compatible with the existing system, and the engineers needed to create a totally new kind of fire extinguisher. The new extinguisher consists of a sphere partly filled with unpressurized liquid Novec, with a gas generator containing an energetic material integrated into the upper part. On ignition, the energetic material releases inert gases, thereby increasing pressure within the sphere and forcing the liquid Novec out through spray pipes and over the fire.

The new concept was perceived as so potentially groundbreaking that the Federal Aviation Administration (FAA) launched its own test series to evaluate the new agents extinguishing efficiency. While the FAAs findings are yet to be released, all signs point to them being extremely positive. Airbus aims to put the new system into production by the end of the decade. As such, it could be fitted as standard on the A350 XWB and could also be retrofitted on in-service aircraft.

Website: www.airbus.com/en

## Fire suppression system with reduced harmful emissions

An article written by Dr. Juan Vitali, formerly of the United States Air Force research laboratorys materials and manufacturing directorate, entitled Halon substitute protects aircrews and the ozone layer, says that although Halons make up only a small percentage of ozone-depleting substances in the stratosphere, as much as 23 per cent of ozone depletion observed in recent years is due to Halons. When released into the lower atmosphere, Halons do not break down and within a year, diffuse into the stratosphere where they become fragmented by the suns ultraviolet light, releasing free halogen atoms that destroy ozone.

Afrox, the South African gas manufacturer, offers Afrox FS 125, a fire-suppression system with Underwriters Laboratory (UL) listing. The FS125 fire-suppression system, using seamless cylinders pressurized to 42 bar, is claimed by Afrox to be at least 20 per cent more efficient at extinguishing fires than comparable products.

The solution, developed by global fire-suppression system supplier Safety Hi-Tech of Italy, requires less gas by weight and uses fewer cylinders. The products selling point is that the gas used is more environment-friendly than Halon 1301. The product releases an electrically non-conductive agent, which leaves no harmful residue, and can be used in occupied and unoccupied areas.

Website: www.engineeringnews.co.za

## New fire extinguisher material

A research team under the Materials Directorate of Wright Laboratory, the United States, has developed a new fire extinguisher material, which is an environmentally friendly and less expensive fire-extinguishing agent that outperforms Halon 1301. The Huntington Research and Engineering (HRE), California Institute of Technology and the University of North Texas were the other research team members.

The team tested a variety of materials such as solid powders, slurries, liquids and gases, at HREs jet engine fire simulator. The testing yielded a new type of fire suppression composition, which could extinguish a 500 kW fire at about $0.25, occupies less space and is lighter than Halon systems. The mass of this new fire suppressing composition is about one-thousandth that of Halon 1301. With its ability to save weight, volume and costs, this new fire extinguishing agent may be the alternative to Halon systems for the aircraft industry.

Further testing will be conducted on this material to determine chemical kinetics, material compatibility, toxicology, agent propulsion, and ease of manufacturing. Other applications of this technology will be explored during the testing process.

Website: www.bnae.asso.fr

## Nitrogen-containing perfluoroalkyl bromide

Japans Agency of Industrial Science & Technology and Ministry of International Trade & Industry have been awarded a United States patent for a nitrogen-containing perfluoroalkyl bromide, a new compound produced by decarbonylating a perfluoro(dialkylamino group-substituted acetic acid bromide) by exposure to ultraviolet

light. The process produces nitrogen-containing perfluoroalkyl bromide in high purity and yield. This product is a useful Halon substitute and an intermediate in the synthesis of products that contain fluorine.

Website: www.freepatentsonline.com

## Powder fire extinguisher alternative to Halon systems

Changzhou Xinhua Electronics Co. Ltd., China, offers a Superfine powder extinguisher, claimed to be a Halon substitute suitable for industrial and domestic use. It is non-toxic, non-irritant to skin, non-contaminating to the objects protected, and easily clears up after use. Its efficiency per unit volume is reportedly twice that of Halon-based systems, and up to ten times that of dry powder, iodine propane and carbon dioxide systems. It displays a very strong inhibitory action to flaming combustion. The products small diameter and fluidity help it to extinguish fire by smothering it. The system has three start-up modes:

Temperature-controlled: When the surrounding temperature rises to a preset value, the fire-extinguishing agent is automatically released.

Electrically controlled: The extinguisher is connected to a fire alarm system, which sends signals to start the extinguishing system.

Super-conductive material-controlled: When a number of devices have to function simultaneously to put out fire, a super-conductive material is used to send the signal to all the devices.

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Website: www.xinhuaelec.en.alibaba.com

## Substitute developed for halocarbons

Indias Defence Research and Development Organization (DRDO) has developed a substitute for the harmful halocarbons (Halons), providing an alternative to using the banned gas in fire-fighting equipment. The Halon substitute, heptafluropropane (HFP), can be used effectively in fire-fighting equipment, said Mr. A.K. Kapoor of DRDO. HFP is not harmful to the ozone layer but it does affect global warming; so, it will only be used till a better substitute comes along, he added. Mechvac Fabricators, Mumbai, is entrusted to manufacture HPF. Currently, only two companies in the United States manufacture HFP.

Website: www.newkerala.com

# SOLVENTS

## Non-ODS cleaners

K-Chem Inc., the United States, offers a series on non-ozone depleting solvent cleaners. Its Fast Solvent Degreaser comes with a special dual-action valve for mist and blast sprays. The fast-drying, non-inflammable, non-conductive product has a dielectric strength of 29,000 V, low odour and leaves no residue. It is used for

cleaning electric motors, power equipment, printing press, conveyors, etc.

The K-Chem 2002 Safety Solvent Degreaser is a non-chlorinated, non-inflammable solvent, which is non-conductive to 24,000 V. The fast-drying solvents low-odour formula leaves no residue. It is compatible with many metals and alloys such as aluminium, brass, carbon steel, stainless steel, copper, titanium, magnesium and zinc. It is safe for use on some plastics, and is ideally used for general-purpose degreasing when chlorinated and inflammable solvents are not recommended. The degreaser is available in aerosol.

K-Chem 2004 Safety Solvent is another fast-drying, non-chlorinated, non-inflammable and non-conductive blend that may be used to clean as well as degrease a wide variety of equipment. The low-odour formulation that leaves no residue can be used on many metals including steel, galvanized steel, brass, copper, magnesium, nickel, zinc, tin and titanium. This general-purpose degreaser is safe on some plastics, and is suitable for applications that do not tolerate chlorinated and inflammable degreasers. The product is supplied in bulk. Kontact Kleaner II is a contact and circuit board cleaner, with high dielectric strength, that quickly removes contaminants such as oil, grease and flux from delicate electronic circuitry. It dissolves residues and safely flushes away particulate matter. Developed for aeronautical, electronics, and communications industries, this non-chlorinated, non-inflammable formulation is harmless on most plastics. It comes in aerosol and bulk.

Contact: K-Chem Inc., P.O. Box 530632 Birmingham, AL 35253-0632, United States of America. Tel: +1 (205) 592 0844; Fax: +1 (205) 592 8106

E-mail: info@k-chem.com

Website: www.k-chem.com

## New water-rinsable solvent

Florida Chemical Company, the United States, offers Citrus Burst8TM solvent suitable for parts washers, degreasers, adhesive removers and industrial cleaners. The water-rinsable formulation has low VOCs and high flash point (>62C). The solvent with a light citrus fragrance is non-carcinogenic, non-toxic and 100 per cent biodegradable. It has no global-warming compounds, ozone depleting chemicals, petroleum ingredients or hazardous air pollutants.

Contact: Florida Chemical Company, 351 Winter Haven Boulevard NE, Winter Haven, FL 33881-9432, United States of America. Tel: +1 (863) 294 8483; Fax: +1 (863) 294 7783

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## Heavy-duty degreaser

Heavy-duty Degreaser C from Micro Care Corporation, the United States, is a powerful general purpose precision metal cleaner and degreaser. Based on Vertrel HFC solvents from DuPont, and enhanced with VersaTrans from PPG, the cleaner has been engineered for high performance cleaning of oils and grease. This

innovative ternary azeotrope offers affordable, high-reliability cleaning without the environmental baggage of other solvent choices.

The powerful and non-inflammable Heavy-duty Degreaser C is suitable for all types of metals, substrates and rugged plastics, particularly for semiconductors, disk drives, gyroscopes, medical devices and any other application in which product reliability and performance are crucial. The product easily removes most oils, light grease, lubricants and coatings based on urethanes and silicones, and is generally sub-optimal on fluxes, inks and paints.

The blend is suitable for use in heated cleaning systems such as vapour degreasers or ultrasonic systems. This HFC solvent is a true drop-in replacement for old-style solvents. Nearly odourless, Heavy-duty Degreaser C has a very low boiling point, low vapour pressure and rapid evaporation. This makes it ideal for difficult cleaning situations where solvent entrapment is a concern. Powerful enough to clean without scrubbing, it is safe for fragile metal components.

Heavy Duty Degreaser C generally will clean glass, ceramics, metals, hard plastics and synthetics. It is safe for cured epoxies, flex laminates, solder masks, metals and metal alloys, but not urethanes, natural rubber, silicones, acrylics or polystyrene for prolonged contact.

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## Polar contaminant cleaner

EnSolv-Ionic, from Enviro Tech International Inc. based in the United States, is an ideal direct replacement in many applications where Freon, TCE, perchloroethylene, 1,1,1-trichloroethane, HCFC-141b and other hazardous solvents are used. It performs as effectively, but without the negative environmental, health and safety issues.

EnSolv-Ionic was developed to not only remove rosin flux, no-clean flux, oil, grease and wax contaminants, but also to remove residual halide salts, ions and other polar contaminants that cause component failures. It is a patented azeotropic mixture that can be distilled and reused several times.

Contact: Enviro Tech International Inc., 2525 West LeMoyne Avenue, Melrose Park, Illinois 60160, United States of America. Tel: +1 (708) 343 6641; Fax: +1 (708) 343 4633

E-mail: sales@ensolv.com

Website: www.ensolv.com

## Cleaner for aircraft alloys

AV-8 cleaner, produced by Spray Nine Corporation, the United States, is a Type IV cleaner designed to clean aircraft alloys with less environmental impact than Type I cleaners. Spray Nine says that AV-8 contains no ozone-depleting substances, hazardous air pollutants, carcinogens, ketones or volatile organic compounds. AV-8s low emulsifying properties promote cleaner wastewater and easier recycling/reclamation. It conforms to United States Air Force technical orders, meets commercial specs and has qualified under Mil Spec: MIL-PRF-87937 Type IV.

Contact: Spray Nine Corporation, 251 N. Comrie Avenue, P.O. Box 290, Johnstown, New York, NY 12095, United States of America. Tel: +1 (518) 762 4591; Fax: +1 (518) 762 2566.

Website: www.aviationtoday.com

# FUMIGANTS

## Muscodor biofumigant as methyl bromide alternative

The experimental biofumigant QRD 300 (common name Muscodor, proposed trade names Andante, Glissade and Arabesque) from AgraQuest Inc., the United States, is composed of the fungus Muscodor albus and the active ingredients it produces. Originally an endophytic fungus isolated from the internal bark of a cinnamon tree, this fungus is a naturally occurring biofumigant that can be used in field and greenhouse vegetable, flower and fruit production as a soil fumigant. M. albus produces a series of natural volatiles that negatively affect plant root pathogens and nematodes, and can be used on field beds as a methyl bromide replacement product.

QRD 300 is non-toxic, environmentally benign, safe for workers, and will have a short re-entry interval. It is very effective on organisms such as Rhizoctonia, Pythium, Phytophthora, Fusarium, Ralstonia and Sclerotinia. Trials are being held to evaluate its efficacy on nematodes species, and activity has been shown on the root knot nematode Meloidogyne incognita, and on sting and lesion nematodes. The product has received EPA Section 3 approval for use, and final stability and formulation studies are under way. In a 2005-06 strawberry trial in Florida, Muscodor applications increased plant growth and yield, and decreased nematode numbers compared with the untreated control.

Website: www.mbao.org

## A niche methyl bromide alternative

Ethyl formate (EtF), a volatile highly inflammable liquid, is a dried fruit fumigant and a rapid acting, GRAS-registered food additive. EtFs advantages include natural occurrence in food, rapid kill of insects (2-4 hours), fast breakdown of residues to natural products and low human toxicity. Mixing it with carbon dioxide enhances EtFs toxicity and eliminates its inflammability. BOC Limited, now part of the multinational Linde Group, dilutes EtF 6 times in liquid carbon dioxide to formulate the non-inflammable VapormateTM.

Vapormate is a post-harvest fumigant that controls insects in stored grains, fresh produce and food processing equipment. It is dispensed as a fog (particle size ~5-10 microns) or vaporized to a gas/vapour mixture to assist uniform distribution and optimize efficacy. Its applications include a niche alternative for methyl bromide to

fumigate fresh produce, grain, dried fruit, nuts, etc. A 50 t silo of grain needs 12 minutes to apply, three hours to fumigate and two hours to air out with no withholding period.

A single dose of 450 g/m3 has been established as sufficient to obtain high-level control (> 99 per cent) of all stages of the flour beetle Tribolium castaneum and the grain borer Rhyzopertha dominica when the grain was held for 24 hours, and moderate control (86 per cent) of the rice weevil Sitophilus oryzae. Vapormate can be dispensed by spraying via a manual handgun, or vaporized as a hot gas and dispensed using aeration fans or mixing devices based on pressure equalization or Venturi principles. As it leaves no residues, Vapormate can be used also to disinfest enclosed food equipment spaces.

Website: www.mbao.org

## Emission control technology destroys methyl bromide

Value Recovery Inc., an environmental technology company from the United States, has demonstrated the destruction of 91 per cent of methyl bromide emissions from fumigation operations using its new breakthrough technology that uses a non-hazardous, water-based scrubbing system. The commercial-scale demonstration involved attaching the scrubbing system directly to a commercial shipping container that had been fumigated with methyl bromide.

The patent-pending technology is an environmental triple play because it reduces volatile organic carbon (VOC) emissions, protects the ozone layer and improves the safety of workers. The company has plans for improvements so that more than 98 per cent of the methyl bromide can be destroyed for both small container and large-scale commodity import fumigations.

Value Recoverys proprietary process chemically destroys methyl bromide by forcing it through a water-based solution that converts the methyl bromide into harmless water-soluble products, which could then be disposed of by licensed waste disposal companies. A blower fan captures the fumigation air stream and pumps it into a scrubber tank. In the tank, the methyl bromide-laden air is converted into a column of fine bubbles, thus destroying the methyl bromide.

Website: www.enewschannels.com

## Sulphuryl fluoride discussed as methyl bromide alternative

Several presenters discussed sulphuryl fluoride as a viable alternative to methyl bromide at the 9th International Working Conference on Stored Pest Protection (IWCSPP) held recently in Sao Paulo, Brazil. Dr. Linda Mason from the Department of Entomology at Purdue University presented ongoing research that compares the effectiveness of sulphuryl fluoride (as ProFume, a fumigant for stored product pest control developed by Dow AgroSciences) and methyl bromide in real world conditions two fumigations with each product in four different flour mills on Indian meal moths and red flour beetles. Current results indicate 100 per cent mortality of larval and adult stages of both species for both fumigants and sanitation issues within facilities were critical to pest rebound, reported Dr. Mason.

Dr. Chris H. Bell from Central Science Laboratory in the United Kingdom examined how sulphuryl fluoride

can be used in different temperatures and exposure times with no negative effects on commodities or equipment. Dr. Bell reported that there was at least a ten-fold difference in the levels of fumigant absorbed by flour at 25C the sorption of methyl bromide on flour was 705 mg/kg at a minimum while that of sulphuryl fluoride was just 75 mg/kg. Sulphuryl fluoride is the nearest like-for-like alternative to methyl bromide, Dr. Bell stated.

Research by Dr. Dirk Maier from the Department of Agricultural and Biological Engineering, Purdue University, aimed at developing flow models for predictions of fumigant distribution and leakage during the fumigation process in a reference flour mill. It found that sealing methods followed during sulphuryl fluoride fumigation do not cause any pressure build up during fumigant introduction and were effective in preventing heat loss during the fumigation period.

Website: www.pctonline.com