THE SCIENCE OF OZONE LAYER

Antarctic ozone update

This update provides information about ozone at Halley, Rothera and Vernadsky/Faraday stations as of 31 March 2008. The ozone hole of 2007 ended at around the time of the summer solstice. The temperature of the ozone layer is now highest over Antarctica and cooler northward. It is too warm for polar stratospheric clouds (PSCs) to exist; however, temperatures are dropping as autumn progresses. Across Antarctica, ozone values are generally around 300 DU. Values are now near the normal autumn minimum.

The circum-polar stratospheric vortex was more disturbed this year than it was last year; however, there were periods of stability also. Some areas of Antarctica saw ozone values down to ozone hole levels (less than 220 DU) in mid-June 2007, hinting the possibility of early chemical depletion, combined with some dynamic processes. In mid-July the minimum temperature of the Antarctic stratosphere at 70 hPa and 50 hPa was close to the normal, although that at 30 hPa was below the normal. Early August saw the largest ozone hole recorded for this time of year, although at the same time very high ozone levels existed over the northern Antarctic Peninsula. The vortex was more circular in mid-September but returned to an elliptical shape and initially warmed slowly. A spring warming took place over the Pacific coast of Antarctica and the Antarctic Peninsula in late October; however, this subsided as the ozone hole became more symmetric again. A second major warming took place towards November-end, which lessened towards early December. (Source: www.antarctica.ac.uk)

Ice yields 2,000 year record of atmospheric methyl bromide

A study undertaken at the University of California Irvine, the United States, has uncovered methyl bromide (CH_3Br) measurements in air bubbles from a South Pole ice core, with gas ages covering the past two millennia. The air was extracted by mechanical shredding of the core under vacuum and the evolved gases were analysed through gas chromatography with high-resolution mass spectrometry and isotope dilution. The samples had estimated mean gas ages ranging from 160 BC to 1860 AD. The mean CH_3Br mixing ratio in the ice core samples was 5.39±0.06 ppt (1s.e., n = 113). The CH_3Br measurements from this core agree with those from a Siple Dome ice core for mean gas ages between 1671 and 1860 AD, where there is overlap between the cores. The data show no linear trend over the 2,000 year period prior to industrialization. Together, Antarctic ice core and firn air measurements demonstrate that the increase in atmospheric CH_3Br during the 20th century exceeds natural variability during the past 2,000 years.

There is evidence of centennial-scale variability in CH_3Br on the order of ±10-20 per cent that may indicate a natural climate sensitivity of the atmospheric levels of this ozone-depleting substance. Analysis of CH_3Br in additional Antarctic ice cores will be needed to substantiate that the centennial-scale variability observed in this core represents a Southern Hemisphere atmospheric history. *Contact: Ms. Margaret Williams, School of Physical Sciences, Department of Earth System Science, Croul Hall, University of California Irvine, California, CA 92697-3100, United States of America.* (Source: www.agu.org)

Stratospheric injections could damage ozone layer

New research by a team led by Dr. Simone Tilmes of the National Centre for Atmospheric Research (NCAR), the United States, reveals that a much discussed concept to offset global warming by injecting sulphate particles into the stratosphere would have a drastic impact on Earth's protective ozone layer. The study portends that such an approach might delay the recovery of the Antarctic ozone hole by decades and cause significant ozone loss over the Arctic.

In recent years, climate scientists have studied geo-engineering proposals to cool the planet and mitigate the severe impacts of global warming. Such plans could be in addition to efforts to reduce greenhouse gas emissions. One of the most discussed ideas, analysed by Nobel laureate Dr.

Paul Crutzen and other researchers, would be to regularly inject large amounts of Sun-blocking sulphate particles into the stratosphere. The goal would be to cool Earth's surface, much as sulphur particles from major volcanic eruptions in the past have resulted in reduced surface temperatures. Sulphates from volcanoes provide a surface on which chlorine gases in the lower stratosphere can become activated and cause chemical reactions that intensify the destruction of ozone molecules, although the sulphates themselves do not directly destroy ozone.

The study concluded that, over the next couple of decades, hypothetical artificial injections of sulphates would likely destroy between about one-fourth and three-fourths of the ozone layer above the Arctic. This would affect a large part of the Northern Hemisphere because of atmospheric circulation patterns. The impacts would likely be somewhat less during the second half of this century because of international agreements that have essentially banned the production of ozone-depleting chemicals. The sulphates would also delay the expected recovery of the ozone hole over the Antarctic by about 30-70 years, or until at least the last decade of this century. (Source: www.sciencedaily.com)

Regional nuclear conflict would create near-global ozone hole

According to a study undertaken by researchers at the University of Colorado-Boulder, the United States, even a limited nuclear weapons exchange between Pakistan and India using their current arsenals could create a near-global ozone hole, triggering human health problems and wreaking environmental havoc for at least a decade. The computer modelling study showed a nuclear war between the two countries involving 50 Hiroshima-sized nuclear devices on each side would cause massive urban fires and loft as much as five million tonnes of soot about 50 miles into the stratosphere. The soot would absorb enough solar radiation to heat surrounding gases, setting in motion a series of chemical reactions that would break down the stratospheric ozone layer protecting Earth from harmful ultraviolet radiation.

Computer simulations reveal that fires ignited in large cities by nuclear explosions would send millions of tonnes of soot into the upper stratosphere, which would be heated by massive smoke injections. The higher temperatures would accelerate catalytic reaction cycles in the stratosphere, particularly the reactions of nitrogen oxide gases, known collectively as NOx, which destroy ozone. In addition to ozone losses of 25-40 per cent at mid-latitudes, the models show a 50-70 per cent ozone loss at northern high latitudes. This magnitude of ozone loss would persist for five years, with substantial losses continuing for at least another five years.

The team used a cluster of computer processors to run three separate 10-year simulations – each more than 300 h long – linking the urban fire nuclear scenario to climatic and atmospheric chemistry processes. The team coupled NCAR's Whole Atmosphere Community Climate Model 3 with the Community Aerosol and Radiation Model for Atmospheres developed by Colorado University-Boulder and NASA Ames. Two studies in 2006, led by Prof. Brian Toon and involving UCLA and Rutgers University, showed that such a small-scale regional nuclear war could produce as many fatalities as all of World War II and disrupt global climate for a decade or more. Of the eight nations known to possess nuclear weapons, even those with the smallest nuclear arsenals, such as India and Pakistan, are believed to have 50 or more Hiroshima-sized weapons. In addition, about 40 countries possess enough plutonium, uranium or a combination of both to construct substantial nuclear arsenals. A nuclear exchange involving one hundred 15 kt, Hiroshima-type weapons is only 0.03 per cent of the total power of the world's nuclear arsenal. (Source: www.sciencedaily.com)

Skies sensitive to variation

Seasonal variation in the stratospheric ozone concentration over Antarctica is large, with the greatest depletions occurring in the austral spring when the Sun returns to Antarctica. The resulting ozone hole, which is often displaced from the pole, cools the stratosphere because less ozone means less absorption of ultraviolet radiation. Although models suggest that the ozone hole also cools the troposphere over Antarctica, simulations are not entirely realistic as ozone concentrations used in models are usually averaged over latitude bands. Observing that ozone concentrations are

more heterogeneous than this, researchers at the United Kingdom's University of East Anglia and University of Reading prescribe a realistic three-dimensional distribution of ozone in a high-vertical resolution atmospheric model and simulate the climate response to this ozone distribution. On comparing the results with simulations containing averaged ozone concentrations, it was revealed that the three-dimensional ozone yields cooler temperatures in the stratosphere and upper troposphere, with a magnitude of cooling comparable to that caused by ozone depletion itself. This result suggests that heterogeneous ozone concentrations influence Southern Hemisphere climate and that this influence will change in the future as the recovery of ozone decreases this heterogeneity. *Contact: Ms. Julia A. Crook, Climate Research Unit, School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom.* (Source: www.eurekalert.org)

Stratospheric ozone chemistry influences atmospheric airflow

Various interactions between the stratospheric ozone chemistry and atmospheric airflow lead to significant changes of airflow patterns from the ground up to the stratosphere – report scientists at the Research Unit Potsdam, Alfred Wegener Institute for Polar and Marine Research. The team investigated this fundamental process for climate interactions in the Arctic, and for the first time, incorporated it into climate models.

Atmospheric airflows follow certain preferred patterns. The most crucial pattern for the Northern Hemisphere is the Arctic Oscillation. It is a spacious oscillation of the atmosphere characterized by opposing anomalies in air pressure in the central Arctic region and in parts of the mid- and sub-tropical latitudes. In the positive phase of the Arctic Oscillation, which has been predominant since 1970, the polar vortex during the winter is stable and the exchange of air masses between the mid- and higher latitudes is limited. In mid-latitudes, strong westerly winds bring warm air from the Atlantic Ocean to North and Central Europe and Siberia during the winter. In the negative phase of the Arctic Oscillation cold polar air could penetrate further south, which leads to harsh winters in Europe. (Source: www.sciencedaily.com)

ODS PHASE-OUT IN INDIA

Chlorofluorocarbons phase-out

Appropriate technologies have been identified and provided to 140 small and medium units for the phase out of CFCs in the foam sector. Technology has been identified and suitable equipment provided to 200 units under the refrigeration manufacturing sector. Small equipment items, such as vacuum charger and leak detectors, have been provided to refrigeration technicians under the Servicing Sector Plan. About 120 technical institutes have benefited from this programme. Efforts to phase out the use of carbon tetrachloride (CTC) in Steel Authority of India (SAIL) plants and two private units are ongoing. Further, a national awareness campaign has been carried out by the Ozone Cell. (Source: www.data.undp.org.in)

National CFC consumption phase-out plan

The National CFC consumption phase-out plan (NCCoPP) currently has a presence in 15 states. It aims to encourage good servicing practices among all RSEs, with a special focus on those firms consuming more than 50 kg/y of CFC. The project is scheduled to end by 31 December 2009. The work plan targets for the year 2006 were achieved. Awareness generation workshops were initiated for small refrigerant filler industry so that more refrigerant fillers can participate in the project to take advantage of the assistance provided under the Montreal Protocol. Equipment support to another 120 ITIs has been procured and processed. (Source: www.ozonecell.com)

Window ACs: Railways first to treat the eyesore

In the capital's Central Vista area, government buildings are set to a get a "cool" look. With an eye on the Commonwealth Games, the Planning Commission wants the buildings in the area around Rajpath to have central air-conditioning so that their outer facades are not deformed by window

air-conditioners (ACs) and coolers. Rail Bhawan, the headquarters of Indian Railways located at Raisina Road, has already begun the process of putting a central air-conditioning system in place, with Voltas executing the work. At present, Rail Bhawan has about 450-500 window ACs installed in the building. "The variable refrigerant flow technology is being used for Rail Bhawan. Instead of the ozone-depleting R-22 refrigerant, we will be employing the R-410a refrigerant, a globally recognized refrigerant that does not contribute to ozone depletion", said an official involved with the project. (Source: www.indianexpress.com)

Dow Europe joint venture with Gujarat Alkalis & Chemicals

The state-owned Gujarat Alkalis and Chemicals Ltd. (GACL) and Dow Europe, a unit of Germany-based Dow Chemical Co., announced the forming of a joint venture for an organics manufacturing plant. The US$140 million chlorinated organics products (chloromethane) plant to be located at Dahej in south Gujarat is being tipped as a special chemical hub by the Gujarat government. The agreement for the construction, operation and ownership of the manufacturing facility for the project was inked in the state capital. The financial closure for the project will be completed by the end of this year and the project will commence operations in 2011.

The plant will manufacture 200,000 t/y of chloromethane and the joint venture will have a 50:50 shareholding partnership. GACL will supply about 600 t/d of chlorine to the joint company. The synergy of GACL and Dow's strengths will lay a strong foundation for mutual future growth, both partners believe. Dow's best-in-class process technology to produce chloromethane will help minimize production of hazardous carbon tetrachloride. The joint venture company will primarily cater to the demand of SAARC nations. According to the state minister for energy and petrochemicals Mr. Saurab Patel, "The new investment through this joint venture will give a push to downstream users in the pharmaceuticals, paints and grease removal, refrigerant and solvent sector by making raw materials available at more competitive rates and bringing valuable forex to the country." (Source: www.indiaprwire.com)

IN THE NEWS

Multilateral Fund helps accelerate phase out of HCFCs

The Executive Committee of the Multilateral Fund agreed at its 54th meeting to immediately begin the preparation of plans that will assist developing nations eliminate their production and consumption of HCFCs. This decision was taken less than seven months following the historic agreement in September 2007 to accelerate the phase-out of HCFCs, chemicals that not only damage the ozone layer but also contribute to global warming. The production and use of HCFCs in developing countries – particularly in air-conditioning, the refrigeration sector and foam industries – have grown significantly over the past five years, and without early action this growth is expected to continue. The September 2007 adjustments to the Montreal Protocol oblige countries to take action as soon as possible to freeze their HCFC production and consumption levels in 2013, and decrease by 10 per cent their production and consumption of HCFCs by 2015.

The Executive Committee approved guidelines that will assist each country to prepare an HCFC phase-out management plan (HPMP) mapping out a detailed plan of action to eliminate their use of HCFCs. The guidelines not only take account of the ozone-depleting potential of HCFCs but also the global warming implications of alternative substances and technologies. Seed funding of about US$1 million for the preparation of HPMPs was approved to enable the Multilateral Fund's implementing agencies to start work immediately. In addition, the Executive Committee requested that data on each country's HCFC prices be included in their annual reports to the Executive Committee so that it can be incorporated into the Committee's planning process. In future, the Executive Committee will take account of all ozone-depleting substances to be addressed in its three-year phase-out plan. *Contact: Ms. Julia Anne Dearing, Information Management Officer, Secretariat of the Multilateral Fund, McGill College, 27th Floor, Montreal QC, H3A 3J6, Canada. Fax: +1 (514) 2820 068; E-mail: secretariat@unmfs.org.* (Source: www.multilateralfund.org)

Natural alternatives to HCFCs explored

Carbon dioxide-based refrigeration and heating applications feature as strong candidates to replace HCFCs worldwide and reduce ozone and climate impacts altogether. This outlook emerged at an expert meeting organized by the European Commission in Canada. Next to minimizing ozone depletion, alternatives were evaluated for their global warming impact. Several applications based on carbon dioxide and other natural refrigerants attracted high interest from experts of private and public institutions. This meeting, according to the European Commission, is the first in a series of events which will serve to evaluate thoroughly different alternatives and help countries decide the best alternative according to their specific situation. Some of the options are: R-744: from refrigeration to heat pumps; hydrocarbons; and ammonia. (Source: www.r744.com)

Beating the clock: Early phase out of ODS

Asia-Pacific countries are way ahead in meeting their commitments to end both production and consumption of chemicals that harm the Earth's protective ozone layer, years ahead of internationally agreed deadlines. At least five countries – Sri Lanka, Maldives, China, Indonesia and Fiji – have phased out CFCs nearly two years ahead of the 2010 deadline. Sri Lanka and Maldives recently joined China, Indonesia and Fiji in announcing early phase out of CFCs in their countries. Last year, China shut down five of its six remaining CFC plants, while Indonesia imposed a ban on the import of CFCs into the country in January 2008. Fiji phased out its CFC use as early as 2000. In addition, 14 nations in the region have phased out CTCs and 13 countries have phased out halons ahead of the 2010 schedule.

Asian countries are also moving ahead in early phase-out of other ozone depletion substances like methyl chloroform and methyl bromide, due for phase-out in 2015. Afghanistan, Bhutan, Brunei, the Democratic People's Republic of Korea, Fiji, India, Indonesia, Lao PDR, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Singapore, Thailand and Viet Nam have already ceased production and consumption of methyl chloroform, while Afghanistan, Bangladesh, Brunei, Bhutan, Cambodia, India, the Democratic People's Republic of Korea, Lao PDR, Maldives, Mongolia, Myanmar, Nepal, Pakistan and the Republic of Korea have phased out methyl bromide, used for soil and post-harvest fumigation. *Contact: Ms. Satwant Kaur, UNEP Regional Office for Asia and the Pacific, Thailand. E-mail: kaur@un.org.* (Source: www.unep.fr)

Illegal trade in ODS rises in the Asia-Pacific region

According to a new study released by the United Nations Environment Programme (UNEP), illegal transboundary trade in ozone-depleting chemicals has increased dramatically in the Asia-Pacific region. The scourge of illegal ODS has developed into one of the major obstacles in achieving their "timely and efficient phase-out", the report states noting that the Earth's ozone layer remains "fragile and under threat". According to Mr. Ludgarde Coppens, policy and enforcement officer for the UNEP-DTIE, there are discrepancies between what is being legally exported into a particular country and the actual legal import figures of the country. "The figures just do not match", says Mr. Coppens. "A good 55 per cent of these goods are unaccounted for."

An analysis of CFC exports and imports between key importing countries – Thailand, Malaysia, the Philippines, Indonesia, Viet Nam and Iran – and major exporting countries, such as China, India and Singapore, in 2004 found more than 4,000 t

Filler

of CFCs unaccounted for in the importing nations. Nearly 51 per cent of legal exports from China and 47 per cent of legal exports from India into Thailand, Indonesia, the Philippines, Malaysia, Viet Nam and Iran are not found in the import statistics of the importing countries, the study said. The study was released prior to UNEP's Business for the Environment Global Summit. It said the main routes used by smugglers are India/China-Viet Nam-Laos/Cambodia-Thailand, Nepal-India, Bangladesh-India, China-Philippines, China-Malaysia, China-Indonesia, Singapore-Malaysia and Malaysia-Thailand. The key reasons cited for illegal trade include the high costs of substitutes, the long lifespan of equipment using CFCs, the high demand for CFCs in the servicing sector and the "often paltry penalties for smuggling these illegal substances." The report cited Malaysia, the Philippines and Indonesia for taking action to decrease suspicious shipments and review the licensing system. (Source: www.earthtimes.org)

Switching over to ozone-friendly inhalers

Industry and government representatives from around the globe have penned their commitment to work together towards a smooth transition to ozone-friendly metered-dose inhalers under the "Langkawi Declaration on Public-Private Partnership on Phasing Out CFC Metered Dose Inhaler". Metered-dose inhalers are commonly used in the treatment of millions of chronic respiratory and asthma patients in the region. These inhalers use CFCs. Under the Montreal Protocol, developing countries would have to cease production and consumption of CFCs and other ozone-depleting chemicals by 2010. Asia-Pacific accounts for 60 per cent of CFCs used in metered-dose inhaler production. More than 80 participants from 24 nations, health, industry and patient groups took part in the Regional Workshop on Phasing-out CFC-based Metered Dose Inhaler for South Asia. The workshop was organized by the United Nations Environment Programme to assist countries in the Asia-Pacific to develop their MDI transition strategy. *Contact: Ms. Satwant Kaur, Regional Information Officer, UNEP Regional Office for Asia and the Pacific, Bangkok, Thailand. Tel: +66 (2) 2882 127; E-mail: kaur@un.org.* (UNEP ROAP News Release 08/2)

REFRIGERATION/ AIR-CONDITIONING

Environmentally sound and energy-efficient solution

A business unit of United Technologies Corp., Carrier Corp., is offering its 3,000 refrigeration tonne (RT) Evergreen® 19XRD dual-compressor centrifugal chiller that represents cutting-edge heating, ventilation and air-conditioning (HVAC) industry technology. This is Carrier's largest single-unit cooling capacity chiller employing non-ozone-depleting refrigerant HFC-134a to be manufactured in Shanghai, China. Carrier's Global Research and Development Centre in Shanghai developed and engineered the new chiller for large airports, shopping malls, commercial complexes, factories and district cooling plants. Carrier will manufacture the Evergreen 19XRD in China for both the local and global market.

The chiller contains Carrier-patented technology that is designed to improve indoor air quality and provide environmental benefits. It has obtained certification as an energy-saving product from China Standard Certification Centre. The dual-compressor and large cooling capacity chiller achieves up to 7 per cent improvement in integrated part-load efficiency. In a large commercial building that requires 12,000 RT cooling capacity and operates 180 days per year, the chiller can reduce annual electricity usage by approximately 400,000 kWh, the total electricity consumption of 222 Shanghai families. (Source: www.webwire.com)

Low-carbon emission refrigerant

In the United States, a Kaneohe auto mechanic may be on the verge of gaining Environmental Protection Agency approval for a new refrigerant that can help reduce carbon emissions. According to Mr. Richard Maruya, his HCR188c hydrocarbon blend is designed to replace current refrigerants in air-conditioners, refrigerators and freezers. The EPA has not approved Mr. Maruya's creation yet, but the agency's regional office last week honoured him with a 2008 Environmental Award. (Source: www.kpua.net)

Industrial low-energy chillers

Coolmation, an exclusive distributor for the Rhoss range of chillers in the United Kingdom, has launched the new Micro Powercool series of industrial low-energy air-cooled chillers with a three-year warranty. Developed specifically for industrial and process cooling applications, the Micro Powercool series is available in cooling capacities from 15 kW to 70 kW. A breakthrough in low energy, environmentally friendly cooling, Micro Powercool chillers are designed by Rhoss to provide the best energy efficiency ratio (EER) performance in their range. They come with a three-year warranty.

In addition, Micro Powercool is the first industrial chiller to use the green energy-efficient refrigerant R-410a with scroll compressors. Comprising nine chillers, the Rhoss Micro Powercool series is Eurovent-approved and designed to run on the efficient, ozone-safe R-410a refrigerant charge. The three largest units of this unique breed of chillers have two scroll compressors of different capacity installed in the same refrigerant circuit to provide three cooling capacity steps and further increase the chiller efficiency. Coupled with R-410a, one of the new refrigerants developed to replace R-22 now rapidly being phased out, this new range operates at a significantly higher energy efficiency ratio than previous chillers. Micro Powercool chillers, featuring a unique patented control system called Adaptive Function Plus, offer energy efficient compressor operation and highly precise temperature stability. *Contact: Coolmation, Unit 7, Millstream Industrial Estate, Ringwood, BH24 3SD, United Kingdom. Tel: +44 (1425) 478 971.* (Source: www.processingtalk.com)

Hydrocarbon refrigerant

Researchers at the University de Oriente-Santiago, Cuba, developed LB-12 more than a decade ago. LB-12 – a refrigerant gas comprising the hydrocarbons propane, isobutane and n-butane – does not affect ozone and can be used to substitute CFCs, particularly CFC-12 (CCl_2F_2). Using LB-12 as a refrigerant is more energy-efficient than using CFCs. A refinery in Santiago de Cuba has been producing small amounts of the hydrocarbon mixture since 1994. Cuba converted about 500,000 refrigerators from using CFC-12 to LB-12.

A Canadian firm, Refrigerant Services Inc. (RSI), has now developed and patented a separation technology capable of producing high-purity LB-12. RSI's patented fractional distillation, multi-pass batch process is capable of separating the LB-12 mixture to purity levels exceeding 99.5 per cent and demonstrates Canadian expertise in an application of hydrocarbon distillation. The project also demonstrates that developing countries can phase out the production and consumption of ozone-depleting substances as stipulated in the Montreal Protocol and reduce GHG emissions through gains in energy efficiency. *Contact: Mr. Jim Thomas, Refrigerant Services Inc., 105 Akerley Blvd., Unit D, Dartmouth, Nova Scotia B3B 1R7, Canada. Tel: +1 (902) 4684 997; Fax: +1 (902) 4685 102; E-mail: jthomas@rscool.com/ info@rscool.com; Website: www.rscool.com.* (Source: www.team.gc.ca)

CO_2 bus air-conditioning

Konvenkta, a leading German manufacturer of integrated thermal systems for commercial vehicles has added a bus air-conditioning unit to its R744 products. Winner of last year's prestigious German Environmental Award, Konvekta was the world's first to successfully install R-744 vehicle air-conditioning. Some of the salient features of Konvekta's CO_2 bus air-conditioning are cooling capacity of 28,400 kcal/h, evaporator air capacity of 6.480m^3/h and current consumption at 104 A at 26 V. The unit measures (length/width/height) 2,680/2,100/220 mm. (Source: www.r744.com)

Bock adds subcritical CO_2 compressor range

The German manufacturer Bock has added to its products range four compressor models for CO_2 cascade refrigeration systems. The company's robust, semi-hermetic models offer lower energy consumption in commercial and industrial refrigeration applications. The piston compressor range that Bock has developed, based on its current semi-hermetic product range and building on extensive experience in the transport sector, fits all CO_2 (R-744) applications of up to 40 bar in supermarket and industrial refrigeration. Bock's new compressors permit the greatest possible level of operational safety and an economic spare part

storage through adjustments to the existing technology and an extensive use of tried-and-trusted standard parts. Their solid construction with low-friction sleeve bearings, aluminium piston with two ring assembly and high-resistance piston bolt bearings ensure a wear-resistant, durable driving gear, which leads to substantial life cycle cost reductions. Also, a valve plate construction using impact-resistant spring steel parts, tested thoroughly all over the world, enables safe operation of the compressors. (Source: www.r744.com)

Tetrafluoropropene production processes

E.I. Du Pont de Nemours & Co., the United States, has patented a process for producing 2,3,3,3-tetrafluoropropene and 1,3,3,3-tetrafluoropropene. The process involves pyrolysing 1,1,1,2,3-pentafluoropropane. The invention pertains to the production of tetrafluoropropenes: more specifically to the production of 2,3,3,3-tetrafluoropropene (HFC-1234yf) and of 1,3,3,3-tetrafluoropropene (HFC-1234ze) from 1,1,1,2,3-pentafluoropropane (HFC-245eb).

Both HFC-1234yf and HFC-1234ze, having zero ozone depletion and low global warming potential, have been classified as potential refrigerants. Another United States patent discloses the separate production of HFC-1234ze (mixture of E- and Z-isomers) by a catalytic vapour-phase dehydrofluorination of $CF_3CH_2CHF_2$ and of HFC-1234yf by a catalytic vapour-phase dehydrofluorination of $CF_3CF_2CH_3$.

The pyrolysis of HFC-245eb to HFC-1234yf and HFC-1234ze and HF is carried out without any catalyst, in a substantially empty reactor. Through proper selection of operating conditions, such as temperature and chemicals contact time, the process may be operated to produce predominantly mixtures of HFC-1234yf and HFC-1234ze from HFC-245eb. The reaction is preferably conducted at sub-atmospheric or atmospheric total pressure. The reaction can be beneficially run under reduced total pressure (i.e., total pressure less than one atmosphere). However, near atmospheric total pressure is preferred. *Contact: E.I. Du Pont de Nemours & Co., 1007 Market Street, Wilmington, Delaware 19898, United States of America.* (Source: www.freepatentsonline.com)

SOLVENTS

Safest solvent

EnviroTech International manufactures EnSolv precision cleaning solvent, which is a patented, stabilized n-propyl bromide (nPB) based vapour degreasing solvent. The company has extended the series of *in vitro* human bioassay tests, which compared EnSolv solvent with commonly used chlorinated solvents, to include other recently introduced halogenated vapour degreasing solvents based on fluorine chemistry. These tests are part of the ongoing product stewardship programme for EnSolv sponsored by EnviroTech International.

In a new report, the authors detail the results of the *in vitro* human cell bioassay studies using techniques developed by Enviromed Laboratories along with Dr. Khosrow Adeli of the University of Toronto Hospital for Sick Children. It assesses the results and produces a comparative rating for the solvents according to their toxicity for human cells. EnviroTech said that this unique study is a must for people assessing safety when vapour degreasing. As the study details, this is a far more reflective guide than animal testing, which is now being discouraged by the European Union. *Contact: EnviroTech Europe, Bermuda House, 45 High Street, Hampton Wick, Kingston upon Thames, Surrey KT1 4EH, United Kingdom. Tel: +44 (208) 2816 370; Website: www.ensolv-europe.com.* (Source: www.manufacturingtalk.com)

Plastic-safe HFE/HCFC base precision cleaner

PF™ precision cleaner from CRC Industries Inc., the United States, is an innovative contact cleaner blend of hydrofluoroether (HFE) and HCFC-141b that performs similarly to the CFC-113 contact cleaners. The precision cleaner's unique blend offers strong cleaning action, fast evaporation and no residue. It has no flash or fire points and is safe to use on plastics. The cleaner contains no Class I ozone-depleting chemicals. It is recommended for precision cleaning of contacts, printed circuit boards, switches, telephones, motors, relays, PCs, generators, edge connectors, tape heads, buss bars and circuit breakers. It is excellent for

use around plastics and insulators. *Contact: CRC Industries Inc., 885 Louis Drive, Warminster, PA 18974-2869, United States of America. Tel: +1 (215) 674 4300; Tel: +1 (215) 674 2196; E-mail: crcwebmaster@crcindustries.com.* (Source: www.orders.summit.com)

Secret to long stencil life

Q-Tek Inc., the United States, offers stencil cleaning products that offer tough but safe cleaning. Q-Tek Stencil Clean has been specifically developed to quickly eradicate solder paste, inks, flux and other stencil print materials for industrial purposes. Q-Tek Stencil Clean is designed to be suitable for use in both vacuum and conventional under-stencil cleaning mechanisms as well as in pre-saturated wipe form. It is also compatible with reservoir and autofeed solvent dispensing systems. The cleaner is environmentally benign, as it does not contain ozone-depleting substances, and is RoHS and WEEE compliant. It is a non-corrosive and non-inflammable aliphatic hydrocarbon, safe for use on stencils, frames, boards and the printer itself. *Contact: Q-Tek Inc., 1309, Main Street, Crescent, PA 15046, United States of America. Tel: +1 (724) 457 6193; Fax: +1 (724) 457 1200.* (Source: www.news.thomasnet.com)

Advanced ultrasonics cleaning

Guyson International, the United Kingdom, offers its all-new flexible Kerry ultrasonic Primewave generator. Guyson has incorporated numerous productivity and performance improvements that will be available on all larger Guyson Kerry Ultrasonic systems with integrated generators as well as in a host of OEM products, including generator and submersible transducer sets, suitable for retrofit into pre- and post-cleaning tanks or for incorporation into new process lines. Primewave generator has two boards, which produce up to 1,000 W when running at full power. They will deliver a real 1,000 W output and not simply a nominal peak figure. For larger ultrasonic tank systems, this equates to fewer generators being required and real savings to be made.

The new Kerry generator can operate in a variety of ultrasonic applications, in aqueous, solvent or viscous liquids. It can also be customized by the operator for producing the quality of ultrasonic activity required, as dictated by the component complexity or by the substrate. The Primewave generator can precisely control the ramp-up of power delivery to provide a surge of power to jump-start cavitation in viscous liquids. It can also feed in power incrementally to obviate damage to delicate items such as electronic circuits. The new Primewave generator is proven to deliver a very robust cavitation, which is where millions of miniscule cleaning bubbles are generated by the alternating pressure waves created in the wash solution. These waves create cavitational bubbles that grow and implode when at an optimum size, producing an extremely high-energy scrubbing action that imparts the cleaning.

Primewave can also be used to power the two separate stages of a two-stage cleaning machine, e.g. Kerry Microsolve, at different frequencies. *Contact: Guyson International, Snaygill Industrial Estate, Keighley Road, Skipton, North Yorkshire BD23 2QR, United Kingdom. Tel: +44 (1756) 799 911.* (Source: www.manufacturingtalk.com)

Polyurethane cleaner has lower VOC emissions

In the United Kingdom, a prominent manufacturer of offshore buoyancy products approached Mykal Industries to help it eliminate hazardous solvents from its production processes and reduce VOC emissions. The main area of concern was the use of methylene chloride for the flushing of polyurethane (PU) mixing heads and the cleaning of mixing vessels. Mykal trialled its PU cleaner (SB6) as this could be used with minimal change to the current procedures. The first trial was carried out on the PU mixing vessels. The Mykal PU cleaner was poured into the vessels and cleaning carried out using brushes, to remove any PU deposits. The main advantage of the PU cleaner in this application is that the lower volatility of the product allows for a longer contact time to clean the vessel. This means that less product is used and it can also can be reused after it is allowed to stand and is then collected.

The second trial was carried out on the PU mixing heads that deliver the PU directly into the moulds. The PU cleaner was used in the same way as methylene chloride by charging the pressurized container and flushing the mixing head after each

discharge or when necessary. The flushed mixture of PU and PU cleaner could then be collected in a container and allowed to stand for 24-48 h. Once the PU cleaner has separated from the PU, it can be removed and recycled for repeated use. *Contact: Ms. Morris Close, Mykal Industries, Park Farm Industrial Estate, Wellingborough, Northants NN8 6XF, United Kingdom. Tel: +44 (1933) 402 822.* (Source: www.manufacturingtalk.com)

Perfluorinated cleaning solvent

SPI Supplies, the United States, offers a cleaning solvent – PFS-2 – for perfluorinated polyether fluids and greases. The odourless, clear and CFC-free, liquid has a boiling point of 57°C, a vapour pressure of 228 mg Hg (at 25°C), specific gravity of 1.070 and water solubility of 14 ppm (wt). It is a low molecular weight perfluoropolyether solvent and diluent that can be used as a replacement for CFC-113 and other ozone depleting solvents.

Safe, inert and non-toxic, PFS-2 is not classified as a VOC by the United States Environmental Protection Agency (EPA). It needs few safeguard precautions or use-restrictions and is completely compatible with all metals, rubbers and commercially available elastomers and plastics. PFS-2 was formulated to be fully miscible with perfluoropolyether oils and greases and perfluorocarbon fluids such as those often used in the semiconductor and electronic manufacturing operations. PFS-2 is also fully miscible with chlorotrifluoroethylene oils above 45°C.

Whether used alone or in conjunction with other solvents, PFS-2 performs well in many electronic and semiconductor cleaning functions, such as pump cleaning, degreasing, dewatering, vapour blanketing, reducing flash point, eliminating trace residue and other niche cleaning applications. It well suited for cleaning operations where solvent is applied to hot components, heated prior to application, pressure-sprayed onto components or used in forced air stream cleaning. PFS-2 also performs many diluent functions for specialized product applications. Compared with CFC-113, PFS-2 solvent requires slightly more time but is equally efficient. PFS-2 is also used to improve the flashpoint of organic solvents and as a vapour blanket to lower both solvent losses and the fire hazard.

PFS-2 is preferable in those cleaning operations where CFC-113's high evaporation rate make its use too costly or impractical. Comparative tests showed that PFS-2 solvent's evaporative loss is up to 70 per cent less. In almost every cleaning procedure tests, PFS-2 solvent was found easier to use. *Contact: SPI Supplies, PO Box 656, West Chester, PA 19380, United States of America. Tel: +1 (610) 436 5400; Fax: +1 (610) 436 5755; E-mail: spi3spi@2spi.com.* (Source: www.2spi.com)

Component cleaning systems

Aqueous-based component cleaning technology from MecWash Systems, the United Kingdom, is now meeting the extremely high-performance standards laid down by one of the world's leading manufacturers of measurement equipment. Four MecWash Midi cleaning stations are now being used at Renishaw and are achieving results that even satisfy Time-of-flight Secondary Ion Mass Spectrometry (Tof SIMS) analysis – a highly demanding surface analysis process undertaken at Bristol University.

The 330,000 components per month produced at Renishaw's Stonehouse and Wotton-under-Edge facilities in the United Kingdom are achieving the stipulated high levels of cleanliness. Renishaw supplies products for a range of applications in industries as diverse as forensics, calibration, medical, aerospace and automotive. Each of the four MecWash Midi systems is comprehensively specified. The sites benefit from a built-in Aqua-Save wash water treatment system that cleans and recycles the wash and rinse solutions. As such, the wash installations do not require a connection to drains, thereby allowing them to be sited where required within the production lines.

The technology ensures that material such as metal swarf, coolant and auto de-burring residue is removed from each component ahead of further assembly operations that take place at Renishaw's plants. The systems also provide a clean, bright, residue-free surface finish without spots and stains, which is paramount to the highly aesthetic appearance of the final product. *Contact: MecWash Systems, 64, Hundred Severn Drive, Tewkesbury Business Park, Tewkesbury, Gloucestershire GL20 8SF, United Kingdom. Tel: +44 (1684) 271 600.* (Source: www.manufacturingtalk.com)

FOAMS

Process for forming polyisocyantate-based foam

Intercool Energy Corporation, the United States, has patented a blowing agent for use in preparing a polyisocyanate-based foam that comprises HCFC-123, HCFC-141b and hexane and/or octane. The invention constitutes a process for preparing a polyisocyanate-based foam that has lower inflammability and superior cell structure without the use of CFCs by reacting a polyisocyanate with an isocyanate-reactive material, using a CFC-free blowing agent. The blowing agent consists of a mixture having a major portion of HCFC-123, a minor portion of HCFC-141b, and about 1-30 mole per cent of a hydrocarbon selected from the group consisting of hexane and octane and their isomers. In general, the per cent of hydrocarbon used is less than 30 mole per cent, e.g. 20 per cent or, more preferably, 10 per cent.

With respect to the quantities of HCFC-123 used, another broad expression of the invention is that this compound is used in approximately 90-15 mole per cent and the HCFC-141b in about 75-5 mole per cent. More specifically, the HCFC-123 is present in about 90-65 per cent and the HCFC-141b in about 25-5 mole per cent. The percentages of these two ingredients can vary. Most preferably, the HCFC-123 is present in about 75 per cent and the HCFC-141b in about 15 mole per cent, in which instance the hydrocarbon, which preferably is n-hexane, is present in about 10 mole per cent. (Source: www.freepatentsonline.com)

Patented water-blown foam technology

Source of Supply Packaging Systems, the United States, has announced an environmentally friendly alternative to existing spray foams that use HFC or cyclopentane blowing agents. SOS-5070 is a patented non-ozone-depleting spray foam that may be used wherever a typical spray system has been used. Many users have found that the water blown technology is not as hazardous as inflammable cyclopentane blown foams. It also has a much wider window for usage, handling and storage than the HFC-245fa blown foams. There have been reports of HFC-245fa boiling off in the drums during transportation and problems during application.

SOS-5070 water blown foam does not contain CFC, HCFC or HFC-245fa. It is fire-rated using ASTM E-84, ANSI 2.5, NFPA 255 and UL 723 with a flame spread of 20 and smoke developed index of 425. K factor results are excellent. Applications for this foam system include commercial roofing, cavity wall insulation, stage scenery, refrigerated trucks and trailers, spa and hot tub insulation, walk-in freezers, tank and pipe insulation, and wherever lightweight thermal insulation is needed. *Contact: Mr. Brian DeRosso, Source of Supply Packaging Systems, United States of America. Tel: +1 (914) 4500 358; E-mail: bpderosso@msn.com.* (Source: www.sprayfoam.com)

Fluid composition

Ineos Fluor Holdings Limited, the United Kingdom, has reported a new invention that relates to fluid compositions containing a fluoropropene, such as pentafluoropropene or tetrafluoropropene, and other fluorinated hydrocarbons. The compositions may be of use as foam blowing agents for thermoplastic or thermoset insulation foams, as well as refrigerant compositions with the potential to replace refrigerant compositions having a higher level of global warming potential (GWP). In one aspect of the invention a fluid composition consisting of a fluoropropene and a hydrofluorocarbon, having a formula $CF_3(CHa)_nCF_2H$ wherein n = 1 or 2, is provided. Compositions of this type would be particularly suitable as foam blowing agents for either thermosetting or thermoplastic insulation foams, and also as a refrigerant.

Another embodiment of the invention provides a fluid composition comprising a fluoropropene, which is pentafluoropropene or tetrafluoropropene or mixtures thereof, and a pentafluoropropane or a pentafluorobutane or their mixtures. Compositions according to the invention might provide superior blowing agents for use in foam blowing. The addition of fluoropropene to these compositions increases the vapour pressure of the composition when it is employed as a blowing agent at relatively low temperatures. This ensures that an adequate vapour pressure of insulating

gas is maintained in the cells in the subsequently blown foam. This increased vapour pressure acts to decrease the likelihood of foam cell collapse, under partial vacuum, and to retain a relatively high foam insulation performance, as reflected in a higher foam insulation factor, called the R-value. *Contact: Ineos Fluor Holdings Ltd., P.O. Box 13, The Heath, Runcorn, Cheshire WA7 4QF, United Kingdom.* (Source: www.wipo.int)

New technology for foam insulating systems

Owens Corning, the United States-based world leader in building materials systems and glass fibre reinforcements, reports to have developed blowing agent technology that would allow it to manufacture its complete line of foam insulating systems in North America with more than a 70 per cent reduction in greenhouse gas emissions and zero ozone depletion. Owens Corning PINK Foamular® and Propink® rigid foam insulating systems save energy and reduce greenhouse gas emissions by providing a durable exterior sheathing that is resistant to damage. The sheathing provides an insulating value of R5 per inch and is moisture resistant. Owens Corning foam insulation products are used in above and below grade applications in the residential, commercial and industrial markets. (Source: www.money.cnn.com)

Process for making rigid polyurethane foams

Huntsman International LLC, the United States, reports an invention related to rigid polyurethane or urethane-modified polyisocyanurate foams and to processes for their preparation. It is an object of the present invention to provide a process for manufacturing rigid polyurethane foams based on polyester polyols showing a low lambda value, especially at 10°C and also that can make use of notably cyclopentane.

According to the present invention, a process for making rigid polyurethane or urethane-modified polyisocyanurate foams is provided by reacting an organic polyisocyanate composition with an isocyanate-reactive composition in the presence of a hydrocarbon as a blowing agent, characterized in that the isocyanate-reactive composition has between 3 and 30 wt% of polyester polyols derived from side-streams, waste or scrap residues from the manufacture of DMT and/or PET and between 20 and 50 wt% of polyether polyols obtained from reacting propylen oxide with aromatic amine initiators containing at least two active hydrogen atoms per molecule the amounts being calculated on the basis of total isocyanate-reactive compound. *Contact: Huntsman International LLC, 500, Huntsman Way, Salt Lake City, Utah 84108, United States of America.* (Source: www.freepatentsonline.com)

Thermal insulation foam for high-temperature water storage

Honeywell International Inc., the United States, is offering a new solar water heater system that incorporates the following: a sealed storage tank, a reflective surface and a vacuum tube. The reflective surface is capable of reflecting sunlight. The vacuum tube extends along the reflecting surface between the reflecting surface and the Sun. The vacuum tube is in communication with the tank.

The sealed storage tank is adapted to hold water. The outer surface of the tank is covered by a thermal insulating layer of a closed-cell polyurethane or polyisocyanurate foam having a blowing agent therein having about 60 weight percentage or more of the hydrocarbon 1,1,1,3,3-pentafluoropropane. *Contact: Honeywell International Inc., 101, Columbia Rd., Morristown, NJ 07962 2245, United States of America.* (Source: www.freepatentsonline.com)

Filler

HALONS

HF generation and decay

Defence Science and Technology Organization, Australia, has investigated the effects of water spray cooling in conjunction with halogenated extinguishants on hydrogen fluoride (HF) generation and decay. The halogenated extinguishants halon-1301, HFC-227ea (FM200) and NAF-S-III are still used within Royal Australian Navy vessels for total flooding fire suppression applications. HF is readily produced when these extinguishants are subjected to elevated temperatures and is highly toxic in small concentrations. In the open literature, water spray used in conjunction with halogenated extinguishants has been reported to reduce peak HF production during extinguishment, as well as raising the HF decay rate. These data are summarized as a function of compartment sizes, type of extinguishant, spray initiation time prior to the extinguishant release, spray duration and the rate of spray application. However, the use of water spray in conjunction with halogenated extinguishants still resulted in HF levels above the Occupational Health and Safety workplace maximums and exceeded the Immediate Danger to Life and Health level. (Source: www.stormingmedia.us)

"Green" aircraft fire suppression system

In the United States, Life Mist Technologies Inc. has entered into a Product Development and Licence Agreement with Pacific Scientific HTL/ Kin-Tech Division to develop a fire suppression system for use in aircraft. Life Mist owns acoustic water mist/nitrogen technology ideally suited to replace existing aircraft fire suppression systems that use ozone depleting and global warming agents such as halon. Life Mist's water mist technology represents a safe and effective replacement.

Under the terms of the agreement, Pacific Scientific will co-develop aviation fire suppression systems with Life Mist and has an option to license the water mist technology for use in aircraft. The Life Mist nozzle creates extremely fine droplets of water mist by channelling water through acoustic shock waves created by ultrasonic flows of gas, usually compressed air or nitrogen, at very low pressure. The mist product and resulting vapour are extremely effective at extracting heat from a fire and also depriving it of oxygen. This combined action extinguishes flames with minimal amounts of water. *Contact: Mr. William D. Chamblin III, CEO, Life Mist Technologies Inc., United States of America. Tel: +1 (610) 6440 419; Or Mr. Floyd Fredrickson, VP, Business Development, Pacific Scientific HTL/Kin-Tech Division, United States of America. Tel: +1 (626) 4341 193.* (Source: www.businesswire.com)

Water mist technique replaces halon systems

High-pressure water mist systems being used to safeguard platforms in the Far East and North Sea against fire damage is a technique developed by Fogtec, Germany. This process involves dousing a wide area with minimal amounts of water by means of special nozzles. The systems use pure water, which is atomized at 100 bar into 0.01 mm diameter droplets. A reaction surface area of 200 m^2 can be reached using 1 litre of water. That compares with the 2 m^2 that is typically achieved by sprinkler systems with 1 mm droplets. This larger reaction surface in turn aids absorption of the fire's combustion energy. In addition, the much lower volumes of water employed, together with the faster evaporation rate of the mist generated, lessen the potential for secondary structural damage.

Once the mist droplets have diffused across the reaction surface, their subsequent absorption of the fire's energy leads to an immediate drop in temperature of the ambient air or gases. This in turn protects equipment in the vicinity from radiant heat. Swift conversion of the droplets into steam leads to further energy absorption. Vaporization increases the water volume more than 1,600 times. Air/oxygen in the area is displaced, thereby suppressing the flames, but the oxygen concentration away from the fire is left virtually undisturbed. This lessens the risk to people present. Gas extinguishing systems cannot achieve the same effect. Low oxygen content makes Fogtec work faster. The mist droplets also trap or dissolve flue gas particles, lessening the resultant flue gas damage. (Source: www.offshore-mag.com)

FUMIGANTS

New method of controlling pests developed

Shivat Limited, the United Kingdom, presents an invention that relates to pest control compositions and a method of employing, as essential active ingredients, the formic acid derivatives that may be represented by the formula "R-OCHO", where R- is C_1 H, N, O, derivatives and can be an alkyl such as propyl, butyl, propargyl (CH = CH-CH_2-OCHO), sllyl (CH_2 = CH_2-CH_2-OCHO), aryl, substituted aryl, acetylene, polyhydric compounds such as glycerol, polyethylene glycols, amidines and the like.

Pest control can be achieved by various means such as by direct use or by mixing active ingredient with solid, liquid, conditioning agents or gaseous carrier for fumigation or spray for application to soil, stored food grains, containers, general fumigations and the like as a substitute for methyl bromide. Solid compositions can be pellets, prills or tablets made from natural clay, diatomaceous earth, alumina, silica, coconut shell and other such conventionally employed carriers in preparing pest control composition of solid form. Liquid compositions employing active ingredients are prepared in the usual way by mixing the active ingredient with conventional liquid diluents media or through mixing two or more different compositions to give a controlled composition of synergistic and sustained effect.

The active ingredients are freely miscible with common organic solvents such as acetone, furfural, hexane, ethanol, isobutyl alcohol, vegetable oils, etc. Gaseous compositions are prepared by dilution with neutral carriers such as nitrogen, carbon dioxide and the like. *Contact: Shivat Limited, The Gate House, 784-788, High Road, London, Greater London N17 ODA, United Kingdom.* (Source: www.wipo.int)

Dry hot air heat treatment system for pest control

Heat treatment for wood packaging material (WPM) requires that it be exposed to a heat source in which the core temperature of the wood reaches 56ºC for a continuous period of 30 minutes. Alam Mesra Agrochemicals Sdn. Bhd., Malaysia, offers Amact Dha HT system to control pests in WPM. Amact Dha HT is a unique system that offers lower operating costs without neglecting quality. The system consists of quality BAK European heaters, thermocouples and graph recorders calibrated to standards, backed by an international warranty fro one year.

Amact Dha HT system is logically designed so that the heaters are located outside the insulated chamber; powerful blowers then helps to push the dry hot air into the heaters and also into the insulated chamber, giving a good heat distribution throughout the chamber. Unlike other heat treatment systems that use filaments, the dry hot air does not crack WPM that is being treated under intense heat. *Contact: Mr. Mohamed Razeef/Mr. Joseph Pichler, Alam Mesra Agrochemicals Sdn. Bhd., No. 541, Jalan 3/13, Kawasan Perindustrian Nilai 3, 71800 Nilai Negeri Sembilan Darul Khusus, Malaysia. Tel: +60 (6) 7996 104/105 Fax: +60 (6) 7996 110; E-mail: info@alammesra.com.my/alamesragro@ gmail.com.* (Source: www.alammesra.com.my)

Control of cigarette beetle in stored grains

A team of scientists at the Tamil Nadu Agricultural University, India, has studied the management of cigarette beetles in stored grains. Cigarette beetle is the most destructive insect pest of stored products such as ginger, tobacco, turmeric, herbal tea products and chillies. Monitoring the insect's presence is the basic and preliminary step in the successful management of this pest. Installation of probe traps will help in this regard.

Periodical microscopic observation of the stored product samples for the presence of the beetle's eggs and the observation of randomly collected samples of 100 g through the hand lens for the presence of larvae and adult beetles will be very much helpful. Fumigation with aluminium phosphide tablets is quite effective in controlling the beetle. *Contact: Mr. Zadda Kavitharaghavan and Mr. S. Mohan, Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India.* (Source: www.hindu.com)

RECENT PUBLICATIONS

22nd International Congress of Refrigeration

This book provides a compilation of the 877 papers presented during the 22nd International Congress of Refrigeration held in Beijing, China, during 21-26 August 2007. Topics covered include cryophysics, cryoengineering; liquefaction and the separation of gases; thermodynamics and transfer processes; refrigerating equipment; cryobiology, cryomedicine; food science and engineering; refrigerated storage; refrigerated transport; air-conditioning; and heat pumps.

Energy Efficiency in Refrigeration and Global Warming Impact

This book deals with topics pertaining to natural refrigerants; cycloid compressors, water, two-phase ice, CO_2, electronic injection, modelling and automatic devices, oil-refrigerant balances, thermophysical properties of substitutes, glides in mixtures; heat exchange during phase changes; thermophysical properties of pure refrigerants and mixtures; technology of refrigerating-circuit components: high-performance heat exchangers, compressors, control devices; energy savings; and use of glide.

6th International Conference on Compressors and Coolants

This book discusses the 55 papers presented by 107 authors at the 6th International IIR Conference on Compressors and Coolants, held in Casta Papiernicka, Slovak Republic. Topics discussed include compressors, vibration and noise reduction, lubrication issues, regulations and performance certification programmes and much more.

For the above three publications, *contact: International Institute of Refrigeration, 177, boulevard Malesherbes, 75017 Paris, France. Tel: +33 (1) 42 27 32 35; Fax: +33 (1) 47 63 17 98.*

TECH EVENTS

20-21 May
Berlin
Germany

The 10th International Conference on Blowing Agents and Foaming Processes 2008
Contact: Ms. Sharon Garrington, Conference Organizer,
Rapra Technology Ltd., Shawbury, Shrewsbury, Shropshire SY4 4NR, United Kingdom.
Tel: +44 (1939) 250 383;
Fax: +44 (1939) 252 416;
E-mail: sgarrington@rapra.net.

2-4 Jul
Singapore

HVAC Asia 2008
Contact: HQ Link Pte Ltd., 205, Henderson Road, #03-01, Henderson Industrial Park, Singapore 159549.
Tel: +65 6534 3588;
Fax: +65 6534 2330;
E-mail: hqlink@singnet.com.sg.

7-10 Sep
Copenhagen
Denmark

8th IIF/IIR Gustav Lorentzen Conference on Natural Working Fluids Refrigeration and Energy
Contact: Ms. Hanne Christoffersen, Conference Secretary,
IIR Gustav Lorentzen Conference 08, Kongsvang Allé 29, DK-8000 Aarhus, Denmark.
E-mail: secretariat@iir-gl-conference-2008.dkT

21-26 Sep
Chengdu
China

8th International Conference on Controlled Atmosphere and Fumigation in Stored Products
Contact: Chengdu Grain Storage Research Institute,
State Administration of Grain Reserves, No. 95, Huapaifang Street, Chengdu 610031, China.
Tel: +86 (28) 8766 0408;
Fax: +86 (28) 8766 1523;
E-mail: caf20088th@yahoo.com.cn.

25-28 Sep
Xian
China

6th International Conference on Compressors and Refrigeration '08
Contact: ICCR Organizing Committee, Xian Jiaotong University, China.
Tel: +86 (29) 8266 3785;
Fax: +86 (29) 8266 8724;
E-mail: sec@iccr2008.org;
Website: www.iccr2008.org.

6-8 Nov
Manila
Philippines

Refrigeration Philippines 2008
Contact: Global-Link Inc.,
Unit 1003, Antel 2000 Corporate Centre, 121 Valero Street, Salcedo Village, Makati City, The Philippines.
Tel: +63 (2) 7508 588;
Fax: +63 (2) 7508 585;
E-mail: jing@globallinkph.com.