VATIS UPDATE

Ozone Layer Protection

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Highlights

- Delay in ozone layer recovery
- Solar-powered air-conditioning
- Non-ozone depleting chlorination solvents
- Clean agent system with FM-200
- 4-G PU foam blowing agent
- MB alternatives for tomato production

United Nations
ESCAP

APCTT
ASIAN AND PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY

OZONE CELL
MINISTRY OF ENVIRONMENT AND FORESTS
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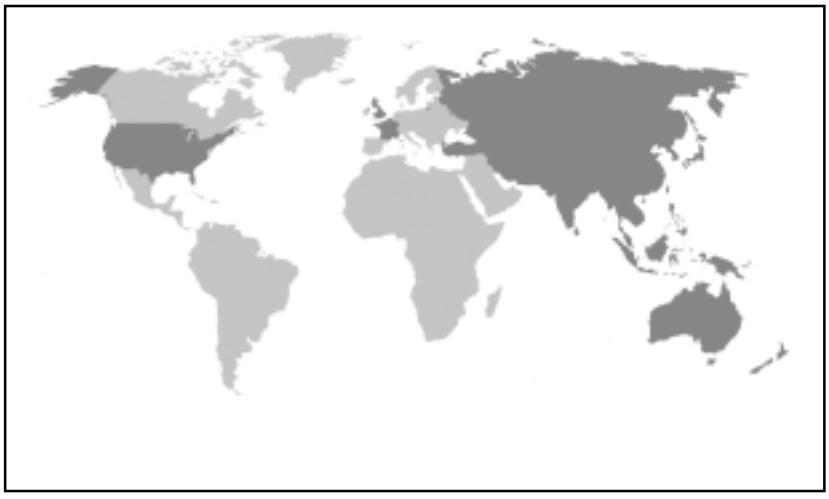
The **Asian and Pacific Centre for Transfer of Technology (APCTT)**, a subsidiary body of ESCAP, was established on 16 July 1977 with the objectives: to assist the members and associate members of ESCAP through strengthening their capabilities to develop and manage national innovation systems; develop, transfer, adapt and apply technology; improve the terms of transfer of technology; and identify and promote the development and transfer of technologies relevant to the region.

The Centre will achieve the above objectives by undertaking such functions as:

- Research and analysis of trends, conditions and opportunities;
- Advisory services;
- Dissemination of information and good practices;
- Networking and partnership with international organizations and key stakeholders; and
- Training of national personnel, particularly national scientists and policy analysts.



The shaded areas of the map indicate ESCAP members and associate members

Cover Photo

INERGEN® (left) and SAPPHIRE® (right) clean agent fire suppression systems with zero ozone depletion potential. *(Credit: Ansul Incorporated, USA)*

VATIS* Update
Ozone Layer Protection
is published 6 times a year to keep the readers up to date of most of the relevant and latest technological developments and events in the field of Ozone Layer Protection. The Update is tailored to policy-makers, industries and technology transfer intermediaries.

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*** Value Added Technology Information Service**

CONTENTS

Vol. 4 No. 93 Mar - Apr 2009

THE SCIENCE OF OZONE LAYER

Delay in ozone layer recovery

A new study led by Mr. Darryn Waugh of Johns Hopkins University, the United States, reveals that the increasing greenhouse gases (GHGs) that cause global warming could delay or even halt the recovery of stratospheric ozone above some parts of the Earth. Climate change could cause changes in wind patterns above countries such as Australia and Brazil. "Global warming causes changes in the speed at which the air is transported into and through the lower stratosphere (in tropical and southern mid-latitudes)" says Mr. Waugh. "You are moving the air through it quicker, so less ozone gets formed." These changes would cause ozone levels in those areas to stay at dangerously low levels, even long after ozone depleting substances such as chlorofluorocarbons (CFCs) have been completely removed from the atmosphere.

Mr. Dan Lubin, an atmospheric scientist at the Scripps Institution of Oceanography, states that if ozone does not recover, the risk of skin cancer for fair-skinned populations living in countries like Australia and New Zealand, and probably in Chile and Argentina too, will be greater in the 21st century than it was during the 20th century. However, above the poles and in the northern mid-latitudes, such as over the United States, ozone restoration should suffer little impact from increasing GHGs. (Website: www.blogs.usatoday.com)

UNEP progress report

The Environmental Effects Assessment Panel (EEAP) is one of the three expert panels within the Montreal Protocol. It deals with the increase of ultraviolet (UV) irradiance on the Earth's surface and its effects on human health, animals, plants, biogeochemistry, air quality and materials. For the past few years, interactions of ozone depletion with climate change have also been considered. It has become clear that environmental problems will be long lasting. In spite of the fact that worldwide production of ozone depleting chemicals has been reduced by 95 per cent, the environmental disturbances are expected to persist into the next half a century, even if the protective work is actively continued and completed. The latest full report was published in *Photochemical and Photobiological Sciences,* 2007, 6, 201-332*,* and the last progress report in in the same journal's issue 2008, 7, 15-27*.* (Website: www.rsc.org)

Sulphuryl fluoride alternative to methyl bromide is potent GHG

In the United States, a team at the University of California-Irvine (UCI) reports that an insecticide used to fumigate termite-infested buildings is a strong greenhouse gas (GHG) that stays nearly 10 times longer in the atmosphere than previously thought. Sulphuryl fluoride (SF) has an atmospheric lifetime of at least 30-40 years (perhaps as long as 100 years). Prior estimates put its lifetime at a low five years, grossly underestimating the global warming potential. Kilogram for kilogram, SF is about 4,000 times more efficient than carbon dioxide at trapping heat, though it exists in the atmosphere in very less quantities. A major cause for concern to the researchers is that emissions will increase as more new uses are found for SF – given the ban of methyl bromide, an ozone depleting pesticide regulated under the Montreal Protocol. (Website: www.sciencedaily.com)

Mountains bad for ozone layer

Latest research indicates that mountain waves in the atmosphere above Antarctica create rare clouds that are helping to destroy the ozone layer. Mr. Steve Eckermann of the United States Naval Research Laboratory, along with Mr. Lars Hoffmann and colleagues, used satellite infrared data to study atmospheric temperatures above the Antarctic peninsula. They found pockets of high and low-temperature air in the stratosphere, and these only occur above mountains. The colder pockets fell below -78°C: cold enough to form polar stratospheric clouds (PSCs). This implicates so-called mountain waves, which are created when an airstream flows over high relief. The waves churn up air high in the atmosphere and appear to create the temperature variations. Chemical reactions that lead to ozone depletion occur on the surface of PSCs. (Website: www.newscientist.com)

ODS PHASE-OUT IN INDIA

Progress report: Ozone-friendly technology at Indian Railways

As part of its green initiative, the Indian Railways plans to equip its entire fleet of over 1,000 air-conditioned coaches with eco-friendly refrigerant technology by March 2009. Thus far, the Indian Railways has been using CFC-based refrigerant technology that leads to depletion of the ozone layer. The R-134a refrigerant technology that is being retrofitted in place of the existing one is considered as environment-friendly. According to the statement by a senior official in the Ministry of Railways, 650 air-conditioned coaches have been converted to R-134a refrigerant as a result of efforts put in by various railway zones, while the rest are likely to be converted by March this year. East Coast Railways is reported to have already converted all air-conditioned coaches handled by it. (Website: www.hindu.com)

DGFT policy mandates NOC for clearance of ODS

The Directorate General of Foreign Trade (DGFT) has stipulated "No Objections Certificate" (NOC) as a mandatory requirement before clearance of ODS against advance authorizations. The policy circular issued by DGFT has been addressed to all regional authorities, Commissioners of Customs, and the trade and industry. According to the circular, the import policy for ODS is "restricted" and subject to condition of Import Licensing Note No. 1 mentioned at the end of Chapter 29 of ITC (HS) Classification of Export and Import Items. Other key points notified in the circular are:

- Further, under Advance Authorization Scheme, restricted items are allowed to be imported for export production, unless otherwise stipulated.
- It has been noted that Advance Authorizations are being issued by the regional authorities for ODS, such as CFCs, as one of the inputs under Standard Input Output Norms (SION) or under self-declared cases (under para 4.7 of HBP v.1). The matter has been examined in the light of restrictions on import of ODS and it has been decided that a separate NOC from DGFT would be required for import of ODS items under Advance Authorization Scheme whether under SION or Annual Advance Authorization or under para 4.7 of HBP, v.1. Request for NOC would be considered by the concerned Norms Committee in DGFT headquarter, in consultation with the Ministry of Environment and Forests. Import of ODS as one of the inputs against Advance Authorizations would be allowed by the customs authority subject to the explicit production of an NOC for the same issued by DGFT, New Delhi.
- Imports of ODS under Advance Authorization Scheme shall be subject to the condition that the entire quantity of ODS will be exported out of the country along with manufactured export product, and no part of it will be utilized in the DTA for domestic consumption. Further, no import of ODS shall be allowed from 2010 even against the valid Advance Authorization. Regional Authority shall make a specific endorsement to this effect at the time of issuance of Advance Authorization.

(DGFT Policy Circular No. 52/2008, dated 06/01/2009)

Seminar on ozone depleting substances

Aiming to phase out Ozone Depleting Substances (ODS) in the defence sector, a one-day seminar on "Combating Climate Change by Management of ODS in Defence Applications" was conducted at HQ Technical Group, EME, New Delhi, as a major initiative towards addressing a vital environmental issue that concerns not only the Defence Forces but the entire international community. Lt. Gen, Noble Thamburaj, Vice Chief of Army Staff, was the Chief Guest at this seminar. Several renowned personalities from among senior defence service officers, civilian dignitaries from Ministry of Environment and Forest, Ozone Cell, eminent scientists of the Centre for Fire Explosives and Environment Safety, Defence Research and Development Organization, and domain experts who are closely involved with the issue of ODS phase-out participated in the seminar.

The terminal objective of the seminar was to draw out strategies to enhance awareness levels, enhance synergy between various stakeholders,

evolving a road map for management of ODS in in-service equipment and measures to be adopted for future induction of weapon systems in defence forces. (Website: pib.nic.in)

Seminar on carbon tetrachloride

Recently, a seminar was organized by the Gem and Jewellery Export Promotion Council (GJEPC), the Indian Institute of Gems and Jewellery (IIGJ) and the German Technical Co-operation (GTZ-Proklima) in Mumbai to focus on the ill-effects of carbon tetrachloride (CTC). The event targeted factory owners, production managers, casting technicians and jewellery artisans. It highlighted the harmful effects of CTC, which is used in the finishing of the wax pattern before a mould is made for casting of jewellery. CTC harms the ozone layer and the health of individuals. As per to the Montreal Protocol, India has to phase out the use of CTC by 31 December 2009 and hence, information needs to be disseminated on safe alternatives to CTC that can be equally effective in the jewellery industry. The objectives of this seminar were to create awareness regarding the harmful effects of CTC on the environment and human health, to inform the jewellery industry of the schedule of the phase-out programme according to the Montreal Protocol and to provide useful information about the safer alternatives to CTC. (Website: www.diamondworld.net)

Methyl Bromide Alternatives Information System

The Methyl Bromide Alternatives Information System (MBAIS) of the Australian Government Department of Agriculture, Fisheries and Forestry aims to provide information on alternatives to methyl bromide (MB) fumigations for plant and plant product commodities by:

- Identifying alternatives to MB being researched, or in use in Australia and/or those alternatives in use internationally for quarantine pre-shipment (QPS) and non-QPS use; and
- Providing data to be able to identify gaps where there are no technical and economic alternatives to MB fumigation, and the scope will be broadened to include international research on MB alternatives.

For more information, contact:

Office of the Chief Plant Protection Officer
Department of Agriculture, Fisheries & Forestry
GPO Box 858, Canberra ACT 2601, Australia
E-mail: ocppo@daff.gov.au

IN THE NEWS

International Customs Day celebrations

"Customs and the Environment: Protecting our Natural Heritage" was the theme of International Customs Day celebrated on 26 January 2009. The day was marked by celebrations organized at the World Customs Organization (WCO) headquarters in Brussels, Belgium, as well as those organized by customs administrations around the world. The highlights of the Brussels event included speeches by the WCO Secretary General Mr. Kunio Mikuryia and other distinguished guests, an exhibition by Belgium Customs of seizures of endangered species and a demonstration by the German Customs of the use of sniffer dogs in identifying smuggling of such items.

The event highlighted the growing problem of environmental crime and illegal trade in eco-sensitive items and recognized the important role that customs officers play in the worldwide effort to combat this issue. Mr. Mikuryia outlined the measures developed by WCO to ensure that cross-border movement of environmentally sensitive goods complies with the relevant international pacts and on facilitation of communication between customs authorities and other competent authorities to enforce trade controls. Some specific examples of co-operation were described, including a number of joint WCO and UNEP activities. UNEP DTIE OzonAction used the occasion to launch the second edition of the Training Manual for Customs Officers: Saving the Ozone Layer – Phasing Out Ozone Depleting Substances in Developing Countries – which it prepared to assist customs authorities in developing countries to ensure compliance with the Montreal Protocol. (Website: www.unep.fr)

Thailand to end CFC imports

Thailand's Minister for Industries Mr. Charnchai Chairungruang has announced that Thailand will terminate imports of CFCs, a major refrigerant, on 1 January 2010 to comply with the Montreal Protocol. The Montreal Protocol calls for a total elimination of CFCs from developing countries by

2010. The ministry will promote the use of substitutes, such as HFC-134a or R-134a. (Website: www.nationmultimedia.com)

Myanmar: First-ever high-level meeting on Montreal Protocol

Dr. Husamuddin Ahmadzai, Senior Adviser to the Swedish Environmental Protection Agency and Chairman of Executive Committee of the Multilateral Fund of the Montreal Protocol, along with UNEP and UNIDO representatives, visited Myanmar to encourage continued commitment towards compliance and to alert on risk of non-compliance in future, and to advise the Minister of Forestry to accelerate the implementation of the Montreal Protocol. Sweden has financially and technically supported a regional network of national ozone units in Southeast Asia and Pacific for the last 16 years. Myanmar is one of the members of this network. Dr. Ahmadzai met with the Minister of Forestry, Brigadier General Thein Aung, and the Director-General and Secretary of the National Commission for Environmental Affairs, Mr. Sann Lwin.

The Minister promised to take early steps to set up a licensing system, ratify the remaining amendments of the Montreal Protocol (Beijing, Copenhagen and Montreal) and take steps to speed up the HCFC phase-out management plan (HPMP). He accepted UNEP's suggestions to hold a sub-regional celebration on 16 September 2009, the International Day for the Preservation of the Ozone Layer. High-level delegations from India, China, Bangladesh, Lao People's Democratic Republic and Thailand will be invited by the Minister along with implementing agencies. On 4 February 2009, a one-day workshop on policy and regulations was held in the Forest Research Institute in which more than 40 participants from various ministries took part. (Website: www.unep.fr)

IOR updates refrigeration guidance

The Institute of Refrigeration (IOR) has issued a new refrigerant code of practice to complement the BS EN 378:2008 safety standard for the refrigeration industry. The publication in late 2008 of the BS EN 378:2008 "Refrigerating systems and heat pumps – Safety and environmental requirements" standard has led IOR to revise its A1/A2 and A3 refrigerant codes of practice. The requirements for A2 refrigerants have been moved to the Safety Code of Practice for A2 and A3 Refrigerants (low inflammable and inflammable). The requirements for carbon dioxide R-744 are covered in a separate specialist document. The four IOR codes are:

- Carbon dioxide;
- Ammonia;
- A2 and A3 refrigerants (inflammable halocarbons and hydrocarbons); and
- A1 refrigerants (non-inflammable halocarbons).

According to IOR secretary Ms. Miriam Rodway, "The standard is often neglected by designers, installers and those altering or maintaining existing systems. The IOR codes reinforce the standard's technical requirements and recognize and incorporate relevant aspects of other standards." Wider obligations referred to include provisions of the Health & Safety at Work etc. Act 1974, PSSR 2000 and DSEAR 2002. The Pressure Systems Safety Regulations (2000), the Ozone Depleting Substances Regulation as well as the European Regulation on Certain Fluorinated Greenhouse Gases (2006) (F Gas Regulations) impose certain obligations on the user of refrigerating equipment, which are also incorporated. Each code includes a substantial and updated list of references to standards, regulations, heath and safety and industry guidance. (Website: www.hvnplus.co.uk)

Daikin receives prize for ozone layer protection

Daikin Industries Ltd. (DIL), Japan, has built a network that centrally manages information for the recovery of fluorocarbons. DIL has realized for the overall Daikin Group in Japan a system that assuredly recovers fluorocarbons and even manages the destruction of fluorocarbons after their recovery. Mr. Yukiyoshi Okano, President and COO of DIL, said "Constant vigilance is needed in the recovery of refrigerants. This award provides great encouragement and confidence to those who are directly involved with the recovery and management of fluorocarbons at the worksite." For these efforts, DIL was awarded the prize of

Japan's Ministry of Economy, Trade and Industry (METI) during the 11th Grand Prizes for Protection of the Ozone Layer and Prevention of Global Warming. The awards are organized by industrial economy newspaper, Nikkan Kogyo Shimbun, with sponsorship from METI and the Ministry of Environment. (Website: www.refrige.com)

New product catalogues under import and export licensing

China will use licences to manage imports of two categories of products and exports of 50 kinds of commodities in 2009, reports the Ministry of Commerce. According to the Ministry, licences will be used to control imports of ODS and major used mechanical and electrical products in 2009. Meanwhile, it will use licences to manage exports of 50 kinds of commodities, including corn, wheat, cotton, coal and oil. New versions of product lists are available on the Ministry's website – www.mofcom.gov.cn. The 2008 versions expired on 31 December 2008. (Website: www.news.xinhuanet.com)

R-22 replacements in China

Natural refrigerants, such as hydrocarbons and carbon dioxide, feature prominently as an option for replacing ozone depleting refrigerants in household use in China. Using these would allow China to leapfrog from the use of HFCs and avoid both ozone depletion and global warming issues altogether. These conclusions were arrived at during a workshop held by the Chinese Electrical Appliances Association (CHEAA) in Guanzhou during 27-28 November 2008. Presenters included experts from the Chinese and international industry and public authorities, including the United Nations, the European Commission and the United States Environmental Protection Agency (EPA). While the current growth rate in the production of HCFCs is around 20 per cent per year, by 2013 China will be obliged to freeze its production to values from 2009-2010. In the long term, a reduction by 67.5 per cent in consumption is targeted for 2025.

To support the transition to more viable alternatives, the United Nations Industrial Development Organization presented the available funding options to the Chinese industry. The focus for the allocation of funds, besides eliminating ozone depleting substances, will be on improving the efficiency of the appliances and significantly reducing their global warming impact. A substantial review of potential alternatives is planned as a first step, to be followed by cost assessments and more detailed analysis. Both the European Commission and UNEP presented the approach that the European Union and the United States, respectively, are taking to phase out HCFCs. The Commission presented an overview on the restrictions to common fluorinated gases currently in place, and its upcoming review. The United States EPA focused on the restrictions to the use of HCFCs and the need for alternatives to obtain approval for use under the SNAP programme, which for the time being excludes hydrocarbons. (Website: www.r744.com)

Refrigerant use in 2012 London Olympics

The London 2012 Committee of the Olympic Games and Paralympic Games (LOCOG) has published the first online edition of its Sustainable Sourcing Code, reiterating its commitment to making the 2012 Games sustainable. The code outlines the Committee's approach to sustainable sourcing (i.e. the procurement of products and services with environmental, social and ethical issues in mind). Appendix A of the code identifies a list of substances and materials that suppliers and licensees will avoid using in the products, services or packaging they will supply for the London Games. Fluorocarbons are identified as a group of substances to be avoided. As per the code, "chilling or cooling equipment containing substances with a global warming potential of 150 or more in composition should be avoided". This includes:

- Chlorofluorocarbons;
- Hydrochlorofluorocarbons – HCFC-22, -123, -124, -141b, and -142b; and
- Hydrofluorocarbons – HFC-23, -32, -43-10mee, -125, -134a, -143a, -152a, -227ea, -236fa, -245fa, and -365mfc.

The Sustainable Sourcing Code does not make specific recommendations regarding which other refrigerants should be chosen. Natural refrigerants emerge as the most promising alternative for

several applications. The code will be applied via the tendering process. Following award of a contract, LOCOG will monitor the supplier or licencee's practices to ensure they are being carried out as agreed in the tender process. LOCOG's procurement activity will involve many thousands of individual purchases from a wide range of suppliers and licencees in a relatively short but intensive time period. The build-up will begin in late 2009 and peak during 2010-2012. (Website: www.r744.com)

Patents service on R744.com

R744.com, committed to constantly increase the worldwide CO_2 (R-744) know-how, has launched a new website section listing patents that are available to be licensed or sold. A simple search engine and illustrated listings make it easy to look for existing patents on CO_2 technology, and provides all the key information needed to identify inventions in different world markets that could help you design the most efficient R-744 air-conditioning, refrigeration or heating systems. With a growing interest in the natural refrigerant around the world, this will further contribute to openly sharing knowledge needed to accelerate the design and market uptake of CO_2 solutions.

A reduced number of search fields ensure the user can find patents by keyword, patent agent, inventor, patent number, country or region, and filing year. R744.com's patents database lists 11 inventions to be licensed, covering transcritical vapour compression cycle devices, improved defrosting methods, vapour compression heat pump systems, refrigerating systems with gliding temperature heat rejection, or systems for cooling and heating of vehicles. After using the search fields or selecting one of the patents from the listing below, the individual fact sheet provides the following information:

- Official title;
- i-Paper;
- Published as;
- Abstract;
- Inventors;
- Agent; and
- Interested to advertise your patents?

(Website: www.r744.com)

REFRIGERATION/ AIR-CONDITIONING

Refrigeration system based on magnetics

An exotic metal alloy discovered by an international collaboration working at the Centre for Neutron Research of the National Institute of Standards and Technology (NIST), the United States, is predicted to lead to smaller, quieter and more economical cooling systems. The alloy may prove to be a long-sought material that will permit magnetic cooling instead of the gas-compression systems used for home refrigeration and air-conditioning. The magnetic cooling technique, though used for decades in science and industry, is yet to find application in the home because of technical and environmental hurdles – but the NIST collaboration may have overcome them.

Magnetic cooling relies on materials known as magnetocalorics, which heat up when exposed to a powerful magnetic field. After they cool off by radiating this heat away, the magnetic field is removed and their temperature drops again, this time dramatically. This effect can be used in a classic refrigeration cycle, and scientists have attained temperatures of nearly absolute zero. However, most magnetocalorics that function at close to room temperature require both the prohibitively expensive rare metal gadolinium and arsenic, a deadly toxin.

The new alloy – a mixture of manganese, iron, phosphorus and germanium – is not merely the first near-room-temperature magnetocaloric to contain neither gadolinium nor arsenic – rendering it both safer and cheaper – but it also has such strong magnetocaloric properties that a system based on it could even rival gas compression in efficiency. Working alongside (and inspired by) visiting scientists from the Beijing University of Technology, China, the team used NIST's neutron diffraction equipment to analyse the novel alloy. They found that when exposed to a magnetic field, the newfound material's crystal structure completely changes, which explains its exceptional performance. "Understanding how to fine-tune

this change in crystal structure may allow us to get our alloy's efficiency even higher", says NIST crystallographer Mr. Qing Huang. "We are still playing with the composition, and if we can get it to magnetize uniformly, we may be able to boost the efficiency." (Website: www.sciencedaily.com)

Air-cooled screw chillers

Daikin Industries Ltd., Japan, and McQuay International, a Daikin Group company, have teamed up to launch the AWS air-cooled screw chiller. The new Daikin-McQuay brand represents the integration of Daikin technology and design into McQuay commercial products distributed worldwide. The AWS line of air-cooled screw chillers (Model AWS; 175-510 tonnes), is the first product to include the new brand, and features improved efficiency and reliability and quiet operation. The new line of screw chiller has been redesigned from the bottom up. It utilizes an efficient and reliable compressor, new quieter fans and Micro-Tech® III controls. Daikin engineers were involved in the design and Daikin fans are being employed to make the AWS the quietest air-cooled chiller in the marketplace. (Website: www.ad-hoc-news.de)

Solar-powered air-conditioning

With the likelihood of extreme weather events becoming more frequent and the demand for air-conditioning during heat waves continually increasing, Australia's electricity infrastructure faces dire challenges. Dr. Mike Dennis, a senior research fellow at the Centre for Sustainable Energy Systems, Australian National University College of Engineering and Computer Science, is developing extremely efficient solar-powered air-conditioning systems that will not only lighten the load on the mains transmissions grid, but also address greenhouse gas emissions generated by air-conditioners. Dr. Dennis' research goes beyond the carbon emissions associated with coal-fire generated electricity use in favour of clean solar energy and extends to the refrigerants used in air-conditioning units. According to Dr. Dennis, for every kilogram of refrigerant in a split air-conditioning system, there is 2,000-3,000 kg of carbon dioxide equivalent in refrigerants – around the average that a car emits in a year. While evaporative air-conditioners use far less electricity, they only work effectively in dry areas – the same areas where water is getting scarce.

Dr. Dennis' air-conditioner design replaces the electrical compressor in a traditional air-conditioner with a solar-powered thermal compressor. Solar power is provided in the form of heat, and not as electricity, from conventional solar hot water collectors. The technology, known as ejector cooling, operates using compressed air expanding out of a jet that sucks refrigerant and air into a line and then expels the air at a much cooler temperature. The refrigerant is recirculated back and then recompressed. The closed loop system can utilize any form of refrigerant, including water.

A two-year development programme is due to begin this year, with the units expected to be available commercially in Australia during 2010. While an approximate price is not yet available, Dr. Dennis expects that the manufacturing cost of the solar-powered system, with only one moving part and no hazardous chemicals, will be low. (Website: www.energymatters.com.au)

New range of CO_2 compressors

With the use of carbon dioxide (CO_2) as a natural refrigerant becoming increasingly popular, the United Kingdom-based Bitzer now offers an enhanced range of CO_2 Octagon® compressors for air-conditioning and medium and low-temperature refrigeration applications. Bitzer's proven Octagon compressors are optimized for use with CO_2 and have short-stroke technology, a smooth-running drive gear and multi-valve technology. With these features, they are ideally suited for operation with frequency inverters and for parallel switching. The sophisticated oil management is particularly beneficial for CO_2 applications, while the optimized centrifugal lubrication system minimizes the oil carry over even with high fluctuations in pressure and speed-regulated operation.

For sub-critical CO_2 applications, there are now 17 models of the Octagon CO_2 series. Their cooling capacity ranges from 4.4 kW to 80 kW in low-temperature operation at 50 Hz. Bitzer has also extended its offering of Octagon CO_2 compressors for transcritical applications. *Contact: Bitzer UK Limited Partnership, 10 Holdom Avenue, Milton Keynes MK1 1QU, Great Britain, United Kingdom.*

Tel: +44 (845) 2303 007; Fax: +44 (845) 2303 006; E-mail: sales@bitzeruk.com; Website: www.bitzeruk.com. (Website: www.refrige.com)

CO_2 booster system better than HFC

Danfoss, Denmark, reports that a transcritical carbon dioxide (CO_2) booster system with gas by-pass from the intermediate pressure receiver to the suction side of the high-pressure compressors can outperform both R-410A/CO_2 cascade system and R-404A-only system used in commercial refrigeration. Both laboratory and field tests over several months have confirmed this finding. The energy consumption of the cascade system was 99 per cent of that of the R-404A system, while the CO_2 booster system showed the lowest energy consumption – approximately 96 per cent of the R-404A system.

Danfoss in co-operation with partners designed a 10 kW (-30°C) and 24 kW (-10°C) refrigeration system for a small discount supermarket. After evaluating different systems for energy use and the availability of components, Danfoss opted for a CO_2 booster system with a gas by-pass from the intermediate pressure receiver to the suction side of the high-pressure compressors. It was built with standard components available from normal suppliers of refrigeration equipment. The CO_2 system, in operation since 1 March 2007, was then compared with a cascade system using R-410A and CO_2, and an R-404A reference system. All systems were of similar size and cooling capacity, with a comparable load profile. The reference R-404A unit is a standard parallel system for both medium and low temperatures. The cascade system uses a plate heat exchanger as condenser, with the low and medium temperature being served by two parallel systems having a common condensor. (Website: www.r744.com)

New condensing unit

Heatcraft Refrigeration Products LLC, the United States, has launched its newly designed 0.5-6.0 hp condensing unit with HyperCore microchannel technology, an energy efficient and eco-friendly offering that qualifies as an E+ Solutions product. The condensing units comes in configurations that are compatible with R-404A. The HyperCore microchannel coil technology allows for superior heat transfer capabilities and reduced refrigerant charges, as compared with the standard copper-aluminium round tube plate fin (RTPF) coils. An all-aluminium construction assures unsurpassed protection from corrosion as well as refrigerant leaks for excellent reliability. *Contact: Heatcraft Refrigeration Products LLC, 2175 West Park Place Blvd., Stone Mountain, Georgia 30087, United States of America. Tel: +1 (770) 4655 600; Fax: +1 (770) 4655 990; E-mail: hrpd.feedback @heatcraftrpd.com.* (Website: www.refrige.com)

A new age in air source heat pump technology

Stroma LZC, the United Kingdom, is offering two high-temperature air source heat pumps (ASHPs) that will revolutionize both the residential and commercial heating market. Overcoming all the limitations that previously constrained traditional low-temperature ASHP technology, the Stroma HiRES is the first genuine alternative to traditional gas or oil-fired boilers for the residential sector. The high appliance efficiency, even at high output temperatures, greatly decreases the emissions generated by space heating and the production of domestic hot water compared with those of traditional gas or oil-fired systems.

For the commercial sector, Stroma LZC offers the ICON – an air source heat pump employing the carbon dioxide-based refrigerant R-744. Apart from not containing ozone depleting substances, R-744 maximizes the transfer of heat energy inherent in the ambient air to the heating system. This increases both the maximum output temperature of the heat pump as well as the overall appliance efficiency, referred to in the industry as coefficient of performance (COP). The ICON can achieve a maximum output temperature of 90ºC and a COP in excess of 6, bringing to the commercial market all the advantages that the HiRES delivers to the residential sector.

Correctly employed and installed, these ASHPs deliver high levels of efficiency and increased occupier comfort while also facilitating good EPC and DEC ratings by immediately improving the energy efficiency of the building – something not yet achieved with previous models. The Stroma

LZC product range also includes ground source heat pumps and solar thermal systems for the commercial, residential and public sector. *Contact: Stroma LZC, Pioneer Way, Castleford WF10 5QU, United Kingdom. Tel: +44 (845) 6211 111; Fax: +44 (845) 6211 112; E-mail: lzc@stroma.com.* (Website: www.24dash.com)

LG expands commercial air-conditioner portfolio

LG Electronics of the Republic of Korea, a world-wide leader in air-conditioning, has exhibited new advancements in energy-saving technologies, temperature controls and design flexibility at the annual Air-conditioning, Heating and Refrigeration Exposition held in the United States early this year. At the forefront of LG's line of commercial air-conditioner products is the new Duct-Free Flex Multi-Split Quad-Zone air-conditioning system. This new series extends the firm's broad portfolio of applied commercial air-conditioning products into the United States market and features design flexibility and industry-leading energy efficiency.

The new air-conditioning system can operate up to four interior units mounted in separate rooms for easy temperature control in each setting, but all connected to one single exterior condensing unit. Architects and engineers focusing on green buildings would appreciate the built-in Inverter technology for enhanced energy efficiency, while homeowners as well as those in the hospitality and lodging industries will enjoy the variety of modern interior styles to choose from, including the popular Art Cool Inverter Mirror design-oriented series available in eye-catching designs such as a mirror finish. LG utilizes an advanced inverter compressor technology and an environmentally friendly refrigerant in its systems. It has also incorporated the advanced inverter technology with its line of Multi-V systems that use a variable refrigerant flow (VRF) heat recovery system to operate cooling and heating simultaneously with one outdoor unit for easy temperature zoning. Altogether, these advanced energy-saving technologies are incorporated throughout LG's 2009 line of commercial air-conditioning products, thus offering innovative comfort solutions that meet the needs of a variety of commercial applications. (Website: www.sev.prnewswire.com)

SOLVENTS

Non-ozone depleting chlorination solvents

Dover Chemical Corp., the United States, offers a process for the chlorination of a paraffin wax. The patent-pending process includes the steps of contacting the paraffin wax or partially chlorinated paraffin wax with chlorine wherein improvement is the use of a non-ozone depleting aromatic solvent with a boiling point of less than 180°C, preferably less than 160°C, and which is non-reactive to chlorine in a free radical chlorination environment, in contrast to typical C1-C2 aliphatic solvents. The invention provides a chlorination process for obtaining chlorinated resins without using ozone depleting organic solvents, especially chlorinated alkane-based solvents that are difficult to remove from the final product. It is an object of this invention to provide a non-ozone depleting halogenated aromatic solvent useful for chlorination of paraffin resins. The invention also intends to provide a non-ozone depleting perhalogenated aromatic solvent that is useful for the chlorination of paraffin resins. (Website: www.freepatentsonline.com)

Cleaner/degreaser contains no ozone depleting chemicals

CRC Industries Inc., the United States, is offering Super Soy™ degreaser specially formulated with soya methyl ester and ethyl lactate, which are renewable resources that conserve non-renewable resources such as petroleum. The heavy-duty, low-odour, non-inflammable, biodegradable cleaner/degreaser is very effective in removing grease, oil, lubricants, adhesives and tar. Super Soy does not contain Class I or Class II ODS; so it offers a cleaning alternative to chlorinated products while complying with EPA regulations on the use of CFCs. It is NSF K1 registered for use in meat and poultry plants. *Contact: Ms. Carol Brown, CRC Industries Inc., 885, Louis Dr., Warminster, PA 18974, United States of America. Tel: +1 (215) 4426 285, ext. 308; Fax: +1 (215) 6742 196; Website: www.crcindustries.com.* (Website: news.thomasnet.com)

Compositions comprising perfluorobutyl methyl ether

Solvay S.A., Belgium, is patenting compositions comprising perfluorobutyl methyl ether (C_4F_9-O-CH_3) that can be particularly used as an agent to clean or dry solid surfaces. It is known that perfluorobutyl methyl ether forms pseudoazeotropic or azeotropic compositions with esters. These compositions have specific use as solvents for cleaning and defluxing electronic components, degreasing metals, removing water adsorbed at the surface of solids and for fixing a toner to the printing substrate.

The patent application filed covers azeotropic compositions formed of perfluorobutyl methyl ether with one or more organic solvents chosen from linear or branched and cyclic or acyclic alkanes comprising from 6 to 8 carbon atoms, cyclic or acyclic ethers comprising from 4 to 6 carbon atoms, ketones comprising 3 carbon atoms, chlorinated alkanes comprising 1, 3 or 4 carbon atoms, chlorinated alkenes comprising 2 or 3 carbon atoms, alcohols comprising 1 to 4 carbon atoms, partially fluorinated alcohols comprising 2 to 3 carbon atoms, 1-bromopropane, acetonitrile, HCFC-225ea and HCFC-225cb. (Website: www.freepatentsonline.com)

Non-ozone depleting co-solvent compositions

Loctite Corp., the United States, is patenting a non-ozone depleting, non-inflammable co-solvent composition useful as a carrier for actives such as accelerators, catalysts, initiators, activators and other primer materials for use as adhesive promoter formulations together with adhesive compositions. The co-solvent compositions include an azeotropic solution of a perfluorocarbon and an alkylsiloxane. The perfluorocarbon may be selected from the group consisting of perfluoromethylmorpholine, perfluoroalkanes having from 5 to 8 carbon atoms, and mixtures thereof. The alkylsiloxane may be selected from the group of compounds having the formula “STR1” where R is an alkyl group having from 1 to 10 carbon atoms and T is an integer from 1 to 5. It has been discovered that the aforementioned alkylsiloxanes when combined with a perfluorocarbon unexpectedly results in a co-solvent composition which has the desired traits necessary to serve as replacements for CFCs in adhesive promoter compositions.

The invented co-solvent compositions are non-ozone depleting, non-inflammable solvent systems, which serve as excellent carriers for the aforementioned promoter components. For example, an amine accelerator for cyanoacrylate adhesives may be added to the co-solvent composition to form an accelerator composition. Other promoter compositions for various adhesive systems, such as anaerobic adhesives, olefinic adhesives, epoxy adhesives, and acrylic adhesives, may be formed from the present co-solvent compositions. Such promoter compositions are formed by adding the promoter component to the co-solvent composition in an appropriate amount such that when applied to a substrate surface, ample promoter component will be deposited to serve its intended function. The co-solvent compositions are azeotropic, which correlates with their non-inflammable volatility. (Website: www.freepatentsonline.com)

Electronic cleaning solvent, contact cleaner and lubricant

Chemtools, Australia, supplies various chemical products that fulfil the chemical requirements in the manufacture of electronics. The products include acrylic conformal coating, air dusters and freezers, contact cleaners, electronic cleaning solvent, flux remover, liquid flux in aerosol, water displacers, lubricants, PCB cleaners and VCI corrosion protection. Designed either for hand operation or batch cleaning, the contact cleaner and lubricant when used with lubrication offers long-term protection from oxidation. It serves to be the optimal lubricant and solvent for contacts. The contact cleaner is non-ozone depleting and safe on most plastics. The lubricant evaporates rapidly and is non-corrosive. Electrical contacts require degreasing, lubricating and precision cleaning. The contact lubricant is the solvent of choice and is utilized in switches and relays. It is ideal for tape heads, PCBs, electronic parts and business machines. *Contact: Chemtools, Unit 4, 3 Pullman Pl, Emu Plains, NSW 2750, Australia. Tel: +61 (2) 4735 3126; Fax: +61 (2) 4735 3746.* (Website: www.ferret.com.au)

HALONS

Fluoroiodocarbon blends as CFC and halon replacements

JSN Family Ltd., the United States, is patenting fluoroiodocarbon blends for replacing halons and CFCs. The patent application relates to a new set of effective, non-inflammable, environmentally safe, low-toxicity refrigerants, propellants, foam blowing agents, solvents and firefighting agents. The agents are clean, electrically non-conductive and have short atmospheric lifetimes, zero ozone depletion potential and low GWP. The agents comprise at least one fluoroiodocarbon agent satisfying the general formula $C_aH_bBr_cCl_dF_eI_fN_gO_h$, wherein a is between and including 1 and 8; b is between and including 0 and 2; c, d, g, and h are each between and including 0 and 1; e is between and including 1 and 18; and f is between and including 1 and 2, either neat or mixed with additives selected from the group consisting of esters, fluoroethers, hydrocarbons, hydrofluorocarbons, alcohols, ethers and perfluorocarbons. (Website: www.freepatentsonline.com)

Clean agent fire suppression system with FM-200

Utilizing the industry recognized suppression agent FM-200, Amerex Corp., the United States, has developed an affordable pre-engineered clean agent fire suppression system to protect areas with sensitive electrical equipment and valuable data. Amerex claims that it developed the CPS system to be the most cost-efficient clean agent available. The modular design incorporates pre-assembled wiring harnesses and keyed locking connectors on all electrical components to enable simple and confident installation.

Agent tanks come in two sizes having a diameter of 10 inches, which makes tank location in confined spaces less strenuous. Tanks are charged with FM-200 in increments of 900 g in a small tank or 1.36 kg in a larger tank for custom installation without unnecessary expense. Electrical actuators used for system actuation can be reset, thereby reducing the number of components to be replaced during service after discharge. The CPS system is designed to use schedule 40 pipe providing easy access to the materials needed to complete the installation. Nozzles are available in three designs; corner, side wall and centre room for flexibility in system installation to protect those "challenging" areas. *Contact: Amerex Corp., 7595, Gadsden Highway., P.O. Box 81, Trussville, Al 35173, United States of America. Tel: +1 (205) 6553 271.* (Website: www.amerex-fire.com)

FE-13 pre-engineered clean agent fire extinguishing system

Riser Enterprises Philippines offers total flooding systems based on trifluoromethane (CHF_3) or FE-13 for use in fire extinguishing. FE-13 can at present be used for the protection of persons and property. Key features include low toxicity, no physical effects on most fragile equipment, minimum environmental impact, and zero ozone depletion potential. *Contact: Riser Enterprises Philippines, 117 C, De Venecia Street, Mandaluyong City, Metro Manila, The Philippines. Tel: +63 (2) 7474 671; Fax: +63 (2) 7474 671, Website: www.riserphil.ws.* (Website: www.alibaba.com)

Foam/water spray auto fire extinguishing system

Zhejiang Jindun Pressure Vessel Co. Ltd., China, offers ZPS32 series of foam/water spray auto fire extinguishing systems that are highly efficient with a comparatively wide application range. These systems combine the wet-type water spray auto fire extinguishing system and the membranous pressure type air-foam proportion mixer with foam liquid control valve, pressure release valve, control pipeline and control valve fittings. In case of a fire, the glass ball of the closed type spray nozzle breaks and the system is automatically started; the liquid mixture of aqueous film foam (3 per cent or 6 per cent) goes through the pipe net and is sprayed to the protected areas for fire extinguishing by the spray nozzle. This device can be used in parking garages, generator rooms, boiler rooms and other locations where any inflammable liquid is present. *Contact: Zhejiang Jindun Pressure Vessel Co. Ltd., Xiaoyue Town, Shangyu City, Zhejiang Province, China 312367. Tel: +86 (575) 2718 689; Fax: +86 (575) 2718 238; Website: www.jindun.cc.* (Website: www.alibaba.com)

FOAMS

Process for synthetic resin foam, blowing agent and premix

Daikin Industries Ltd., Japan, has applied for a United States patent for its process to produce synthetic resin foam blowing agent and premix. The patent application relates to a process for producing a synthetic resin foam that comprises reacting at least one polyol with at least one polyisocyanate compound in the presence of an organic blowing agent, wherein organic blowing agent is a blowing agent for the synthetic resin foams and is characterized by being a mixture comprising 1,1,1,3,3-pentafluorobutane (HFC-365 mfc) and at least one halogen-containing compound and optionally containing at least one member selected from the group consisting of glycol compounds and amide compounds. Also provided are a premix comprising the blowing agent and a polyol mixture, and a process for producing a synthetic resin foam from these. (Website: www.freepatentsonline.com)

4-G PU foam blowing agent

Honeywell International, the United States, has developed and is commercializing HBA-1, a new, fourth-generation polyurethane (PU) foam blowing agent having attributes of very low global warming potential (GWP = 6) in conformance with the European Union (EU) F-Gas Regulation. This blowing agent has proved its efficacy in PU foam applications, particularly one-component PU foams. Further adoption is anticipated for the European industry's applications, which require a gaseous blowing agent that offers high performance and meets environmental regulations.

HBA-1 is commercialized in the EU. Manufacturing capacity has been completed, commercial runs have commenced, and EU inventory and supply chain logistics have been established. While the initial market to commence adoption of HBA-1 is the EU one-component foam industry, broader acceptance of this molecule is being embraced in two-component PU foams, and in the aerosol industry as an alternative to HFC-134a in view of the EU regulatory pressures of GWP. Furthermore, the chemical and physical properties of HBA-1 have been shown desirable in the extruded thermoplastic foam industry as a potential alternative to HFC-134a. In effect, HBA-1 is developing a broad stature as the low-GWP, non-inflammable as well as environmentally desirable solution in foamed insulation goods demanding a high-performance blowing agent. (Website: www51.honeywell.com)

Leading technology to extrude foam using CO_2

Nanjing Useon Extrusion Equipment Co. Ltd., China, offers technology for extruding foam with carbon dioxide (CO_2). XPS insulation boards begin as a solid granule. The granules are fed into an extruder where they are melted and critical additives mixed with the viscous fluid that is formed. Then, a blowing agent is injected to render the mixture foamable. In carefully controlled heat and pressure conditions, the foamable mixture is forced through a die for forming and shaping. The rigid foam is then trimmed to the final product dimensions.

The Comer series production line can produce better quality of final products. This is the result of the comprehensive understanding of single-screw and twin-screw extruders. Comer integrates the excellent mixing performance of twin-screw extruder and cooling performance of single-screw extruder. This provides the guarantee for higher capacity and better quality of final products. Automatic uploading units are configured to provide a fully automatic solution. Other key features are:

- Precise metering and injection units for CO_2, HFC or butane could be specifically configured according to requirement;
- Excellent twin-screw extruders;
- Patented cooling extruders;
- Melt homogenization and die; and
- PCC interface.

Contact: Nanjing Useon Extrusion Equipment Co. Ltd., No. 89, Dadingfang Industrial Zone, Tiexinqiao Street, Yuhuatai District, Nanjing City, Jiangsu Province, China 210012. Tel: +86 (25) 5235 3368; Fax: +86 (25) 5235 3368; Website: www.useongroup.com. (Website: www.alibaba.com)

PVC foam

Atofina Chemicals Inc., the United States, has applied for a patent relating to PVC foam blown with a blowing agent consisting of a gaseous hydrofluorocarbon (HFC). It has been found that the use of an HFC physical blowing agent allows one to extrude PVC foam, which has a variety of foam densities and to avoid the leaving of residues. Low-density foams (less than about 0.2 g/cc) are useful as insulation, while medium-density foams (on the order of 0.5 g/cc) are useful for applications such as fencing, pipe, profile and board. As the gaseous HFC blowing agent can be fed to the extruder independent of the PVC, density can be controlled simply by adjusting the flow rate of the blowing agent relative to the PVC in the extruder. Unlike chlorinated blowing agents, HFCs also feature the environmental benefit of zero ozone depletion potential. In practice, the physical blowing agent is injected into an extruder containing the PVC formulation in molten form. Conventional extruders, such as single screw or twin screw extruder, can be employed. (Website: www.freepatentsonline.com)

Azeotropic compositions of cyclopentane

The multinational E.I. du Pont de Nemours and Co. reports an invention relating to compositions of cyclopentane and a compound selected from the group comprising hydrofluorocarbons, hydrofluoroethers or fluorinated sulphur compounds. Specifically these compounds may be selected from the group consisting of tetrafluoroethane, hexafluoropropane, pentafluoropropane, tetrafluoropropane, trifluoropropane, difluoropropane, difluorobutane, octafluorobutane, hexafluorobutane, pentafluorobutane, nonafluorobutane, trifluoro-2-methoxyethane and bis(pentafluoroethyl)sulphide. The compositions, which could be azeotropic or azeotrope-like, may be used as cleaning agents, refrigerants, expansion agents for polyolefins and polyurethanes, aerosol propellants, refrigerants, heat transfer media, gaseous dielectrics, fire extinguishing agents, power cycle working fluids, polymerization media, particulate removal fluids, carrier fluids, displacement drying agents or even buffing abrasive agents. (Website: www.freepatentsonline.com)

FUMIGANTS

Methyl bromide alternatives for strawberry nurseries

In the United States, methyl bromide (MB) has been the foundation for the control of soil-borne diseases and weeds in California strawberries. Though this Class I stratospheric ozone depleting chemical has been phased out since 2005, it is still being used in strawberry production as a critical-use exemption. A research team has evaluated the effectiveness and cost efficiency for weed control in lower and higher-elevation nurseries with MB-alternative fumigants.

The study results show that fumigating with MB is still much cheaper than using iodomethane. In terms of weed control, all the alternative fumigant treatments were acceptable replacements for MB. *Contact: Mr. Michael W. Neff, American Society for Horticultural Science, United States of America. Tel: +1 (703) 8364 606; E-mail: mwneff@ashs.org.* (Website: www.eurekalert.org)

MB alternatives for tomato production

Methyl bromide (MB) is a highly effective broad-spectrum fumigant used extensively in the United States in agriculture to control a wide variety of pests. The Montreal Protocol of 1991, however, defined MB as a chemical that contributed to the depletion of the stratospheric ozone layer. This resulted in an incremental reduction in the amount of MB produced and imported in the country. In January 2005, a total phase out of MB (except for emergency and critical-use exceptions) was imposed.

Researchers at North Carolina State University and the United States Department of Agriculture (USDA) analysed the economic feasibility of chemical alternatives to MB in the plasticulture production of tomatoes in the mountain region of North Carolina. Lead researchers Mr. Frank Louws and Mr. Olha Sydorovych detailed the methodology, stating that they first estimated the costs and returns associated with growing, harvesting and marketing tomatoes in a plasticulture pro-

duction system, including pre-plant fumigation with MB. Second, they evaluated the economic feasibility of the alternatives to MB using a partial budget methodology.

The study results indicated that technically and economically feasible replacements to MB for tomato production exist in growing conditions. However, the researchers advised growers to estimate individual production, harvesting and marketing costs based on their own production techniques, price expectations, local supply of labour and market situation before selecting an alternative pre-plant fumigant, noting that "actual costs and returns will vary from grower to grower due to market situation, labour supply, age and condition of equipment, managerial skills, and many other factors". *Contact: Mr. Michael W. Neff, American Society for Horticultural Science, United States of America. Tel: +1 (703) 8364 606; E-mail: mwneff@ashs.org.* (Website: www.eurekalert.org)

Vineyard soil fumigation alternatives to methyl bromide

Methyl bromide (MB) or Telone (1,3-dichloropropene or 1,3-D) is used for soil fumigation by the grape growers in central California, the United States, to control nematodes and other soil-borne pests. Regulations are being developed and modified to limit total fumigant emissions (including 1,3-D) in townships and require larger buffer zones to reduce potential exposure to farm workers and bystanders. More stringent regulations on fumigant emissions are likely to be issued in the near future to protect air quality. However, no emission information is available in the literature on 1,3-D and chloropicrin (CP) volatilization losses under grape replant situations.

The project is part of the USDA-ARS Pacific Area-Wide Pest Management Programme for Methyl Bromide Alternatives. The overall goal of the project is to determine, in grapevine replant situations, the needs and alternatives for soil fumigation with MB for controlling plant pathogens and parasitic nematodes, lowering emission losses, and evaluating responses in vine growth. In this second year of the five-year project, preliminary results have exhibited nematode control in all fumigated plots, but not in the non-fumigated plots. Effective control was found for *Pythium,* but not for *Fusarium* (except in MB treatment). Reductions in fumigant emissions were achieved with virtually impermeable films. (Website: www.ars.usda.gov)

Technology versus wood pest spread developed

In the Philippines, an agency of the Department of Science and Technology (DoST) has developed a technology that could help eliminate pest spread in the industries relying heavily on wood as raw material. DoST's Forest Products Research and Development Institute (FPRDI), in a joint project with Nippon Express Phils. Corp., has come up with a heat treatment (HT) technology using a 1,000-board feet capacity furnace type timber dryer. "HT requires that the pallet's wood core be treated at 56ºC for 30 minutes. We found in our study that the optimum HT time was 5 hours and average operation cost is 46 per cent cheaper than methyl bromide (MB) fumigation", Mr. Robert Natividad, an FPRDI forester, disclosed. FPRDI, however, said MB fumigation is hazardous to human health, as it is 60 times more damaging to the ozone layer than chlorine and is responsible for 5-10 per cent of the ozone depletion. "Further, it renders wood non-recyclable", FPRDI revealed. (Website: www.articlearchives.com)

Ethylene oxide used to fumigate corrosion promoting microbes

AlliedSignal Inc., the United States, has patented a method of fumigating a closed system susceptible to microbially influenced corrosion. The system may contain articles or means wherein aqueous media is contained or through which aqueous media flows. The method consists of exposing the surfaces of the article or means or to an effective amount of a fumigant for an effective period. In one embodiment of the method, the fumigant consists of a non-inflammable blend of ethylene oxide and an inert carrier gas. In another embodiment, the method comprises humidifying the system to about 30-90 per cent (preferably 50-80 per cent) relative humidity prior to introducing the fumigant. In yet another embodiment, the method comprises adding heat to the system to accelerate the biocidal activity of the fumigant. (Website: www.freepatentsonline.com)

RECENT PUBLICATIONS

Technology Transfer for the Ozone Layer: Lessons for Climate Change

This book tells how the Montreal Protocol, the most successful global environmental agreement so far, stimulated the development and worldwide transfer of technologies to protect the ozone layer. Technology transfer is the crux of the 230 international environmental pacts and is essential to fighting climate change. While debate rages about obstacles to technology transfer, until now there has been no comprehensive assessment of what actually works to remove the obstacles. The authors, leaders in the field, assess more than 1,000 technology transfer projects funded under the Montreal Protocol's Multilateral Fund and the Global Environment Facility, and identify lessons that can be applied to technology transfer for climate change.

Contact: Earthscan Ltd., Dunstan House, 14a St., Cross Street, London EC1N 8XA, United Kingdom. Tel: +44 (20) 7841 1930; Fax: +44 (20) 7242 1474; E-mail: earthinfo@earthscan.co.uk.

Cryogenic Mixed Refrigerant Processes

This guide explains all the aspects of mixed refrigerant processes utilizing robust analytical methods based on sound thermodynamic tenets, drawing upon many case studies and examples, largely unpublished, to teach:

- The need for refrigerant mixtures;
- The different processes than can be used in refrigeration and liquefaction systems; and
- The methods for simulating and optimizing cryogenic processes.

Contact: Springer Asia Ltd., Unit 1703, Tower I, Enterprise Square, 9 Sheung Yuet Rd., Kowloon Bay, Hong Kong. Tel/Fax: +852 2723 9698/2724 2366; E-mail: maurice.kwong@springer.com.

TECH EVENTS

19-20 May
Hamburg
Germany
Blowing Agents and Foaming Processes 2009
Contact: Conference Department, Smithers Rapra Technology Limited, Shawbury, Shrewsbury, Shropshire SY4 4NR, The United Kingdom.
Tel: +44 (1939) 250 383;
E-mail: conferences@rapra.net.

20-22 May
Taiwan
China
The 4th Asian Conference on Refrigeration and Air-conditioning 2009
Contact: Prof. Yang-Cheng Shih, Secretary General of ACRA 2009, Department of Energy and Refrigerating Air-conditioning Engineering, National Taipei University of Technology, 1, Sec. 3, Chung Hsiao E Road, Taipei 10608, Taiwan, China.
Tel: +886 (2) 2771 2171, ext. 3501;
Fax: +886 (2) 877 33713;
E-mail: acrataipei@acrt.org.tw.

23-26 Jun
Boulder
United States
IIR Conference on Thermophysical Properties and Transfer Processes of Refrigerants
Contact: Conference Secretariat, United States of America.
Tel: +1 (301) 9755 868;
E-mail: david.yashar@nist.gov.

27-29 Aug
Ho Chi Minh City
Viet Nam
RAHV Viet Nam
Contact: Top Repute Co. Ltd., Room 2403, Fu Fai Comm. Centre, 27 Hillier Street, Sheung Wan, Hong Kong.
Tel: +852 2851 8603;
Fax: +852 2851 8637;
E-mail: topreput@top-repute.com;
Website: www.toprepute.com.hk.

7-11 Sep
Bangkok
Thailand
RHVAC 2009
Contact: Thai Trade Fair, 22/77, Rachadapisek Road, Chatuchak, Bangkok 10900, Thailand.
Tel: +66 (2) 5116 020;
Fax: +66 (2) 5116 008-10;
E-mail: titfd@depthai.go.th.

14-17 Oct
Jakarta
Indonesia
AIRCON INDONESIA 2009
Contact: PT. Pamerindo Buana Abadi, Deutsche Bank Building, 13th Floor, Jalan Imam Bonjol No. 80, Jakarta 10310, Indonesia.
Tel: +62 (21) 316 2001;
Fax: +62 (21) 316 1981;
E-mail: info@pamerindo.com;
Website: www.pamerindo.com.

PUBLICATIONS from APCTT

PERIODICALS

(Free access at www.techmonitor.net)

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- ❑ VATIS Update (6 issues/year)
  - ❍ Biotechnology (e-version)
  - ❍ Non-conventional Energy (e-version)
  - ❍ Food Processing (e-version)
  - ❍ Ozone Layer Protection [#] (e-version)
  - ❍ Waste Management (e-version)

BOOKS	Indian Rupees* (India, Bhutan and Nepal)	US Dollars*
❑ Managing Innovation for the New Economy: Training Manual, 2002 Volume 1: How to Guide & Quick reference materials Volume 2: Articles & Lectures	1,000.00	50.00
❑ Regional Capacity-building for the Adoption of ISO-14000 and Transfer of Environmentally Sound Technology: Training Manual, 2000	600.00	30.00
❑ Small Rural Industries in the Asia Pacific Region: Enhancement of Competitiveness of Small Rural Industries in a Liberalized Economic Environment and the Impact of Poverty Alleviation, 2000	600.00	30.00
❑ Technology Transfer and Technological Capacity-building in Asia and the Pacific		
❍ Volume 1: Big Countries and Developed Economies, 1999	600.00	30.00
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❑ Rural Industrialization as a Means of Poverty Alleviation: Report of the Regional Seminar on the Enhancement of Partnerships among Governmental, Non-governmental and Private Sector Entities for the Promotion of Rural Industrialization for Poverty Alleviation, 1999	600.00	30.00
❑ Institutional Development for Investment Promotion and Technology Transfer, 1999	500.00	25.00
❑ Ozone Depletion Substances Phase-out Technologies: Problems & Issues on Technology Transfer, Absorption and Generation, 1998	300.00	15.00
❑ Development and Utilization of S&T Indicators: Emerging Issues in Developing Countries of the ESCAP Region, 1998	300.00	15.00
❑ ODS Phase-out: A Guide for Industry, 1998	500.00	25.00
❑ Proceedings of the Consultative Meeting on Technology Management Education and Training for Developing Countries, 1997	800.00	40.00

Notes: Amount less than Rs 500 should be sent through a demand draft only. Otherwise, payment should be made by cheque/ demand draft/UNESCO coupon in favour of the Asian & Pacific Centre for Transfer of Technology, payable at New Delhi.

[#] Print version supported by the Ozone Cell, Ministry of Environment & Forests, Government of India, for distribution to a select target group.

** Amount to be sent to APCTT with the order for covering costs and handling charges.*