VATIS Update Ozone Layer Protection ▪ May-Jun 2003

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THE SCIENCE OF OZONE LAYER

Polar ozone depletion slows

A report by researchers at the Johannes Gutenberg University and Max Planck Institute for Chemistry, Germany, reveals that mild temperatures in the polar atmosphere did not allow for the normal conditions under which chemical reactions would have led to ozone layer depletion. According to Mr. Joachim Curtius, the ozone layer was depleted by about 30 per cent between last winter and this fall, a normal rate at which ozone can be replaced. Mr. Curtius added that reduced emissions of CFCs have had no impact on the slowing of the ozone layers reduction. He estimates that it could take more than 50 years for CFC phase-out to have an effect.

Website: www.thestar.com

New data on ozone layer

The Improved Limb Atmosphere Spectrometer II (ILAS-II), an ODS monitoring sensor equipment developed by the Ministry of Environment, Japan, has been installed on-board the Advanced Earth Observing Satellite II to record data on Earths dented protective layer. This unit can concurrently measure the vertical profiles of various ozone depleting substances and is expected to provide data that will help clarify the mechanism of ozone depletion. ILAS-II obtained data during the initial checkout conducted in late January for confirming the functions of the sensor, which were then processed and analysed by the National Institute for Environmental Studies (NIES), Japan.

ILAS-II was shown to be functioning normally as planned and capable of accurately measuring the respective atmospheric trace species such that the vertical profiles of their concentrations can be satisfactorily retrieved. NIES succeeded in retrieving the vertical profile of the concentrations of ozone and other atmospheric trace species measured over an altitude range of approximately 15-50 km over Arctic Greenland

and the Antarctic Syowa Station of Japan.

Contact: Research and Information Office, Policy and Coordination Division, Global Environment Bureau, Ministry of Environment, Japan. Tel: +81 (3) 5521 8247; Or Satellite Remote Sensing Research Team, Ozone Layer Research Project, NIES, Japan. Tel: +81 (29) 8502 800;

E-mail: ilas2prj@sun61a.nies.go.jp.

Website: www.ilas2.nies.go.jp

Proof of ozone holes detrimental effect

A team of researchers from Otago University and the University of New Hampshire in the United States has discovered that ultraviolet (UV) radiation is penetrating 2.5 m thick sea ice and harming organisms living underneath. In the absence of ozone layer as a filter, UV radiation is deforming and killing tiny sea urchins deep under the Antarctic ice. Some eggs laid by sea urchins are being grossly deformed, their usual near-perfect circular shape distorted like a badly burned human body while others are dying. Protective screens installed in some areas have proved that UV is lowering the survival rate of newly hatched eggs by 30-40 per cent. In areas where there was no sea ice, thus exposing eggs on the sea surface, none survived. According to Dr. Miles Lamare of Otago University, these results are highly conservative since the ozone hole over Antarctica this summer was much weaker than in the previous few years. Dr. Steve Wood from the National Institute of Water and Atmospheric Research opines that the world ban on using CFCs in aerosols and refrigerators would eventually restore ozone to protective levels, but this will take over 50 years.

Website: www.nzherald.co.nz

Annual fluctuations in Arctic ozone loss

In the United States, a research team analysing data from the Microwave Limb Sounder on NASAs Upper Atmosphere Research Satellite reports to have uncovered that ozone depletion over the Arctic region varies widely from year to year in its amount, timing and pattern of loss. These findings are the first consistent, 3-D pictures of ozone loss during several Arctic winters confirming past Arctic ozone loss variations. Now scientists can better understand current Arctic ozone conditions and predict accurately variations in the future.

The team re-analysed Microwave Limb Sounder observations during seven Arctic winters (1991-2000) to estimate chemical ozone loss. They designed a model to account for naturally occurring ozone variations resulting from atmospheric transport processes such as wind variability. Their results show large year-to-year variability in the amount, timing and patterns of Arctic ozone loss. Variations in the size, location and duration of the Arctic vortex are driven by meteorological conditions. High mountains and land-sea

boundaries in the Northern Hemisphere interact with wind variations to generate vast atmospheric undulations that displace air as they travel around Earth. These waves form in the troposphere, where they produce winter storms, and propagate upward, depositing their energy in the stratosphere. Energy from these waves warms the stratosphere, suppressing formation of polar stratospheric clouds necessary for ozone destruction. Arctic ozone loss tends to be greatest in years when these wave motions are unusually weak. This explains the observed difference between Antarctic and Arctic ozone depletion patterns.

Websites: www.mls.jpl.nasa.gov, www.sciencedaily.com

ODS PHASE-OUT IN INDIA

Changes in ITC (HS) list of export and import items

A notification issued by the Ministry of Commerce provides information regarding the latest amendments made in the ITC (HS) Classifications of Export and Import Items 1997-2002. Notification No. 5 (RE-2000)/1997-2002 lists the item details, policy and nature of restrictions as indicated below:

Code 2902 in Table B Schedule 2

Item: Chemicals included in Annex A and B to the Montreal Protocol on substances that deplete the ozone layer as specified in Schedule 2 Appendix 5 of this book.
Policy: Restricted.
Nature of restriction: Exports permitted under licence subject to the condition that the export is made to a country which is a party to the Montreal Protocol on Substances that Deplete the Ozone Layer. However, export to nations which are not parties to the Montreal Protocol is prohibited.

Existing Appendixes 3, 5, 5A, 6 and 8 in Schedule 2 shall stand deleted.
The Appendix 3 as contained in Annex to this Notification shall be inserted as Appendix 3 in Schedule 2.
The existing Appendix 7 in Schedule 2 shall be renumbered as Appendix 5.

Website: www.kalalchennai.tn.nic.in

Ratification of amendments to Montreal Protocol

India is implementing a Country Programme to phase out ODS in accordance with its national industrial development strategy since 1993 and with a commitment to comply with the phase-out schedule laid down by the Montreal Protocol for different ODSs. India has already phased out halon production and indigenous production of CFCs has to date been reduced by 3,718 MT. About US$127 million has so far been obtained from the Montreal Protocol Multilateral Fund for implementing 347 projects to phase out about 12,000 ODP tonnes.

The Montreal Protocol has been amended four times in order to strengthen its provisions. All of these amendments have come into force with the required number of Parties having already ratified them. The London Amendment of 1990, which had established the financial mechanism for implementation of the Protocol, was ratified by India in 1992. The Copenhagen Amendment of 1992 mandates phase-out of

consumption of HCFCs, HBFCs and production as well as consumption of methyl bromide. Consumption of HCFCs is to be frozen by 2016 at the 2015 consumption level and achieve 100 per cent phase-out by 2040. Control measures for HCFCs and HBFCs have already been included in the ODS (Regulation and Control) Rules, 2000. Ratification of the above two amendments would not require any fresh legislation for carrying out its obligations. Also, India will be able to trade in HCFCs with other Parties, which have ratified the amendments. As such, the Union Cabinet approved a proposal for the ratification of the Copenhagen and Montreal Amendments. Beijing Amendment appends bromochloromethane to the phase-out schedule and extends control of production of HCFCs. It also imposes a ban on trade with non-Parties and decrees the reporting of methyl bromide data for quarantine and pre-shipment applications, which India will hereafter have to report and comply.

India has also ratified the Copenhagen, Montreal and Beijing Amendments on 3 March 2003.

For details of the implications, please visit Website: www.unep.org

New range of frost-free refrigerators

As part of Electrolux Kelvinators aggressive growth plans, the company has announced its next phase of brand management that engages its new brand positioning, Nurturing Hopes, Nourishing Life, and brand strategy after having recently integrated its brands. The new positioning and strategy aim to establish a strong multi-category presence in home appliances, ensuring top-of-the-line superior products for consumers. Topmost in line is the Ozone range of refrigerators featuring the worlds first Life Nourishing System (LNS). The Ozone range of refrigerators is CFC-free and in agreement with the Montreal Protocol. The company plans to offer a range of home appliances of LNS category, which are based on a combination of cutting-edge technology and incisive consumer insights. The initial launches include Aquaflow refrigerator range and Washy Talky washing machine.

Ergonomically designed with a sleek exterior, the Ozone comes with a host of first-ever features and is targeted at consumers who seek pride in owning a new age frost-free refrigerator, prefer fresh and tastier food, superior performance, user-friendly and stylish products. The Ozone range of refrigerators is available in two sizes, 230 l and 270 l, in two variants, premium and luxury.

Website: www.domain-b.com

CFC phase-out scenario

Six months ahead of the January 2003 deadline, India has effectively banned the use of ODSs like CFCs. However, the job is far from completion. Mr. Sanjay Malhotra, Managing Director of an aerosol company, opines that alternatives used currently do not fully satisfy the requirements of the Montreal Protocol. Furthermore, the suggested new alternative for the aerosol industry, hydrocarbon aero propellants or HAPs, is a highly refined form of LPG and is not adequately available. As such, LPG is used in place of the expensive

HAPs.

The Government of India says that there is a detailed country programme to phase out ODS without undue economic burden on both industry and consumers. The government has decided to grant full exemption from payment of customs and excise duties on capital goods required for ODS phase-out projects funded by the Montreal Protocol Multilateral Fund. The Ministry of Environment and Forest (MoEF), in accordance with the national strategy for ODS phase-out, has notified the Ozone Depleting Substances (Regulation and Control) Rules, which came into effect in July 2000. These rules seek to regulate and eventually eliminate the use of substances such as CFCs, halons and methyl bromide, which are known to contribute to thinning of the ozone layer as well as to global warming. The rules are in line with the Montreal Protocol, an international treaty to protect Earths blanket cover. Failure to comply with the rules will result in action under the Environment Protection Act.

Website: www.dailyexcelsior.com

IN THE NEWS

MLF approves US$52 million

The Executive Committee of the Multilateral Fund has approved plans to provide US$52 million for 50 developing countries in lieu of their efforts to phase out around 8,000 tonnes of ODS. At a time when the use of public funds for international efforts is under increasing scrutiny and critical analysis, the Fund provides an example of how the effective management of public finance can achieve internationally negotiated goals within specific deadlines, it stated.

Website: www.unepie.org

Papua New Guinea obtains funds for ODS phase-out

The Multilateral Fund for Implementation of the Montreal Protocol has awarded a US$990,000 grant to Papua New Guinea for phasing out ODS. According to Mr. Zibe Sasa, the countrys Minister for Environment and Conservation, the money will be utilized to comply with the Montreal Protocol phase-out requirements. Papua New Guineas air-conditioning and refrigeration servicing sectors are responsible for over 90 per cent of the nations total ODS consumption.

Website: www.goasiapacific.com

The Philippines signs pact for MLF funds

The Philippines has signed the Ozone Projects Trust Fund Grant Agreement Amendment in order to access funds from the World Banks Multilateral Fund (MLF). It has also endorsed a Memorandum of Agreement to formalize the financing arrangement for the Philippine National CFC Phase-out Plan (NCPP) with the

LandBank of the Philippines. According to the Environment Secretary Ms. Elisea Gozun, These crucial agreements will jump-start the implementation of NCPP, which is the product of a careful study by the Department of Environment and Natural Resources (DENR), with the help of international experts, to identify problem areas in sectors that will be affected by the shift to ozone-friendly chemicals.

DENR, through the Philippine Ozone Desk of its Environmental Management Bureau, is mandated as the lead government agency for implementing NCPP. The agreement calls for DENR, among others, to identify companies/industries that are eligible to receive the grant, and review project proposals that ensure application of cost-effective and environmentally sound technologies. The World Bank, acting as the trustee of the Ozone Trust Fund, requires the service of a government financial intermediary, which in this case is the LandBank, to act as co-implementing agency to facilitate the flow of funds.

Website: www.abs-cbnnews.com

Dupont in joint venture with Chinese firms

Dupont Fluoroproducts has signed a Letter of Intent (LOI) with two companies based in China for manufacturing hydrofluorocarbon (HFC) refrigerants. Blends produced by the joint venture between Dupont, Zhonghao New Chemical Material Co. and Changshu 3F Fluorochemical would be utilized to support the air-conditioning and refrigeration industry in China. According to Dupont, HFC blend refrigerants are widely recognized as accepted replacements for ozone depleting refrigerants. Under the terms of the LOI, Dupont will cooperate with Zhonghao to produce HFC-404a, HFC-407c and HFC-410a refrigerant blends, products for which Dupont has global patent rights. Refrigerants manufactured by the joint venture will be marketed in China and other Asian nations under the Dupont Suva brand. Dupont will be the majority owner of the joint venture, which is expected to be formed later this year.

Website: www.e4engineering.com

European Commission certifies eco-friendly refrigerator

LG Electronics, based in the Republic of Korea, was awarded the Eco Label tag by the European Commission for its built-in-type refrigerator model GR-171. LG is the first non-European company to win the Commissions accredited environmental certification. Eco label certifies that the product is environmentally friendly, saves energy, as well as helps preserve the ozone layer and prevent global warming. The development of an eco-friendly compressor that does not emit gases affecting the ozone layer or accelerate global warming led to the Eco label certification.

Website: www.times.hankooki.com

R-410a refrigerant in PACs

Daikin Industries Ltd., Japan, has announced its plans to use high-pressure R-410a refrigerant in place of the

current R-407c in all its packaged air-conditioners (PACs). Initially, the company will adopt the new refrigerant in Ve-upll (seven basic models of outdoor unit) range of refrigerators that feature top energy saving performance. Daikin intends to adapt R-410a refrigerant in all ACs ranging from RACs to large ACs (corresponding to 100 hp).

In the field of PACs, R-410a has been employed in commercial units up to 10 hp, though units using R-407c are still available. For adapting R-410a, it is necessary to change the units specifications owing to higher working pressures. Daikin is the first company to adapt R-410a in the field of large AC systems such as building AC systems, having so far incorporated it in models up to 16 hp. By a combination of outdoor units, it is possible to configure up to 48 hp systems.

Website: www.jarn.co.jp

Indonesia to be ODS-free ahead of phase-out deadline

According to Indonesias Ministry of Environment, the country would be able to comply with its 2007 phase-out schedule for ODS three years ahead of the Montreal Protocol deadline. The government has implemented an awareness campaign, as well as programmes that provide incentives to eliminate ODS use and to transfer alternative technologies from developed nations. So far, the focus has been on aiding large firms to eliminate ODS. The next step would be to help small and medium enterprises and stop ODS imports. To become ODS-free, Indonesia has to phase out about 2,900 t of ODS.

Contact: Ms. Ina B. Pranoto, State Ministry for Environment, Ozone Unit, Indonesia.

E-mail: ozonenet@cbn.net.id

OzonAction Newsletter, No. 43, December 2002

REFRIGRATION/AIR-CONDITIONING

HFC-free freezer

Frisko Is, Denmarks largest supplier of quiescently frozen ice-cream products, has developed an eco-friendly freezer that could minimize the effects of global warming. Frisko developed the freezer with cooperation from the Danish Technological Institute and Greenpeace. The new unit uses hydrocarbons, a natural coolant also known as a common household gas, and is easily recognizable by their sticker label HFC-free Freezer - Better for the Environment. Frisko plans to join hands with its parent company, Unile ver, for marketing the freezers worldwide.

Website: www.cphpost.periskop.dk

New SNAP alternatives

In the United States, the Environmental Protection Agency (EPA) has added seven new alternatives for CFC- and HCFC-based refrigerants under its Significant New Alternatives Policy (SNAP) programme. R-404a and R-507a are intended for use in new or retrofit systems as a substitute for HCFC-22 and other HCFC blends including, but not limited to, R-401a, R-401b, R-402a, R-402b, R-406a, R-408a, R-409a, R-411a, R-411b, R-411c, R-414a, R-414b and R-416a. While R-404a is a blend of 44 per cent HFC-125, 52 per cent HFC-143a and 4 per cent HFC-134a by weight, R-507a is a blend of 50 per cent each of HFC-125 and HFC-143a. Application areas for both substitutes include retail food refrigeration, commercial ice machines, cold storage warehouses, refrigerated transport, ice-skating rinks, water coolers, vending machines, industrial process air-conditioning, reciprocating chillers, screw and centrifugal chillers, industrial process refrigeration, very low-temperature refrigeration and non-mechanical heat transfer units.

R-24 can be used as a CFC-12 substitute in new or retrofit systems. Application areas include industrial process refrigeration and air-conditioning, ice-skating rinks, cold storage warehouses, retail food refrigeration, refrigerated transport, water coolers, vending machines and commercial ice machines. NU-22 has been added as an accepted alternative for R-502 in industrial process refrigeration and air-conditioning, cold storage warehouses, refrigerated transport, retail food refrigeration, commercial ice machines, vending machines, water coolers and ice-skating rinks. This blend of 46.6 per cent HFC-125, 50 per cent HFC-134a and 3.4 per cent n-butane can be used in new or retrofit systems. R-414b is for use in new or retrofit systems as a replacement for CFC-12 and CFC-114 in industrial process air-conditioning. Available under the brand name HotShot, R-414b is a blend of 50 per cent HCFC-22, 39 per cent HCFC-124, 1.5 per cent R-600a (isobutane) and 9.5 per cent HCFC-142b.

R-407c can replace HCFC-22 and other HCFC blends including, but not limited to, R-401a, R-401b, R-402a, R-402b, R-406a, R-408a, R-409a, R-411a, R-411b, R-411c, R-414a, R-414b and R-416a. It can be used in new or retrofit systems in retail food refrigeration, cold storage warehouses, refrigerated transport, commercial ice machines, ice-skating rinks, vending machines, water coolers, industrial process air-conditioning, reciprocating chillers, screw and centrifugal chillers, industrial process refrigeration, very low-temperature refrigeration and non-mechanical heat transfer. R-407c is a blend of 23 per cent HFC-32, 25 per cent HFC-125 and 52 per cent HFC-134a by weight.

R-410a is for new systems as a substitute for all HCFC blends including, but not limited to, R-401a, R-401b, R-402a, R-402b, R-406a, R-408a, R-409a, R-411a, R-411b, R-411c, R-414a, R-414b and R-416a. This blend of 50 per cent HFC-32 and 50 per cent HFC-125 by weight can be used in retail food refrigeration, cold storage warehouses, refrigerated transport, commercial ice machines, ice-skating rinks, vending machines, water coolers, industrial process air-conditioning, reciprocating chillers, screw and centrifugal chillers, industrial process refrigeration, very low-temperature refrigeration and non-mechanical heat transfer systems.

Website: www.environ.com

Samsung opts for ODS-free refrigerant

Under a four-year agreement with the European company Honeywell Fluorine Products, Samsung of the republic of Korea will convert its air-conditioning equipment to AZ-20 (R-410a), Honeywells patented replacement for R-22 in new air-conditioners. Apart from supplying refrigerant for charging and servicing equipment, Honeywell will also provide support in system R&D, manufacturing, plant conversion and service-technician training. AZ-20 offers thermodynamic properties that allow it to be more energy-efficient than most other substitutes. Global phase-out of ozone depleting refrigerants is continuing at an accelerated pace and Honeywell is at the forefront of this trend, by developing new refrigerant solutions as well as by investing in new manufacturing capacity to meet the needs of businesses and consumers.

Website: www.engineeringtalk.com

High-speed filling systems

Agramkow Fluid Systems A/S, Denmark, offers a range of high-speed fluid filling systems as well as complete factory information and testing systems. The fluid filling models include refrigerant charging stations called EMAC, MACH1, SARAtronic, SARAtronic-2, refrigerant supply systems (RSS series) and safety supervision system (SAFE-IR).

The EMAC evacuation and charging stations offer various features to fulfil demands within the refrigeration and air-conditioning industry. Different EMAC models ensure high charging accuracy within refrigerator production and high charging speeds in the production of air-conditioners. Like other systems such as SARAtronic charging stations, EMAC can handle HFC refrigerants (R-134a, R-404a, R-407c, R-410a) and R-22.

Website: www.jarn.co.jp

CFC-free and super-efficient refrigeration technology

In the United States, researchers from Research Triangle Institute in North Carolina, report to have developed a CFC-free, super-efficient prototype refrigeration system that uses electricity to push heat towards one end of the circuit, thereby cooling the other end. About the size of a large postage stamp, the device comprises a semiconductor chip containing about 1,000 layers of nano-scale films of alternating semiconductors, encased between two thin translucent crystals. Lab-scale tests have shown that the device cools a block of solid steel from 26C to about 18C within two minutes, which is faster than feasible with a conventional counterpart. Moreover, this unit can be used to generate electricity from heat.

Website: www.greenbiz.com

SOLVENTS

CO2-based dry cleaning

ICI, the United Kingdom, and Linde Gas of Germany have developed Washpoint, a new garment cleaning solution based on carbon dioxide (CO2). The product offers better fabric protection and less likelihood of setting of difficult stains than traditional ozone depleting solvents used in dry cleaning. It employs a combination of CO2 and a revolutionary cleaning booster to cleanse the full range of items washed using conventional solvents. As CO2 used in Washpoint is obtained from natural sources or is a by-product of existing industrial processes, only small amounts of energy is required to compress and distribute the CO2 and as such does not add to global warming.

Contact: Linde Gas, Germany. Tel/Fax: +49 (89) 7446-0/7446 1144

E-mail: Juliane.elze@linde-gas.com

Website:www.linde-gas.com

OzonAction Newsletter, No. 43, December 2002

PCB flux residue cleaners

Surface Mount Technology, the United Kingdom, is offering SPR2000 series of semi-aqueous flux cleaners for PCBs. Surclean SPR2050 formulation is for fast and easy removal of flex residues and other soils from electronic assemblies. Cleaning is achieved by a powerful custom-synthesized aprotic solvent combined with dual action saponifiers. The CFC-, HCFC- and phosphate-free SPR2050 has been tested for excellent compatibility with plastics, component markings, encapsulants and varnishes.

A unique chemistry allows for low pH level, thus lowering the risk of dullness or damage to soldered joints and sensitive metals. Following cleaning, SPR2050 can be quickly and easily rinsed off from the assembly. It is exceptionally economical to use, notably in batch type single or multi-tank systems, where it will continue to clean even when heavily saturated with flux residue. Special wetting agents allow SPR2050 to clean under connector quad flat packs and BGAs without mechanical agitation.

SPR2100 is a strong semi-aqueous cleaner based on the successful SPR2050 chemistry, but specified at a higher active solvent concentration level for enhanced removal rates of flux residues and other soils, including some hard to clean no-clean types. Its low foaming traits make it especially suitable for use in single or multi-tank batch type cleaning systems. SPR2100 is available ready diluted with high purity deionized water or in concentrated form, allowing the user to vary the dilution ratio to a level that would give

acceptable cleaning results.

SPR2300 is a strong semi-aqueous formulation based on a combination of the exclusive Surclean aprotic solvent technology and a blend of water miscible solvents with dual action saponifiers. It is available with added low-foam surfactant for single and multi-tank batch type cleaning systems or with minimal surfactant for use with fully automatic dishwasher type systems. Unlike others in this series, SPR2300 is used at full strength for maximum effectiveness.

Key features of the SPR2000 series include:

Powerful aqueous formulation that is fast and easy to use;
Can be used with a wide range of cleaning methods, from bench-top soak applications through to dishwasher type systems and large automatic in-line equipment;
Non-volatile, non-inflammable, odour-free and low toxicity for maximum operator comfort and safety;
Ultra-low surface tension allows penetration under connectors and all component types
including QFPs and BGAs;
Long shelf-life and does not require special storage conditions, providing it is stored in the original containers and kept out of direct sunlight;
Zero-VOC, ozone-friendly and completely biodegradable; and
Can be used at ambient temperatures through to about 36C.

Contact: Surface Mount Technology, Samuel Whites Industrial Estate, Medina Rd., Cowes, Isle of Wight PO31 7LP, the United Kingdom. Tel: +44 (01983) 290 333; Fax: +44 (01983) 295 499

E-mail: surclean@smt.uk.com

Non-abrasive cleaning system

Researchers at NASAs Kennedy Space Centre, the United States, have designed an eco-friendly supersonic cleaning system. Developed as an alternative to using CFC-based solvents, a major benefit of the new system over other pressurized cleaning methods is that it does not abrade the surface of the hardware being cleaned. It requires much lower levels of pressure and uses very little water (less than 100 ml/min.). These features allow the system to be employed to clean anything from small electronic circuit boards to larger historic monuments and buildings.

Contact: Technology Programmes and Commercialization Office, DE-TPO, Kennedy Space Centre, Florida 32899, the United States. Tel: +1 (407) 8673 017.

Website: www.cleaning.com

New cleaners

Poly Systems Inc., based in the United States, is offering Solvon range of solvents for use in various industrial

applications. The cost-effective substitutes for chlorinated, fluorinated, CFC or HCFC solvents facilitate smooth switch-over with least process interruption. Solvon PB and Solvon IP are powerful solvents used for cleaning and degreasing. While Solvon PB exhibits similar characteristics and physical properties as other halogenated solvents like 1,1,1-trichloroethane and trichloroethylene, Solvon IP is an azeotrope-like blend that is milder than Solvon PB but better equipped to remove and clean water-soluble particles and ionic residue. Both the products can be used in existing vapour degreasing equipment after minimal adjustments and can replace 1,1,1-TCA, TCE, HCFC-141b and other cleaning solvents.

Solvon PBA is a stabilized, low-moisture, high-purity n-propyl bromide-based solvent especially formulated for use in adhesive coatings and sealant applications (The ozone depleting potential of n-propyl bromide is not clear at present - Editor). It contains a proprietary stabilizer that prevents breakdown of the base solvent in the presence of water and metals. Solvon PBA can be utilized in the production process of numerous solvent-based contact elements, adhesives, rubberized undercoating, rubber cement, white out coatings and sealants. It has characteristics similar to 1,1,1-trichloroethane, but without the latters adverse effect on the environment.

Solvon DR is a powerful solvent for water removal/drying operations, and exhibits characteristics and physical properties similar to 1,1,1-trichloroethane and trichloroethylene. A rinseable inhibitor prevents breakdown of the base solvent in the presence of water and metals. Application areas include drying solvent, precision drying, metal/glass and ceramic drying, automotive parts drying, drying after plating and drying after water-based operations like water-based cleaning.

Solvon FB series of proprietary solvent blends comprise high-purity n-propyl bromide and pentafluorobutane. Specifically formulated to replace solvents like CFC-113, HCFC-141b and HCFC-225ca/cb, these products are compatible with a wide range of substances, including plastics and elastomers. Solvon FB2, FB5 and FB7 are tailored for cleaning and deposition applications, and can be used as a vehicle to deliver and deposit various dispersion mixtures like lubricants and coatings.

Solvon AER is a stabilized, low-moisture, high-purity n-propyl bromide blend formulated for use as an aerosol cleaner and adhesion promoter. It contains a special stabilizer package, which conforms with all the standard blends in use throughout the aerosol industry. Solvon AER can be applied by aerosol as a non-inflammable carrier solvent, cleaner-degreaser and adhesion promoter. Its uses include metal and electronic precision cleaning, as well as deposition and application of lubricants, adhesives and coatings.

Contact: Poly Systems Inc., 39 Ave. C., P. O. Box 49, Bayonne, NJ 07002, the United States. Tel: +1 (201) 4371 628; Fax: +1 (201) 4370 366

E-mail: sales@solvon.com

Website: www.solvon.com

Non-CFC cleaning solvent

Aoki Laboratories Ltd., Hong Kong, China, offers Enviro Cleaners that fulfil ISO 14001 requirements and could be used in various soldering applications. These super-strong, non-CFC, halide-free, non-corrosive cleaners are designed to replace HCFC-141b. Manufactured using the latest ingredients, the new cleaners evaporate completely at room temperature without leaving behind any residue. Application areas include:

SMT pinhole cleaning can replace alcohols, degreaser, HCFC-141b, toluene and other organic solvents;
Suitable for any cleaning device such as ultrasonic bath, hot spray or cold cleaning, etc.;
Removes SMT flux residue solvating power far better than IPA and less irritating;
Replacement solvent for 1,1,1-TCE, HCFC-141b, MC, IPA and cleaning solvents widely used in ultrasonic bath;
Removes all flux residues; and
Suitable for cleaning any kind of electronic part.

Contact: Aoki Laboratories Ltd., G/F., Tung Ming Industrial Bldg., No. 3, Sang Yick Lane, Tuen Mun, N.T., Hong Kong. Tel: +852 2498 9313; Fax: +852 2498 9692

E-mail: aoki@aokilab.com

Website: www.aokilab.com

New cleaning machines

Kerry Ultrasonics, the United Kingdom, offers low solvent consuming Microsolve cleaning systems and Microclean aqueous range. Microsolve units provide two-stage, multiple-frequency ultrasonic cleaning, rinsing and drying for PCB defluxing, cleaning of precision parts and metal degreasing. Optional accessories with this system include a superheat facility to ensure thorough drying of difficult components and a solvent monitoring/auto top-up feature that guarantees low solvent usage. For aqueous wash applications, Microclean series provide four-stage ultrasonic cleaning, closed-loop high-purity water rinsing and hot air drying. Microclean SC1000 is a fully automated spray wash and DI water rinse system with warm air-drying designed specifically to clean solder paste stencils.

Contact: Kerry Ultrasonics, Hunting Gate, Wilbury Way, Hitchin, Herts SG4 0TQ, the United Kingdom. Tel: +44 (1462) 450 761; Fax: +44 (1462) 420 712.

Website: www.manufacturingtalk.com

Cold degreasing products

IDC, the United Kingdom, offers a new range of cleaners, degreasers and diluents that can be used on all types of common metals and most plastics. Biosane products are free of 1,1,1-trichloroethane, dichloromethane, CFCs and perchloroethylene. They exhibit good toxicological criteria and ecotoxicology to

help protect the workforce and Earths ozone layer. Key features and uses of Biosane are listed below:

Low density and high separation powers for good settling of pollutants at the bottom of the tank;
The range of 18 products allows choice based on needs evaporation times, solvent power or flashpoint;
Low surface tension aids recycling and lowers the quantity used;
Many products can be used in open tanks; and
Formulated for specific tasks, which includes degreasing oils, cleaning uncured resins/adhesives/paints/inks and diluting many substances.

Contact: IDC, Wylds Road, Castlefield Industrial Estate, Bridgwater, Somerset TA6 4DD, the United Kingdom. Tel: +44 (1278) 727 270; Fax: +44 (1278) 425 644.

Website: www.manufacturingtalk.com

New cleaning liquid

Ohgitani Kogyo, Japan, offers hydrocarbon (HC)-based, non-aqueous solvents and vapour cleaning machine that works with HC-based solvents. The HC series comprises solvents developed by Tosoh. These eco-friendly replacements offer excellent solvency and can replace 1,1,1-trichloroethane and CFC-113.

These vapour cleaning systems with HC-based solvents, developed by Cleanvy, feature:

Two-step recycling process for vapour cleaning and vacuum drying, which enables low consumption of solvents thereby lowering operating costs;
Vacuum vapour cleaning and vacuum drying that ensures complete cleaning and drying; and
Deoxygenating system for solvents to improve the effects of ultrasonic cleaning.

Ohgitani also supplies cleaning units manufactured by Sharp Manufacturing System Co. Ltd. These cleaning machines employ the swing mechanism of ultrasonic vibration. It reflects ultrasonic waves in the tank and liquid surface, covering the entire surface of the object to realize efficient cleaning. The machine is equipped with micro-filter and heater-humidifier system. Sharps ultrasonic cleaning machine with HC-based solvents provides good cleaning performance and is suitable for precision cleaning of electric parts, printing plates and other precision processed goods.

Contact: Ohgitani Kogyo, 2-18, Nakanoshima 3-chome, Kita-ku, Osaka 530 0005, Japan. Tel: +81 (6) 6444 1521/1530; Fax: +81 (6) 6444 4930.

Website: www.ogico.co.jp

Metal cleaner

Virotec, the United Kingdom, offers a state-of-the-art metal cleaning machine, LM350, that reduces solvent usage. British Nuclear Fuels plc. achieved 98 per cent reduction in the use of trichloroethylene by adopting LM 350. The hermetically sealed unit requires only a fraction of the solvent used in open-top degreasing machines. Apart from raising cleaning standards, LM 350 can be used within a building because it does not emit any hazardous fumes and there are no emissions at the operator interface. The LM range and smaller CS range of totally enclosed metal cleaning machines are manufactured by Amalind, Italy.

Contact: Virotec, William Kelvin Bldg., Claylands Rd., Bishops Waltham, Hampshire SO32 1BH, the United Kingdom. Tel: +44 (1489) 897 304/309; Fax: +44 (1489) 894 382.

Website: www.manufacturingtalk.com

Solvent to extract flavours used in food products

The Essential Oil Co., the United States, offers the United Kingdom-based Wilde and Co.s Florasols. These exquisite oils capture the totality of fragrant materials, yielding a product true to the plants from which they are derived. The extraction system uses a family of benign, non-CFC gaseous solvents Florasol developed by many international chemical companies as replacements for ozone depleting CFCs. The Scientific Committee for Food of the European Commission approved an amendment to The Solvents Directive for including Florasol (R-134a), the solvent upon which the process is based, as an acceptable solvent for the extraction of flavours for use in food. Florasol is intrinsically safe and has also been approved by the FDA as a propellant for inhalers used by asthma sufferers.

Contact: The Essential Oil Co., 1719, SE Umatilla St. Portland, Oregon 97202, the United States. Tel: +1 (503) 8728 772; Fax: +1 (503) 8728 767.

Website: www.essentialoil.com

New co-solvent cleaning system

Kerry Ultrasonics, the United Kingdom, is offering a co-solvent cleaning system that helps PCB manufacturers boost productivity while consistently satisfying highly stringent standards of cleanliness. Microsolve 450 has more than halved the cycle time and completely eliminated the need for additional manual scrubbing of boards at a PCB production facility owned by Ultra Electronics. The new system removes flux residues and general contamination from a mixture of through-hole and SMT PCB assemblies. The majority of boards are made from standard FR4, although some feature PTFE and the largest measures 200 400 mm. The two-tank (four-stage) cleaning procedure begins with an immersion clean in hydrocarbon Promosol Topklean EL20A and 3Ms Novec HFE-71 IPA. This is followed by immersion and vapour rinses, before the boards undergo a freeboard dry.

Based on the type of PCBs to be cleaned, the first two stages operate with or without ultrasonics. The boiling action and properties of the co-solvent mixture in the first stage, combined with both rinse stages, ensure that a high level of cleanliness is maintained.

Contact: Kerry Ultrasonics, Hunting Gate, Wilbury Way, Hitchin, Herts SG4 0TQ, the United Kingdom. Tel/Fax:

+44 (1462) 450 761/420 712.

Website: www.manufacturingtalk.com

Biodegradable cleaner

TASK2 developed by Master Chemical Europe, the United Kingdom, cleans up carbon residue and oil-heavy as well as greasy soils. This product exceeds the requirements stipulated for internationally accepted standards of labelling as Readily Biodegradable, namely the OECD test method 301D. In the degradation test, TASK2 needed just half the time allowed by the standard. Safe for all metals, TASK2 is currently being market-tested with consumers for tough jobs around the home from automobile, boat and recreational vehicle care to backyard grills, even pre-treating greasy stains on laundry.

As an industrial degreaser, TASK2 is used in full strength from a convenient spray bottle or diluted in ultrasonic and agitated dip washers. TASK2 does not contain silicates, phosphates, phenols, boron, biocides, CFCs or other chlorinated compounds. It is non-toxic, non-inflammable, non-corrosive, non-caustic and butyl-free.

Contact: Master Chemical Europe, Maitland Road, Lion Barn Business Park, Needham Market, Suffolk IP6 8NZ, the United Kingdom. Tel: +44 (1449) 726 800; Fax: +44 (1449) 721 719.

Website: www.manufacturingtalk.com

AEROSOLS

New drug delivery system

Nektar Therapeutics, the United States, is offering patented technology for creating respirable, dry powders for efficient and reproducible delivery to the lungs. Pulmonary particle technology (PPT) can be used to create fine, aerodynamic drug particles of optimum size (1-3 m) and dispersibility by adjusting bulk powder properties, including geometric particle size and distribution, particle density, morphology, surface energy and surface roughness. Key advantages of PPT are:

Non-invasive delivery of injectable drugs;
Efficient and reproducible deep lung delivery;
Dose uniformity;
Greater lung deposition in a single breath up to 25 mg, compared with 2 mg or less for presently available inhalers;
Efficient, targeted treatment for lung disorders;
Rapid onset of action, delivering peak serum drug levels in as little as 10 minutes; and
Better formulation stability, including room

temperature stability for macromolecules.

Non-ozone depleting hydrofluoroalkane (HFA) propellants (both 134 and 227) could be utilized for metered dose inhalers.

Contact: Nektar Therapeutics, 150, Industrial Road, San Carlos, CA 94070, the United States. Tel: +1 (650) 6313 100; Fax: +1 (650) 6313 150

E-mail: nektar@ca.nektar.com

Website: www.nektar.com

New application for CFC-free albuterol

Ivax Corp., the United States, has submitted a new drug application to the Food and Drug Administration for approval to market albuterol sulphate using HFA propellant in a metered dose inhaler. Albuterol is a widely used beta-agonist bronchodilator for the relief of asthma symptoms and is the primary rescue medication for asthma sufferers.

Contact: Mr. Jim Whitlow, Director, Investor Relations and Corporate Communications, Ivax Corp., the United States. Tel: +1 (305) 5756 043.

Website: www.ivax.com

FOAMS

CFC-free foams

Cannon Viking, the United Kingdom, is offering dedicated plants for continuous production of rigid and flexible polyurethanes. CarDio carbon dioxide frothing technology employed by Cannon utilizes a gate-bar device for froth lay-down. Slabstock foams, mainly destined for furniture, bedding and packaging applications, can be produced with conventional plants, Maxfoam, Vertifoam, and the latest CarDio technology. Sandwich panels filled with rigid insulation foam are manufactured with dedicated foam laminators and utilized for walls and roofs of thermally insulated buildings, cold storage rooms and insulated containers used to transport perishable goods.

Contact: Cannon Viking, Viking House, Unit 1, Parkway Trading Estate, Barton Dock Road, M32 0TL Stredford, Manchester, the United Kingdom. Tel: +44 (161) 8669 909; Fax: +44 (161) 8668 808

E-mail: services@cannonviking.com

Website: www.cannonviking.com

Flexible slabstock foam

Beamech, the United Kingdom, offers equipment for manufacturing flexible slabstock foam using proprietary liquid CO-2 process. CO-2 can be used with conventional, Maxfoam and Vertifoam processes, enabling manufacture of standard polyether foams, polymer polyol foam, filled foams and special grades. The CO-2 system is designed for:

Small, medium and large foam producers
To produce low-density foams without CFCs
Foam producers who cannot use methylene chloride; and
Montreal Protocol Fund projects.

The computer-controlled CO-2 system is available both as a polyol blend system and direct high-pressure system. With the first system, a blend of polyol, silicone, amine and water is fed at low pressure from the existing mixing head into a high-pressure pump. This high-pressure blend is then fed to the CO-2 mixing system, and high-pressure carbon dioxide is added to the blend. With the direct high-pressure system, all the components are fed at high pressure to the CO-2 blending system.

Contact: Beamech, Tenax Road, Trafford Park, Manchester, M17 1JT, the United Kingdom. Tel: +44 (161) 8480 316; Fax: +44 (161) 8737 718

E-mail: email@beamech.com

Website: www.beamech.com

CFC-free foam blowing

KoSa Polymer and Intermediates of the United States offers a diverse line of Terate aromatic polyester polyols for use in polyurethanes. The polyols are available in a wide variety of equivalent weights and properties to allow for formulation flexibility. Terate polyols help achieve the rigorous physical and inflammability properties required in many rigid polyurethane and polyisocyanurate foams. The low-cost polyols high aromaticity, along with their low cost, makes them extremely desirable for many applications.

Terate polyols feature a variety of options in colour, acidity, viscosity, processability, hydroxyl value and functionality. They can be stored and handled in tanks made of carbon steel, stainless steel, fibreglass or other conventional construction materials. Storage temperatures must be kept below 60C to maintain product integrity, and storage vessels and process tanks should be protected with dry air or nitrogen to prevent uptake of atmospheric moisture.

Contact: KoSa Polymer and Intermediates, Global Headquarters, 15710 JFK Boulevard, Houston, TX 77032, the United States. Tel: +1 (281) 9861 400.

Website: www.kosa.com

Alternatives for flexibility and high returns

Krauss-Maffei Kunststofftechnik GmbH, Germany, offers two process options for introducing carbon dioxide (CO2) blowing agent into polyurethane (PU) components. Discontinuous batch processing or continuous on-line processing enables a wider window for using this cost-effective, eco-friendly blowing agent in a wider range of applications. In batch processing, CO2 is metered directly into the day tank or to the component in a separate nucleation unit, while in the alternative on-line nucleation, the gas is added immediately upstream of the mixing head. In both cases, CO2 physically dissolves in the PU component, ensuring uniform distribution and a highly reliable process. Compared with other mixing processes, these methods reduce CO2 consumption and improve the quality of the finished product.

Each process is targeted at particular application requirements. Batch nucleation is a cost-effective method of supplying nucleated components to several mixing/metering machines simultaneously. The system is simple to operate, maintain and repair. The technically sophisticated on-line process is better suited for products like slabstock foam. It is also ideal for applications where the CO2 load needs to be varied from shot to shot, e.g. in test labs.

Contact: Krauss-Maffei Kunststofftechnik GmbH, Krauss-Maffei-Strae 2, Munchen D 80997, Germany. Tel: +49 (89) 8899-0; Fax: +49 (89) 8899 3092

E-mail: info@krauss-maffei.de

Website: www.krauss-maffei.de

New production facility

Solvay S.A., Belgium, has started operations in Tavaux, France, for the commercial production of the hydrofluorocarbon Solkane 365mfc. The new state-of-the-art facility is designed for an annual production capacity of 15,000 t. Solkane 365mfc is a blowing agent for rigid polyurethane (PU) foams used mainly for thermal insulation of residential and industrial buildings as well as cold storages. Benefits of Solkane 365mfc include an extremely high insulating capability and excellent physical properties. Furthermore, using the Solvay product allows PU foam to be produced directly on the site where insulation is required.

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E-mail: martial.tardy@solvay.com

Website: www.solvaypress.com

HALONS

Green fire extinguishers

Researchers at Samara State University, Russia, have proposed a new formulation for foams used in fire extinguishers. The team put forth the use of chemicals that, when burnt, form aerosols comprising sodium and potassium chlorides suspended in gaseous nitrogen and carbon dioxide. There are two components to the aerosol-forming composition, which is initially dry. The first is a mixture of potassium perchlorate, perchlorovinyl resin and sodium azide. Once ignited, this mixture produces carbon dioxide, water and nitrogen, and sodium and potassium chlorides. The second component is a mixture of potassium perchlorate and soot.

Reaction products of the propounded components are more eco-friendly than currently used chemicals such as potassium bicarbonate powder or hydrofluorocarbons. The only disadvantage of the new mixture is that sodium azide is toxic. However, it burns rapidly when the extinguisher is activated and the combustion products are harmless. The team conducted multiple experiments and have identified the ideal mixture of components for the new fire extinguisher.

Chemical Industry News, April 2003

New fire suppression system

Gielle Srl., Italy, offers a specialist suppression agent with characteristics similar to that of halon-1301. Gielle FE-13 is for specialist applications, from offshore oil platforms and industrial storage areas to locomotives and anechoic chambers. Gielle FE-13 is trifluoroethane, a high-pressure clean agent free from bromine and chlorine. It can suppress fires rapidly and efficiently through physiochemical thermal transfer. Gielle FE-13 molecules at the flame front absorb heat, just like a sponge absorbs liquid. No exposure limits have been set for Gielle FE-13 use in occupied areas and it does not deplete stratospheric ozone. Gielle FE-13 nozzles have been tested to a height of 7.6 m, which is greater than any currently listed clean agent system and close to the maximum of 9 m for halon-1301.

Contact: Gielle Srl., Administrative Headquarters, Via Ferri Rocco 1001 Z.I. - 70022 Altamura, Italy. Tel/Fax: +39 (80) 3118 998/3101 309

E-mail: info@fm200.biz

Website: www.fm200.biz

FUMIGANTS

Radio frequency as a tool for pest control

In the United States, a cooperative effort by four Agriculture Research Service (ARS) laboratories and two universities aims to overcome technical barriers inhibiting the use of radio wave heating for controlling pests on a commercial scale in places such as orchards, packing houses and food plants. Electromagnetic waves of radio frequency can make molecules vibrate and heat up, in the same way that microwaves heat food. The hitch lies in eliminating pests without altering the taste or texture of the food they infest.

A team led by Mr. Juming Tang of Washington State University, and involving four ARS labs and the University of California-Davis, has been working on a four-year study to determine if radio waves could be used as an economical and environmentally friendly alternative to methyl bromide and other chemicals to effectively rid fruits and nuts of live insects. At Kika De La Garza Subtropical Agricultural Research Centre, entomologist Guy J. Hallman is investigating the use of radio frequency treatment of citrus against the Mexican fruit fly. In cooperation with a team led by Mr. Tang, Mr. James D. Hansen at ARS Yakima Agricultural Research Laboratory plans to bathe tubs full of apples and cherries with radio waves to determine exposure times that will eliminate codling moth larvae. At the ARS San Joaquin Valley Agricultural Sciences Centre, Mr. Judy A. Johnson is testing the use of this technology to rid walnuts, almonds, figs, pistachios and raisins of the wiggly larvae of the navel orangeworm, Indianmeal moth and codling moth.

Website: www.ars.usda.gov

Chitinase as replacement for methyl bromide

In the United States, researchers at the Agricultural Research Service and Kansas State University report that plants engineered genetically to kill insects may provide an alternative to the use of methyl bromide. The team incorporated an insect enzyme called chitinase to create insect-resistant transgenic tobacco and rice plants. Chitinase causes chitinous membranes in insect skin and gut tissue to disintegrate. Without this membrane, insects are vulnerable to microbial infections. Biotech firms are now working with the researchers to transform other plants such as corn, wheat and sorghum.

Website: www.agriculture.com

New methyl bromide substitutes

Researchers at the University of California-Riverside (UCR), the United States, report that liquid methyl iodide has the same spectrum of kill as methyl bromide. Moreover, methyl iodide is safer for workers to apply and remains in the atmosphere for 4-8 days, making it more ozone-friendly than methyl bromide, which remains for up to two years. Arvesta has bought licensing rights from UCR and is piloting its product Midas through the registration process.

At the University of California Cooperative Extension, Mr. Hussein Ajwa has been testing the efficacy of iodomethane on strawberries. According to Mr. Ajwa, pound for pound iodomethane is more effective than methyl bromide. Iodomethane moves through the soil at 10 times higher pressure than methyl bromide and cab be used to propel chloropicrin, another fumigant, for controlling diseases.

Website: www.westernfarmpress.com

Mustard plants suppress pests

According to the University of California Cooperative Extension (UCCE), the United States, mustard plants grown on farmlands have the potential to improve soil fertility and work like a fumigant to suppress soil-borne pathogens, nematodes and weeds. The mustard should be chopped, diced underground and irrigated, approximately 45-90 days after being planted, the time when adequate biomass is achieved during the bloom period, but before seeds develop. The amount of biomass and the degree of chopping and incorporation are critical in getting the maximum biofumigation effect. Mr. Grant Poole, agriculture and environmental issues farm advisor with UCCE, reports that preliminary research reveals a significant improvement in the soil quality of mustard cover crop plots over untreated control plots.

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E-mail: jwarnert@ucop.edu

Website: www.unepie.org

Liquid fumigant for farm-stored grains

At the Stored Grain Research Laboratory (SGRL), Australia, researchers are evaluating the use of ethyl formate as a multi-functional grain treatment tool for on-farm storage. The Grains Research and Development Corp. and the grains industry are funding this project. Ethyl formate is at present registered as a fumigant for dried fruit treatment. It occurs naturally in traces in soil, water, vegetation and a range of raw and processed foods, including fruit, vegetables, grain, beer and animal products like milk and cheese. Unlike phosphine, the only fumigant currently available for on-farm treatment of stored grains, ethyl formate kills insects rapidly and breaks down into non-poisonous, naturally occurring products formic acid and ethanol. SGRL is investigating into the natural occurrence of ethyl formate in stored products, the behaviour of residues on different grains and safe practices in handling and application.

Successful trials using ethyl formate were undertaken on wheat, sorghum and navy beans stored in unsealed farm bins. Liquid ethyl formate was applied to the top of the grain through a PVC probe. This method of

application was selected in order to maintain ethyl formate concentrations below the inflammability level, reduce vaporization and maintain an effective concentration for more than 10 h, and avoid liquid ethyl formate accumulating at the bottom of the bin. For wheat, the concentration of ethyl formate was maintained at effective levels for about two days. All insects and all stages of larvae were eliminated. Left for a further 3-5 days, ethyl formate residues in treated wheat were reduced to natural levels without the use of aeration.

Faba beans sorbed ethyl formate strongly and the residues persisted longer, but full control was achieved. For sorghum, insect mortality was high but not complete. Ethyl formate residues at 10C in sorghum persisted significantly longer than when treated at 20C. During application and fumigation, ethyl formate levels in the work environment did not exceed the worker safety level of 100 ppm. Unlike phosphine, which takes days to kill, ethyl formate kills within hours.

Contact: Mr. Daphne Mahon, Australia. Tel: +61 (02) 6246 4104; Fax: +61 (02) 6246 4202

E-mail: Given_Name.Surname@csiro.au

Website: www.sgrl.csiro.au

PUBLICATIONS

Modern Refrigeration and air-conditioning

This guide provides a thorough course on the basic and advanced principles of refrigeration and air-conditioning. It helps identify and remedy HVAC problems and provides an excellent blend of theory and job qualifying skills. Subjects discussed in the 31 chapters of this book include:

Tools, materials and control systems;
Compression, absorption, special refrigeration, cooling and dehumidifying, and heating and humidification systems;
Refrigerant recovery/recycling/reclaiming;
Electrical-magnetic fundamentals;
Servicing and installing small hermetic and commercial systems;
Air distribution, measurement and cleaning;
Central air-conditioning and heat pumps;
Solar energy;
Automotive air-conditioning;
Servicing and troubleshooting simplified; and
Passing technician certification exams.

Contact: Goodheart-Willcox Co., 18604, West Creek Drive, Tinley Park, IL 60477 6243, the United States. Tel: +1 (708) 6875 000; Fax: +1 (708) 6870 315

E-mail: custserv@g-w.com

Halon and the Alternative Fire Suppression Gases

This report is intended to aid marine contractors track down suitable substitute systems/gases for halons. Topics covered include regulations affecting halons, continued use of halon on-board ships, alternative breathable gas-fixed fire-fighting units and water mist alternative for occupied areas.

Contact: International Marine Contractors Association, Carlyle House, 235, Vauxhall Bridge Road, London SW1V 1EJ, the United Kingdom. Fax: +44 (020) 7931 8935;

E-mail: imca@imca.int.com