VATIS Update Ozone Layer Protection . May-Jun 2004

Content

THE SCIENCE OF OZONE LAYER

Flip side of industrial revolution

Researchers at the University of California-Irvine, the United States, report that human activity in the Industrial Age, approximately the last 150 years, significantly increased atmospheric levels of methyl bromide (MB), a known ozone depleter. The team came to this conclusion after examining an ice core recovered from Antarctica. By studying air bubbles trapped in the ice core, researchers were able to analyse and compare atmospheric MB levels over the last three centuries. The team surmised that during the Industrial Age, the amount of MB in the Southern Hemisphere air appeared to have increased by 3.5 parts per trillion, i.e. around 50 per cent of the pre-industrial level of the gas.

In the study, researchers utilized 23 samples of shallow ice core drilled in 1995 in Siple Dome, West Antarctica, as part of an ice-coring project sponsored by the National Science Foundation. Air was extracted from the samples and analysed using gas chromatography/mass spectrometry, a powerful analytical technique. According to Prof. Eric Saltzman, team leader, This long-term record of MB convincingly demonstrates that the amount of MB in the atmosphere increased during the Industrial Era.

Reconstruction of ancient atmospheric levels of MB is an exciting development. Ice core records can provide insights into the natural variability of MB and shed light on how sensitive its atmospheric cycle is to climate change. The team has also developed a numerical model to stimulate major processes involved in the global bio-geochemical cycle of MB.

Website: www.innovations-report.com

Excessive heat poses risk to human health

In Africa, a survey undertaken by the Property and Environment Desk of the Daily Trust has uncovered that persistent heat levels, fluctuating between 45 and 47C, are practically threatening the immune system and productivity of humans, as well as other organisms. Experts attribute the excruciating heat to ozone layer depletion. They warn that continued depletion could lead to rivers disappearing and rise in the incidence of skin cancer in humans. All the experts opine that the key to avert such a catastrophe is for people to be more environmentally conscious and friendly, by avoiding environmental pollution.

Website: www.allafrica.com

New light on Arctic ozone loss and climatic change

A cooperative study involving NASA scientists quantifies, for the first time, the relationship between Arctic ozone loss and changes in the temperature of Earths stratosphere. Results indicate that the loss of Arctic ozone owing to the presence of industrial chlorine and bromine in the Earths atmosphere may be sensitive to subtle changes in stratospheric climate. Such ozone depletion exposes the Earths surface to increased levels of harmful, ultraviolet solar radiation. According to the study, the sensitivity of Arctic ozone to temperature is three times greater than predicted by atmospheric chemistry models. This leads to the possibility that decreases in stratospheric temperatures may have a larger impact on future Arctic ozone concentrations than presently known.

Researchers analysed more than 2,000 balloon measurements gathered during the past 12 years. It was observed that the amount of ozone loss occurring in any given Arctic winter is related closely to the amount of air exposed to temperatures low enough to support the formation of polar stratospheric clouds. Reactions occurring on the surface of these clouds convert chlorine from non-reactive forms to those that quickly deplete ozone. Based on the relation between ozone loss and polar stratospheric cloud existence, it was found that every degree Kelvin (equal to 1C) cooling of the Arctic results in an additional ozone destruction of 5 per cent. This sensitivity is a factor of three larger than previously estimated by state-of-the-art, coupled climate-chemistry computer models. Also, it was observed that the coldest stratospheric winters, when most of the ozone loss occurs due to greater formation of polar stratospheric cloud formation, have gradually become cooler during the past few decades.

Website: www.jpl.nasa.gov

ODS PHASE-OUT IN INDIA

Methyl bromide in amended plant quarantine norms

The latest amendment to quarantine regulations for plants and planting material entered into force on 1 January 2004, following which the Ministry of Agriculture issued a gazette notification called Plant Quarantine (Regulation of Import into India) (Amendment) Order 2004. As far as pulses trade is concerned, a key feature of the amendment is the stipulation that methyl bromide be used as the fumigant. As methyl bromide is being actively phased out in many countries on environmental considerations, the new stipulation has upset both importers and overseas suppliers. Suppliers in Australia, Canada and Tanzania, for example, are unwilling to ship pulses to India because of the impossibility of compliance. Some suppliers are willing to consider shipment on condition that risk of clearance at the Indian port be with the importer.

Website: www.thehindubusinessline.com

CFC phase-out in service sector

The Ministry of Environment and Forests project catering to CFC phase-out in the RAC servicing and other related sectors will commence shortly. Approved by the 42nd ExCom meeting in March 2004, the Government of India will be responsible for overall management and implementation of the National CFC Consumption Phase-out Plan Service Sector (NCCOPP - former RACSSP).

The German government is the lead implementing agency. The Government of Switzerland, UNDP, UNEP and UNIDO have been designated as cooperating implementing agencies. The Swiss government through FOEFL, the Swiss Agency for the Environment, Forests and Landscape, has endorsed the NCCOPP project document, and mandated INFRAS Consulting Group for Policy Analysis, through SDC, with implementation of the Swiss governments responsibilities. INFRAS will be responsible for identification and establishment of new training cells, developing training material, etc.

Website: www.hidecor.info

IN THE NEWS

Developing nations receive additional funds

At a recent meeting of the Executive Committee (ExCom) to the Montreal Protocol, financing was approved for projects and activities aimed at helping Cote dIvoire and Mexico phase out their use of methyl bromide (MB). Under the Montreal Protocol, developing nations are committed to reduce their use of MB by 20 per cent no later than 2007, followed by complete phase-out by 1 January 2015.

Following up on the outcome of an extraordinary meeting of the Parties to the Montreal Protocol to discuss the timetable for the ban on the production and consumption of MB in developing nations, ExCom is looking at further ways of helping developing nations to implement the ban. The next ExCom meeting in July 2004 will examine this issue in more depth. ExCom also committed US$31 million for national phase-out plans in Argentina, Bangladesh, India, Mexico, Venezuela and Sri Lanka, which will phase out the combined consumption of more than 8,000 t of CFCs over the next few years. In the Latin American region and in India, the phase-out of CFCs is fully coordinated with reductions in CFC production. As CFC consumption is reduced, a concomitant reduction in CFC production will take place through agreements that are either already in place or now being completed.

Website: www.uneptie.org

Compliance with Montreal Protocol in the Asia-Pacific

Representatives from 22 countries in the Asia-Pacific region came together in India recently to tackle priority issues related to compliance with the Montreal Protocol and identify the best combination of approaches that can strengthen and sustain ODS phase-out. The joint meeting of the Regional Networks of Ozone Officers from South Asia, South-East Asia and the Pacific, held from 19-21 April, was organized by the UNEP Compliance Assistance Programme (CAP) and supported by the Protocols Multilateral Fund. As the host, the Ozone Cell of Indias Ministry of Environment and Forests actively contributed to the successful outcome of this event. Discussions centred on three main issues:

Preparation of Compliance Action Plans following the decisions of the 15th Meeting of the Parties to the Montreal Protocol;

Policy issues relating to retrofitting, recovery and reuse of ozone depleting refrigerants; and

Strengthening institutions tasked with ozone protection during the current Protocol compliance period.

Participants committed themselves to meeting benchmarks and action plans to fulfil Protocol requirements specifically relating to the 15th Meeting decisions with regard to Malaysia, Nepal, Pakistan, Thailand and Viet Nam.

Countries also studied opportunities to maximize recovery and reuse of refrigerants, as well as retrofitting and promotion of environmentally sound practices, including ideas for regional policy and technical cooperation. Measures to promote further actions to strengthen existing institutions, improve data reporting, enforce import and export controls, and promote political commitment were also discussed.

Contact: Mrs. Usha Chandrasekhar, Director, Ozone Cell, Ministry of Environment and Forests, India Habitat Centre, Zone IV, East Court, 2nd Floor, Lodhi Road, New Delhi 110 003, India. Tel: +91 (11) 2464 2176; Fax: +91 (11) 2464 2175; E-mail: ozone@del3.vsnl.net.in Or Mr. Atul Bagai, Regional Coordinator (Networking), South Asia, Compliance Assistance Programme, Regional Office of Asia and Pacific, UNEP, Bangkok, Thailand. Tel: +66 (2) 2881 662

E-mail: bagai@un.org

Website: www.uneptie.org

Methyl bromide approved for use after phase-out deadline

At an intergovernmental meeting on the Montreal Protocol organized in Canada, eleven developed nations facing the year-end deadline for phasing out methyl bromide (MB) have been allowed limited critical use exemptions. These exemptions are aimed at providing farmers, fumigators and other users of MB additional time to adopt cost-effective substitutes. MB is employed to eliminate pests in such crops as tomatoes, strawberries, melons, peppers, cucumber and flowers. Exemptions to the phase-out totals 13,438 t of MB for 2005.

The 11 countries are Australia (145 t), Belgium (47 t), Canada (56 t), France (407 t), Greece (186 t), Italy (2,133 t), Japan (284 t), Portugal (50 t), Spain (1,059 t), the United Kingdom (129 t) and the United States of America (8,492 t). In addition, the United States has agreed to limit its 2005 production levels for MB to 7,659 t (equal to 30 per cent of its baseline, as compared with 35 per cent for its exemption). This implies that the United States will supply some of its exemptions from existing stockpiles. Similarly, the eight European Union nations will supply 100 t of their combined 4,011 t exemption from their existing stockpiles.

Contact: Mr. Michael Williams, Information officer, UNEP, Geneva, Switzerland. Tel: +41 (79) 4091 528

E-mail: michael.williams@unep.ch

Website: www.enn.com

HFC refrigerant joint venture

DuPont, the United States, and Zhonghao New Materials Co. Ltd., China, have completed formation of a joint venture to manufacture hydrofluorocarbon (HFC) blend refrigerants to support the fast-growing air-conditioning and refrigeration industry in China. Named DuPont 3F Fluorochemicals Changshu Co. Ltd., the new company is based in Jiangsu province. This joint venture will produce HFC-404a, -407c and -410a refrigerant blends. All products are scheduled to be fully available by mid-year. Refrigerant blends produced at this plant will be marketed in China and other Asian countries by DuPont under the DuPont Suva brand. HFC blend refrigerants are widely recognized as the accepted alternatives to CFCs and HCFCs, since these products are being phased out globally under the terms of the Montreal Protocol.

Website: www.biz.yahoo.com

Control on illegal trade in ODS

The 2nd Joint South Asia, South-East Asia and the Pacific Customs and Ozone Officers Cooperation Workshop, organized at Agra, India, has called for a strict control on illegal trade of ODS. The workshop focused on information exchange and training as key areas to be strengthened to control this menace at the national, regional and global level. Further assistance from international agencies like Interpol, IRLO and WCO was also solicited. Participants also discussed in detail important issues like control of ODS in transit and import/re-export, monitoring international transit trade, policies and measures to deal with seized ODS goods, problems related to the banning of import of ODS and ODS equipment, etc.

The workshop provided appropriate recommendations to fight illegal ODS trade and ensure smooth compliance with provisions of the protocol. Ozone officers and customs officers who participated in the three-day workshop were from member nations Afghanistan, Bangladesh, Bhutan, Brunei, China, Cambodia, Fiji, India, Indonesia, Iran, Lao Peoples Democratic Republic, Maldives, Malaysia, Nepal, Myanmar, Pakistan, Republic of Korea, Sri Lanka, the Philippines, Singapore, Thailand, Viet Nam, Japan and Sweden.

Website: www.haveeru.com.mv

New HFC-134a facility in China

Xian Jinzhu Modern Chemical Industry Co. Ltd., China, has commenced production at its 5,000 t/y HFC-134a project in Shaanxi Jinghe Industrial Park. This project is the largest environmentally acceptable refrigerant commercialization project in the country. HFC-134a is currently the most suitable alternative to Freon. In January 2001, the Multilateral Fund awarded Jinzhu Co. a US$25.41 million award. Sinochem is the largest shareholder with 75 per cent interest while XMCI holds 25 per cent. Also included in the project is a 38 million items/y can production unit, a 10,000 t/y anhydrous hydrocarbon fluoride facility, and a 100 t/y catalyst plant. New catalysts have been adopted. During a trial production period, 600 t/y of HFC-134a was produced. In 2004 Jinzhu Co. will expand capacity by launching another 5,000 t/y HFC-134a unit. On completion in 2005 Jinzhus production capacity will exceed 10,000 t/y. This will reduce Chinas dependence on HFC-134a imports. By 2005, the demand for HFC-134a is estimated to exceed 10,000 t/y and 20,000 t/y by 2010.

Website: www.hoovers.com

Efforts to control import of ODS

The Department of Enivironment and Natural Resources (DENR) and the Bureau of Customs (BOC) in the Phillipines are stepping up their efforts in the fight against illegal trade and importation of ozone depleting substances (ODS) into the country. Custom officers recently completed the training under the United Nations Environment Programme aimed to improve the capability of the bureau in regulating the importation as well as in preventing the illegal yrade of ozone depleting substances in the country. In a speech during the training workshop, Department of Environment and Natural Resources (DENR) Undersecretary Ronaldo L. Metin pointed out the importance of the partnership between government agencies and the private sector for an orderly phase out of ozone depleting substances (ODS) in the country.

The DENR recently revised the chemical control order (CCO) for ozone depleting substances in an effort to strenghthen the implementation of their phase out in the country. at the same time, DENR Secretary Elisea G. Gozun has issued adminoistrative order no. 08 2004, accelarating the ban on the use of CFC 11 by January 1, 2005 while also calling on all importers, dealers, retailers and service providers of ozone depleting substances to register before they are credited and allowed to sell or use said substances.

Website: www.denr.gov.ph

Refrigerant trend in Japanese PACs and VRFs

In Japan, R-410a is increasingly being used to replace R-22 in air-conditioners. This shift started several years ago and in 2003 most room air-conditioners (RACs) became R-410a models. During the same period, R-407c started to replace R-22 in packaged air-conditioners (PAC). This was mainly because R-407c was similar to R-22 in pressure/temperature properties and tended to be easy to shift to ODP-free HFC refrigerant with minor modifications. Also, since VRF (multiple door units AC/heat pump) systems were larger and more complicated than PACs, manufacturers usually opted for R-407c.

Since R-410a has higher density and efficiency than R-407c, it can be easily treated as an azeotropic refrigerant. However, the refrigerants high pressure necessitated the redesigning of components like compressor and pressure vessel. On the other hand, R-407c is a ternary blend with a temperature glide that makes additional recharge difficult.

Website: www.videolife.kiev.ua

REFRIGRATION/AIR-CONDITIONING

Non-Freon technology

Huangshi Donper Mech-Electric Group Co. Ltd., China, offers Donper QD 68YZ, a super high-efficiency non-CFC compressor. Six new products released by the company have passed state verification and are part of Huangshis range of high-efficiency compressors. These products greatly improve performance since they can decrease the capacity of spare space and increase the coefficient of gas transportation. Refrigerators based on these products save up to 50 per cent energy.

Contact: Huangshi Donper Mech-Electric Group Co. Ltd., No. 5, Wuhuang Road, Tieshan District, Huangshi City, Hubei Province, China. Tel: +86 (714) 5416 688; Fax: +86 (714) 5415 588

E-mail: sella@donper.com

Website: www.donper.com

Website: www.chinafair.org.cn

HCFC-22 alternative

Dunham-Bush, the United States, offers an alternative refrigerant to HCFC-22 that eliminates the need for equipment changes. After exhaustive research and testing, the company has found an ideal match of oils and refrigerants to provide customers an HFC refrigerant option with the same capacities and performance as HCFC-22.

The company supplies rotary screw and scroll package chillers, both air and water-cooled, using non-ozone depleting HFC refrigerants R-407c and R-134a. Using these refrigerants with specially formulated Karlube oils, the company provides a long-term solution for air-conditioning needs in commercial, institutional and industrial applications. The company is conducting tests to ensure easy retrofitting of its equipment using HCFC-22 to operate with new refrigerants and oils without much effort and equipment changes, and at an extremely reasonable cost.

Website: www.dunham-bush.com

New refrigerants

Northcutt Inc., the United States, offers a range of HC refrigerant products that are made from natural organic compounds. These products are not a blend of existing, chemical-based synthetic refrigerants. An anti-friction additive enables these products to assure excellent thermal and chemical stability, improve performance and extend the service life of air-conditioning and refrigeration systems and components. This lowers energy requirements and prevents system leakage. The new products include:

HC-12a A drop-in replacement for R-12 and R-134a refrigerant;

HC-22a A drop-in replacement for R-22 refrigerant; and

HC-502a A drop-in replacement for R-502 refrigerant.

Contact: Mr. Bob Small, General Manager, Northcutt Inc., United States of America. Fax: +1 (316) 8386 203

E-mail: bob@hcrefrigerant.com

Website: www.hcrefrigerant.com

Colder R-134a replacement

Cooltop Refrigerants, the United States, offers a refrigerant that is colder than R-134a. Cooltop can be added to a partially full system or fully charged for the maximum cooling effect. The patented blend of refrigerants can get a retrofitted or OEM R-134a system colder and dry. It can also be blended with a metered amount of DRYpak, a product from Cryochem that converts moisture trapped inside a R-134a system into a profitable silicone-based lubricant.

Contact: Cooltop Refrigerants, United States of America.

E-mail: cooltop@cooltop.net

Website: www.cooltop.net

Refrigeration oil for HFC systems

Idemitsu Kosan Co. Ltd., Japan, has developed polyvinylether (PVE) as refrigeration oil for HFC refrigerant systems. Key features of PVE include non-hydrolysis nature, superior lubricity, solubility with process fluid and miscibility with HFC refrigerant. These characteristics directly or indirectly contribute to the total down cost of systems. For example, most PVE users do not use filter driers for HFC air-conditioners by controlling equilibrium water in systems to less than a few hundred parts per million. Following successful tests to prove these benefits, OEMs have started using PVE for commercial production.

Contact: Idemitsu Kosan Co. Ltd., No. 1-1, 3 chome, Marunouchi, Chiyoda-ku, Tokyo, Japan. Tel/Fax: +81 (3) 3213 3142/9415.

Website: www.idemitsu.co.jp

New addition to direct drive range

Thermo King, the United States, has updated its direct drive product range for vans and small trucks with the launch of the new V-100 series and improvements to the design of V-200 and V-300 platforms. V-100 series and road-only-operation models of the V-200 and V-300 series incorporate a newly designed small, lightweight platform. V-100 has been developed especially for installation in smaller trucks and vans, with a load capacity of up to 7 m3. It is available with R-134a refrigerant for chilled-only applications or R-404a refrigerant for frozen or chilled applications.

All models in the new series the V-100, V-200 and V-300 feature a user-friendly Direct Smart Reefer, the latest in microprocessor control for the companys direct drive product range. Direct Smart Reefer controls and monitors the refrigeration unit from inside the cab safely and conveniently, ensuring that the cargo temperature is maintained at the correct level. It can be mounted on top of or set into the dashboard and removed when the vehicle is parked.

Website: www.irishtrucker.com

CO2 air-conditioning system

Nissan Motor Co. Ltd., Japan, has started leasing X-TRAIL fuel cell vehicles (FCVs), which incorporate an air-conditioning system, developed jointly by Nissan and Calsonic Kansei Corp., which uses carbon dioxide (CO2) as the refrigerant. CO2 is especially effective in heating a vehicle than HFC-134a alternative refrigerant used in automotive air-conditioners. Implementation of the CO2 air-conditioning system has been made feasible by two key developments. The first is a compact, lightweight compressor capable of withstanding the high temperature and high pressure required to compress CO2. The other being a heat exchanger capable of withstanding the high pressure and temperature of highly compressed CO2 gas supplied from the compressor. Moreover, power loss that normally occurs in a small car when the air-conditioner is operated while driving could be reduced with the new air-conditioning system by suitable control of the compressor torque.

In the CO2 system, heating is achieved by switching to the refrigerant channel so that the refrigerant can be compressed and supplied to the passenger compartment heat exchanger from where it radiates heat. In other automobiles, an engine coolant heated by engine heat is circulated through the heater core to warm the passenger compartment. Until now, FCVs and electric vehicles did not have the facility to provide effective cabin heating since they lack a heat source in the absence of an internal combustion engine. CO2 air-conditioning uses the same process as ordinary automotive air-conditioners to cool a vehicle. The refrigerant, in this case CO2, is evaporated by a passenger car compartment heat exchanger to absorb heat and cool the vehicles cabin. CO2 is a naturally occurring, non-inflammable refrigerant and is more eco-friendly than HFC-134a. The new CO2 system helps reduce the amount of CO2 discharged from factories since CO2 waste from these sources can be reutilized in this system.

Website: www.nissan-global.com

Sound waves substitute for chemical refrigerants

Acousticians at Penn State University, the United States, have developed a prototype for a compact chiller based on green technology. In this system, sound waves are utilized to achieve cooling. The new thermoacoustic chiller uses helium gas instead of chemical refrigerants.
The chiller takes advantage of heliums inertness and high thermal conductivity as well as the fact that a sound wave is a rapid succession of compressions and expansions of the gas that carries it. A gas heats up when it is compressed and cools down when it is allowed to expand. In thermoacoustics, the compressions and expansions are arranged such that all of the heat of compression is deposited at one end of the system where it can be exhausted into the room. All expansions occur at a different location where the cooling can be used for refrigeration purposes. The compact prototype achieves this without mechanical valves or cams or linkages.

Contact: Ms. Barbara Hale, Penn State University, United States of America. Tel: +1 (814) 8659 481; E-mail: bah@psu.edu; Or Mr. Vicki Fong, Penn State University, United States of America. Tel: +1 (814) 8659 481

E-mail: vfong@psu.edu

Website: www.live.psu.edu

HFC-410a suitable for commercial refrigeration

Researchers from the Centre for Environmental Energy Engineering at the University of Maryland, the United States, report that medium temperature commercial refrigeration equipment designed to use HFC-410a

refrigerant performed better in a life cycle climate performance (LCCP) analysis than equipment designed for propane (R-290), an inflammable hydrocarbon refrigerant. The study exhibited that a system using HFC-410a achieved lower environmental impact during the entire life cycle of the fluid and equipment, including power consumption, than a system using R-290. Findings from the study reveal that:

On an equal first cost condition, the LCCP of HFC-410a is 4.2 per cent lower and the LCCP of HFC-404a is 1.8 per cent higher than that of R-290. The underlying assumption is that the first cost of the R-290 system may be, e.g. 10 per cent higher owing to added safety features, and on an equal cost basis HFC systems would use the additional cost for a large condenser; and

Since a conservative safety cost estimate is used, it is expected that the environmental impact of both HFC-404a and HFC-410a will be reduced further, as compared with R-290 in future system designs. Additionally, HFC-410a holds the potential for additional optimization using smaller tube diameter to improve heat transfer with reduced charge and improved burst pressure capability.

Website: www.ari.org

Compressors offer new twist to air-conditioning

Masterflux, a division of Tecumseh Products Co., has developed a d.c.-powered variable speed compressor designed to accommodate a range of cooling and refrigeration needs. Available in two models and multiple capacities, the compact hermetically sealed units serve as the heart of the cooling system. An important feature of the new compressor is that it does not have the negative impacts of engine-driven compressors, which most often require vehicle idling and as such raise fuel consumption and environmental degradation.

Both compressor models, labelled Alpine and Sierra, feature the same basic design that comprises an electric motor section and compressor. The top-mounted electrical motor is connected by a shaft to a rolling piston at the base of the compressor. When energized, the rolling piston compresses the refrigerant. The compressors are compatible with all CFC, HCFC, HFC and HC refrigerants and can operate at voltages of 12-700 V d.c. The Masterflux BLDC controller allows for variable speed operation. An a.c. version is also available, primarily meant for use in rooftop air-conditioning.

Website: www.findarticles.com

Catering to changing air-conditioning needs

Delphi Corp., the United States, is developing alternative refrigerant air-conditioning systems to support the best option for the environment and their customers. While improving energy efficiency, these options will reduce the atmospheric effect of direct refrigerant emissions as they are gases with lower global warming potentials.

Delphi considers both CO2 and R-152a as viable options for the future. R-152a is a promising alternative because of its chemical and thermodynamic similarity to R-134a. Although an HFC refrigerant, R-152a has a global warming potential rating (120 -140) that is 90 per cent lower than R-134a. Its improved cooling efficiency also has energy saving advantages, particularly in hot climates. CO2 is also a promising candidate, with a global warming potential rating of just 1.0. Occurring naturally in the atmosphere, CO2 has a life cycle climate performance comparable to R-152a and provides an acceptable level of cooling. CO2 also operates

more efficiently in the heat pump mode compared with HFCs. In terms of potential cost, a switch to CO2 presents higher development, manufacturing and service investment than would R-152a, which can be used in adapted current style systems.

Contact: Ms. Barbara Barkley, Delphi Corp., United States of America. Tel: +1 (716) 4392 594.

Website: www.delphi.com

SOLVENTS

New solvent

Lyondell Chemical Co., the United States, offers a versatile solvent for use in a variety of applications, including electronics, agriculture, pharmaceuticals, petrochemical processing, graffiti removal, automotive and industrial cleaning, water-borne coatings and photoresist stripping, etc. N-methyl-2-pyrrolidone (NMP) is a powerful, aprotic solvent with high solvency and low volatility. Key characteristics of the colourless NMP include high boiling point, high flashpoint, low vapour pressure and a mild amine-like odour. NMP has high chemical and thermal stability, and is completely miscible with water at all temperatures. The hygroscopic solvent is stable under normal conditions and can serve as a co-solvent with water, alcohols, glycol ethers, ketones and aromatic/chlorinated hydrocarbons. It is recyclable by distillation and readily biodegradable.

Contact: Lyondell Chemical Co., 1221, McKinney Street, Houston, TX 77010, United States of America. Tel: +1 (713) 6527 200; Fax: +1 (713) 3094 944.

Website: www.lyondell.com

New optimized degreaser-precision cleaner

Micro Care Corp., the United States, offers a new general purpose degreaser and precision cleaner. Vertrel MCA is a powerful, ozone-safe degreaser optimized for the organic contamination typically found in oils and grease. It is a clear, colourless liquid without any aroma and is well-suited for use in vapour degreasing of the most difficult soils.

Vertrel MCA is a proprietary azeotrope of HFC 43-10mee and trans-1,2-dichloroethylene. With zero ODP and a low GWP, it has a broad range of cleaning capabilities. Important physical properties of this non-inflammable solvent include very high density, very low viscosity and low surface tension. Exceptional chemical and thermal stability, low toxicity and easy distillation make this solvent a nearly perfect degreaser for any advanced metal cleaning application.

Contact: Micro Care Corp., 595, John Downey Drive, New Britain, Connecticut, CT 06501, United States of America. Tel: +1 (860) 8270 626; Fax: +1 (860) 8278 105

E-mail: TechSupport@microcare.com

Website: www.vertrelsolvents.com

Workstations for cleaning

Aqueous Technologies, the United States, offers AQ-201CL semi-automatic cleaning station that employs two processes to ensure thorough defluxing. This closed-loop system is equipped with a built-in water recirculation and deionization unit. All process water is captured, filtered, re-deionized and reused. In the spray-under-immersion process, opposing eductors placed in the front and rear of the deep sink provide powerful spray under immersion agitation. Water is heated to the desired temperature by a built-in microprocessor-based water heating system. Since water is constantly re-deionized by the recycler, flux and other contaminants are removed. The spray station allows the operator to spray high-purity DI water on the circuit assemblies using the spray gun and flow-through scrub brush. When cleaning is complete, a hand-held air-knife is used for coarse drying.

StencilWasher stencil cleaning workstation is designed to remove all solder pastes, including rosin (R, RMA, RA), and water soluble (OA) and no-clean pastes from stencils, screens, misprints and related components. This unit, which can clean stencils of size up to 32 32 inches, is equipped with a dual filtration system. Both the wash and rinse sections are equipped with built-in solder paste filter housed in stainless steel cover. Solder paste is automatically trapped and collected in the filters.

Contact: Aqueous Technologies Corp., 9785, Crescent Centre Drive, Building 302, Rancho Cucamonga, CA 91730, United States of America. Tel: +1 (909) 9447 771; Fax: +1 (909) 9447 775

E-mail: sales@aqueoustech.com

Website: www.aqueoustech.com

Solvent cleaners

Tech Spray L.P., the United States, has launched a new generation of cleaning technologies. The G3 solvent blends are an excellent replacement for solvents based on inflammable alcohols or very expensive HFEs. They offer excellent cleaning ability, evaporate rapidly, have low odour, and are non-inflammable, non-ozone depleting and safe on most plastics. G3 range of solvents includes the following:

TEC1630 Blue Shower is designed for precision cleaning of polar and non-polar soils, including hand and solder oils, greases, silicones, fluxes and other similar contaminants. This direct replacement for all cleaners/degreasers containing HCFC-141b is effective in cleaning electronic equipment, metal parts, machinery and other general cleaning needs.

TEC1631 Flux Remover is formulated as a replacement for defluxers that are inflammable or contain HCFC-141b or HFE. Designed specifically for removing R, RA, RMA and SA type flux residues after high-temperature reflow, this flux remover can also be used as an all-purpose cleaner to remove light oils, silicones, waxes, greases and other similar contaminants often found in electronics manufacturing.

TEC1632 Contact Cleaner can easily replace contact cleaners that are inflammable or contain HCFC-141b or HFE. This precision blend is the optimal choice to remove oils, greases, silicones, dirt and grime from all types

of switches, relays, contact pads and other electrical connections.

Contact: Tech Spray L.P., P.O. Box 949, Amarillo, Texas, TX 79105 0949, United States of America. Tel: +1 (806) 3728 523; Fax: +1 (806) 3728 750

E-mail: tsales@techspray.com

Website: www.techspray.com

Website: www.intertronics.co.uk

Cleaning naval oxygen systems

In the United States, an aqueous inorganic alkaline solution developed by the Naval Sea Systems Command can remove organic and particulate contamination from oxygen and oxygen-enriched life support equipment. The new Navy Oxygen Cleaner (NOC) is able to meet and in some cases surpass the cleaning properties of CFC-113. It removes particulates, hydrocarbon oils, greases and fats, fluorinated oils from metallic, rubber and plastic surfaces when applied with agitation at temperatures around 49-77C. Forms of agitation include use of ultrasonic tanks to clean small components, pumps to flush pipe lines or spray impingement to clean large flasks or tanks.

NOC is non-foaming and non-inflammable in liquid or gaseous oxygen. It does not contain any environmentally regulated material, has no ODP or GWP and is not a volatile organic compound.

Contact: Mr. Neil Antin, NAVSEA 03L21, Naval Sea Systems Command, 2531, Jefferson Davis Highway, Arlington, Virginia, VA 22242 5160, United States of America. Tel: +1 (703) 6026 827, ext. 555

E-mail: antin_neil@hq.navsea.navy.mil

Website: www.p2library.nfesc.navy.mil

Low alkaline cleaner

Mykal Industries, the United Kingdom, offers a low alkaline cleaner to remove oil, grease and swarf from steel and cast-iron parts in manufacturing, assembly, pre-paint and refurbishment operations. Aquasolv Spray Wash Cleaner VCI (Aqua 10VCI) is a highly concentrated aqueous cleaner for use in all types of high-pressure spray equipment, including rotary basket washers and multi-stage operations. Aqua 10VCI also contains patented vapour corrosion inhibitors that form a molecular layer over the surface of ferrous metals. This provides components with superb corrosion protection for up to three months in storage. The neutral liquid cleaner can be used at high temperatures and low concentrations. It will not foam when used in high-pressure cleaning operations and can be easily rinsed prior to any succeeding production stages.

The Aquasolv range also contains cleaners for heavy-duty applications and non-ferrous metals, and offers up

to 12 months corrosion protection with Aqua 10VCI2. Spray Wash Cleaner Multi-Metal (Aqua 12) provides inter-stage process cleaning for ferrous and non-ferrous metals without the threat of staining or darkening. Ideal for removing light oils and inter-stage cleaning in both ultrasonic and spray wash facilities, it has been specifically developed for use on metals like copper, brass and aluminium, particularly newly manufactured parts.

Mykal Aquasolv process metal cleaners provide a solvent-free range of highly concentrated degreasers, with the added advantage of corrosion protection. Aquasolv ultrasonic cleaners can clean high-spec components like PCBs and ceramics. These products are formulated to cavitate and de-gas effectively to maximize the ultrasonic cleaning action, aiding in the removal of particulates, lapping slurry and polishing compounds. All Aquasolv products are formulated to operate at low dilution rates, between 5-10 per cent, and are produced without nitrites or phosphates, making it easier for both handling and disposal.

Contact: Mykal Industries, 5, Morris Close, Park Farm Industrial Estate, Wellingborough, Northants NN8 6XF, the United Kingdom. Tel/Fax: +44 (1933) 402 822/488.

Website: www.manufacturingtalk.com

New precision cleaner

Amity UK Ltd. offers a precision cleaning solvent that facilitates an easy transition from ozone depleting circuit board cleaners used in ultrasonic and batch cleaning operations. Hydrothene is a high-performance alternative to CFC, HFC, HFE, HCFC and aqueous circuit board cleaners. It is completely water soluble and easily recoverable with only oil/water filtration required, without compromising performance. The zero ODP cleaner is non-inflammable and has a low odour.

The patent-pending Hydrothene has a moderately fast evaporation rate and is designed to remove solder flux and light oils from electronic components and circuit boards. It is compatible with all types of plastics and elastomers. The cleaner removes both polar and non-polar contamination such as grease, dust, light oil, rosin fluxes, no-clean fluxes, and aqueous, organic and inorganic fluxes. It requires very little rinse water compared with aqueous cleaners, saving time as well as lowering waste generation.

Contact: Amity UK Ltd., Friendship House, Dodworth Business Park, Barnsley, South Yorkshire, S75 3SP, United Kingdom. Tel: +44 (1226) 770 787; Fax: +44 (1266) 770 757.

Website: www.amityinternational.com

Tabletop ultrasonic stencil cleaner

In the United States, Smart Sonic Corp. recently introduced its first tabletop ultrasonic stencil cleaner. Though Model 500 is designed to clean 20 inch stencils, it can also clean 29 inch stencils by using two cleaning cycles. This unit washes and rinses with the same precision and quality as other larger systems, but without the added cost of automated features. It can easily be installed into an existing countertop to conserve valuable floor space or may be used as a stand-alone unit. The stencil cleaner has a footprint of 534 890 mm.

Contact: Smart Sonic Corp., 6724 Eton Avenue, Canoga Park, California, CA 91303, United States of

America. Tel: +1 (818) 610 7900; Fax: +1 (818) 610 7909

E-mail: smt@smartsonic.com

Website: www.smartsonic.com

AEROSOLS

New pharmaceutical aerosol composition

Chiesi Farmaceutici S.p.A. offers a pharmaceutical aerosol composition containing a mixture of HFA-227 and HFA-134a as propellant. In the metered dose inhaler system consisting of an active material, a propellant, a co-solvent and optionally a low volatility compound the use of HFA-134a/HFA-227 mixture as propellant enables the modulation of the mass median aerodynamic diameter (MMAD) of the aerosol particles to target specific regions of the respiratory tract. In addition, the fine particle dose of the active ingredient in the composition is increased by reducing the metering chamber volume.

Website: www.pharmcast.com

LPG in aerosols

Shell Gas offers LPG propellant employed in most aerosols manufactured presently. The aerosol propellant-grade LPG consists of a high purity mixture of propane, isobutane and n-butane. The company offers a unique advantage to customers in the aerosol industry through its strong position as fuel manufacturer and supplier. Compressed air propellants occupy only the head space above the product which is in the form of a liquid, emulsion or suspension in the can. When the aerosol valve is opened, the gas pushes the product out of the can. Spray performance in this type of aerosol is maintained by carefully selecting the aerosol valve and actuator.

Contact: Shell Gas LPG.

E-mail: info@shellgaslpg.com

Plastic, propellant-free aerosol

Keltec Dispensing Systems, the Netherlands, has launched a new, revolutionary dispensing concept for aerosols. AiroPack system technology is an excellent alternative to traditional metal aerosol cans and their dangerous propellants. AiroPack system pumps were developed for application in the foodstuffs and pharmaceutical industries, and offer environmental, transport, ergonomic and logistics advantages. Key features of the plastic AiroPack system are its light weight, increased safety and eco-friendliness.

Contact: Mr. Quint Kelders, General Director, Keltec Dispensing Systems bv., Albert Einsteinweg 10, 5151 DL Drunen, the Netherlands. Tel: +31 (416) 321 600; Fax: +31 (416) 321 610

E-mail: info@keltecbv.com

Website: www.keltecbv.com

Website: www.primezone.com

Delivery technologies for respiratory drugs

SkyePharma PLC., the United Kingdom, offers dry powder and metered-dose aerosol inhaler technologies. The company has developed Skyehaler, a dry powder inhaler device (marketed by Novartis as the Certihaler), as well as the formulation technology that ensures accurate and consistent dosing. SkyePharma has also succeeded in delivering macromolecules with the Skyehaler device.

Flutiform is a proprietary fixed-dose combination of the bronchodilator formoterol and the inhaled corticosteroid fluticasone, which utilizes an HFA propellant. Foradil Certihaler was co-developed with Novartis and efforts are ongoing to develop a dry powder inhaler version of QAB 149, Novartis novel long-acting bronchodilator. GlaxoSmithKline has entered into an agreement with SkyePharma to license the latters formulation technologies for application to the delivery of respiratory drugs, either by breath-actuated dry powder inhaler or metered dose aerosol inhaler.

Contact: SkyePharma PLC., United Kingdom. Tel: +44 (207) 4911 777

Website: www.skyepharma.com

Website: www.pharmalive.com

HFA nasal aerosol approved in the United States

Aventis has obtained approval from the United States Food and Drug Administration for its Nasacort HFA (triamcinolone acetonide) nasal aerosol to treat nasal symptoms associated with seasonal and perennial allergic rhinitis in adults and children aged six years and above. This is the first intranasal corticosteroid dry-aerosol formulation containing HFA to be approved in the United States. In placebo-controlled clinical trials, the most commonly reported side effects were sneezing, headache, nasal irritation and rhinitis.

Website: www.biz.yahoo.com

HALONS

Adiabatic expansion nozzles

At the Federal Aviation Administrations William J. Hughes Technical Centre, the United States, researchers have devised an adiabatic expansion nozzle for producing a continuous gas/solid (CO_2) or gas/aerosol (halon alternative agents) stream from a liquid having high room temperature vapour pressure. The nozzle consists of a series of expansion stages, with the agent flow reversing direction after each expansion (except the first) and going over the conduit, which consists of the previous expansion stage. Additionally, the flow from the last

expansion stage comes in contact with the inlet conduit, thereby exposing the inlet flow to the cold temperature produced in the nozzle.

As the flow in the nozzle in quasi-adiabatic, the expansion in each stage takes heat from the flow in the previous stage, ultimately resulting in very low temperature discharge. It is particularly useful as a fire extinguisher since it can produce solid CO2 snow and an aerosol of halon alternative agents, while substantially reducing the extinguisher exit velocity.

Contact: Ms. Deborah Germak, William J. Hughes Technical Centre, Federal Aviation Administration, United States of America. Tel: +1 (609) 4859 862

E-mail: Deborah.germak@faa.gov

Website: www.federallabs.org

Self-contained, automatic fire suppression system

Firemaster Extinguisher, the United Kingdom, offers automatic fire suppression units containing Novec 1230 fire protection fluid. Self-contained for easy installation with no need for pipework, the new Modula Plus MP-2-000 operates automatically at 68C (5C) with a 360 discharge pattern. These stored pressure units are designed to provide easy and low-cost maintenance. Suitable for B and C fire classifications plus surface Class A fires, they can also be used on electrical equipment. Available in both electrically operated units as well as mechanically operated units, their capacities range from 2.5 kg to 15 kg.

Contact: Firemaster Extinguisher, Firex House, 174-176 Hither Green Lane, London SE13 6QB, United Kingdom. Tel: +44 (20) 8852 8585; Fax: +44 (20) 8297 8020.

Website: www.processingtalk.com

Ozone and climate friendly fire suppression agent

In the United States, Kennedy Space Centre has filed a patent application for a new non-toxic, dry powder fire suppression agent, which combines the flame-cooling and oxygen-displacement traits of water with the flame propagation-inhibition trait of halons. Based on microencapsulated water, the fire suppressant addresses the following issues:

Since the extinguishant is stored in ready-to-disperse microencapsulated form, the problem of generating mists in confined spaces is eliminated;

Because of microencapsulation, the relatively heavy droplets will better approach the fire and not evaporate until exposed directly to the flame heat;

The portion of microencapsulated water that does not impact the flames may remain in dry powder form, minimizing collateral damage; and

This technology may allow use below freezing (0C) point and enable the introduction of free radicals that can interrupt the chemical reactions of the combustion process.

Key benefits offered by the new extinguishing agent include:

Does not contribute to global warming and has no ozone depletion potential;

No toxic products of decomposition;

Low cost ensured through the use of conventional microencapsulation technology;

Microencapsulation prevents evaporation before the pre-produced dry powder reaches the flame base; and

Takes heat away from the fire, removes oxygen and interrupts the combustion reaction.

This halon replacement can compete effectively with other hand-held systems. Potential application areas for occupied and unoccupied spaces are museums, storage facilities, machinery compartments, electrical cabinets, manufacturing plants, laboratories, etc.

Contact: Mr. Mark Obenshain, NASA Technology Applications Team, RTI International, United States of America.

E-mail: mdo@rti.org

Website: www.nasa.rti.org

FUMIGANTS

MB alternative

In the United States, researchers at the ARS Water Management Research Laboratory have developed a safe alternative to methyl bromide (MB). The team demonstrated that mixing soil fumigants in water and applying them through sub-surface irrigation systems could help preserve the production of strawberries and other high-value fruits/vegetables.

Contact: USDA-ARS-SJVASC, Water Management Research Lab, 9611, S Riverbend Avenue, Parlier, CA 93648, United States of America. Tel: +1 (559) 5962 850; Fax: +1 (559) 5962 851

Website: www.fresno.ars.usda.gov

Website: www.ars.usda.gov

Controlling nematodes in greenhouses

Researchers in Italy have tested the efficacy of a combination of different methods, as an alternative to the use of methyl bromide in controlling plant parasitic nematodes in greenhouses. Major root-knot nematodes causing damage to vegetable crops are Meloidogyne incognita, M. javanica and M. arenaria. Results have shown that when proper soil solarization periods were compared with methyl bromide and other chemicals, though some nematode infestation of the roots occurred during harvest, yield increases, compared with controls, were similar to those of other treatments. No significant yield increase was obtained when a chemical treatment followed soil solarization. Soil solarization for 45-60 days during July-August eradicated nematodes from the soil top profile, even in cases of heavy infestation.

Nematicides are useful when nematodes are the only soil pathogens to be controlled. Injection of 100 l of 1,3-dichloropropene at 35 cm depth, combined with soil solarization, controls nematodes in a deeper soil profile. However, if different soil-borne pathogens are present, a combination of fungicide and nematicide or soil solarization with a nematicide can be very effective. Also, cultivation of tomato cultivars resistant to root-knot nematodes in solarized soil is very effective in controlling most of the soil-borne pathogens.

Contact: Mr. Nicola Greco, Istituto di Nematologia Agraria, C.N.R., 70126 Bari, Italy.

Website: www.minagric.gr

New system uses plants to replace methyl bromide

In the United States, researchers at the College of Agricultural and Environmental Sciences (CAES), University of Georgia, are striving to develop a new management strategy that employs plants like mustard, collards and turnips as an alternative to the use of methyl bromide (MB). The new approach will use a group of natural fumigant compounds, known as glucosinolates, found in brassica crops collards and their cousins. When these compounds break down in soil, they release isothiocyanates, which can kill soil pests in a manner similar to MB. This natural fumigation quality of the brassica family has been known for years. Yet, no viable way has been established to use it economically.

The CAES team is focusing on developing a system that would allow brassica crops to be grown specifically for tilling back into the ground to break down and fumigate the soil in preparation for higher value crops such as tomatoes, cucumbers or squash. Farmers could harvest part of their brassica crop for the market and till in the rest as a fumigant.

Website: www.georgiafaces.caes.uga.edu

Aromatherapy for plants

Studies undertaken at the University of Florida, the United States, have shown that essential oils strong-smelling liquids beloved by people seeking relief from stress could be the basis of a new generation of eco-friendly defences against a variety of plant diseases. According to Prof. Tim Momol, Many of these (essential) oils have been used in traditional medicine solutions for bacterial infections and other illnesses. Now we are finding that the natural chemicals in some oils are effective against soil-borne diseases caused by bacteria or fungi.

Researchers applied essential oils to soil in potted greenhouse plants. It was observed that oils from thyme and palmarosa, both often recommended by aromatherapists as a treatment for bacterial infections, can kill Ralstonia solanacearum, a bacterium that causes wilt or rot in a wide range of plants, including major crops like tomatoes, potatoes and bananas. They found that the oils were also effective in controlling some soil-borne fungi known to damage crop plants. Both oils contain naturally occurring chemicals already used in some pest-control products. Researchers are particularly interested in thymol, the active substance in thyme oil, which is already known to repel insects and kill some kinds of mould. At low doses, thymol is safe for human consumption and has been allowed by the FDA for use as a food additive.

Website: www.southeastfarmpress.com

Essential oils to control pests

CSIRO researchers in Australia are investigating essential oils for controlling insects pests in stored grains. They investigated the fumigant insecticidal action of essential oil distilled from *Eucalyptus nocholii, E.blakelyi, Callistemon sieberi, Melaleuca fulgens and M.armilliaris*. Oils with high levels of monoterpene and 1, 8-cineole, proved to be the most effective against major pest species.

Contact: Byung-Ho Lee, CSIRO, Australia. Tel: +61 (2) 6246 4227, Fax: +61 (2) 6246 4202.

Website: http://sgrl.csiro.au

Heat treatment as an MB alternative

PepsiCo Foods Quaker Peterborough plant has been using heat treatment as part of its integrated pest management programme for over 30 years. Though insects die within minutes at about 50-60C, this facility maintains a minimum of 50C for 24 h to ensure that the majority of surfaces reach this lethal temperature. Planning plays an important part in the heat treatment schedule. A tentative annual plan is developed for the period from Easter to Thanksgiving (mid-October in Canada). This schedule is fine-tuned as the year progresses based on pheromone trap findings and knowledge of insects and trouble spots. Once the date for treatment has been finalized the following areas are prepared: the areas to be heated, heaters, building, equipment, sprinkler system and employees.

Once heat treatment is complete, the following steps should be performed prior to plant start-up: ensure window and door screens are in place for cool down, remove sealing material, close equipment, tighten conveyors and look for lubricant leakage and top up gearboxes as needed. Personnel responsible for the plants pest control programme should also monitor and record insect fallout, collect and analyse test cages, and review temperature records from the heat run. This will provide valuable information on insect hot spots within the plant, which could lead to changes in cleaning and inspection practices, as well as point out areas that may require changes to the heater and/or fan placements prior to the next heat treatment.

Contact: Mr. Jim Rosborough, PepsiCo Foods Canada Inc., Quaker Peterborough Plant, 34 Hunter Street West Peterborough, Ontario K9J 7B2, Canada.

E-mail: jim.rosborough@pcfci.com

Website: www.ars.usda.gov

Fumigants for seedling grapevines

Researchers at the Agricultural Research Service, the United States, have uncovered that nematode control in nursery beds of young grapevines fumigated using three experimental treatments yielded the same results as those treated with methyl bromide and then covered with tarpaulin. The treatments were chloropicrin, iodomethane plus chloropicrin or 1,3-dichloropropene plus chloropicrin, then covered with a plastic tarpaulin for 16 days in each case. Grapevines of six different popular wine, dessert and raisin varieties were nematode-free at harvest nine months later and the nursery plants were generally up to quality standards.

Contact: Ms. Sally Schneider, Agricultural Research Service, United States of America.

E-mail: sschneider@fresno.ars.usda.gov.

Ozonaction Newsletter, No. 46, December 2003

Organic herbicide

Certified Organics Ltd., New Zealand, offers a specially formulated fumigant to control branched broomrape, perhaps the worlds most destructive weed. Interceptor Seed Eradicator eliminates seeds lying dormant within the soil. The South Australian state government has commissioned a programme that will use the pine-based weed killer over a trial site. The weed survives by living off and eventually killing host plants and it makes contaminated areas unusable for many forms of arable farming and pastoral farming.

Website: www.scoop.co.nz

ODS RECYCLING/DISPOSAL

Disposing CFCs

Scottish Enterprise Tayside, the United Kingdom, offers a patented method to remove and destroy halogenated compounds. The new technology provides a safe, continuous and potentially fully automated single-phase treatment with more than 99.9 per cent efficiency. This procedure is less expensive and more efficient than conventional CFC removal techniques.

The catalyst technology involves a new preparation of palladium on a conventional mechanical support similar to that used in automotive catalysis. The catalyst can even be prepared using other substrates usually employed in the chemical industry. The formulation is exceptionally robust to the very corrosive environment generated by acid gases during the destruction of halogenated compounds.

Contact: Ms. Carrie Whamond, Scottish Enterprise Tayside, 45, North Lindsay Street, Dundee, Scotland DD1 1HT, United Kingdom. Tel: +44 (1382) 305 599; Fax: +44 (1382) 305 576

E-mail: carrie.whamond@scotent.co.uk

Website: www.dbs.cordis.lu

ODS and CFC recovery

Lesni A/S Air Purification Engineering, the United Kingdom, offers a new system for recovering toxic CFC-11, CFC-12 and pentane gases from refrigerators and freezers demanufacturing process. The combined CFC recovery plant generally comprises a catalytic cracking abator and chemical scrubber. This provides for a compact, favourable and economic solution for on-site purification of fugitive emissions from the refrigerator recycling process, thereby reducing waste, disposal and operating costs. The technology has been running successfully for more than four years.

Contact: Lesni A/S Air Purification Engineering, P.O. Box 7404, Sutton Coldfield, West Midlands B73 6TS, United Kingdom. Tel: +44 (121) 3553 162; Fax: +44 (121) 6287 847

Website: www.lesni-as.dk

Website: www.edie.net