VATIS Update Ozone Layer Protection . Mar-Apr 2004

Content

THE SCIENCE OF OZONE LAYER

Researchers isolate elusive ozone eating molecule

Scientists in the United States report to have caught red-handed a molecule long suspected of depleting ozone in the stratosphere. This first observation of Cl-O-O-Cl could result in more accurate predictions related to ozone. The team, led by Mr. Richard Stimpfle of Harvard University, developed the device that captured and measured the chlorine dimer molecule (two identical chlorine monoxide ClO molecules bonded together) in the Arctic stratosphere.

The chlorine dimer molecule was caught doing its infamous quick change, i.e. letting loose one or both of its bookend chlorine atoms to yield an oxygen (O2) molecule in the presence of sunlight. The chlorine atoms react with two ozone (O3) molecules, forming two ClO molecules and two oxygen molecules. ClO molecules then react with each other to re-form ClO-OCl and the process repeats all over again. This handy recycling of chlorine makes even low and elusive concentrations of ClO-OCl extremely harmful to ozone.

Website: www.abc.net.au

Ozone hole update

Ozone values, which peaked over Antarctica in December 2003, are slowly declining towards the normal autumn minimum. Ozone levels dropped quickly during August and September with the return of sunlight. Depletion exceeded 60 per cent in places, with some areas registering near 100 DU by the end of September. The ozone hole grew rapidly and peaked in size at around 28 million kilometres in mid-September. It was larger than recorded previously for this time of the year in August and early September, but the maximum size only equalled the all-time record.

Ozone levels increased during October and briefly exceeded ozone hole limits in mid-November. Values dropped again giving an ozone hole area of a few million square kilometres in late November. The final spring

warming occurred in December. However, this left many parts of Antarctica down 10-20 per cent of the long-term normal. The tip of South America and the Falkland Islands suffered significant ozone depletion during 4-9 October.

Website: www.antarctica.ac.uk

Ozone chemistry

Ozone affects climate and climate affects ozone. Temperature, humidity, winds and the presence of other chemicals in the atmosphere influence ozone formation and the presence of ozone, in turn, affects those atmospheric constituents. Scientists predict that the Earths stratospheric ozone layer will recover to 1980 levels by the year 2050. These projections are based on the assumptions that most nations have been abiding by international agreements to phase out production of ozone depleting chemicals such as CFCs and halons. However, the atmosphere continues to surprise us and some atmospheric researchers recently demonstrated a new twist to the ozone recovery theory that may change its ending. Well before the expected stratospheric ozone layer recovery date of 2050, ozones effects on climate may become the main driver of ozone loss in the stratosphere. As a result, ozone recovery may not be complete until 2060 or 2070.

The impact of ozone on climate primarily involves temperature changes. The more ozone in a given parcel of air, the more heat it retains. Ozone generates heat in the stratosphere, both by absorbing the suns ultraviolet (UV) radiation and by soaking upwelling infrared radiation from the lower troposphere. Consequently, the decreased ozone in the stratosphere results in lower temperatures. Observations have shown that in recent decades, the mid to upper stratosphere (30-50 km above the Earths surface) has cooled by 1-6C. This stratospheric cooling has taken place at the same time that greenhouse gas amounts in the troposphere have increased. Both these phenomena could be linked.

The deepest ozone losses over both the Antarctic and Arctic regions are a result of special conditions that occur in the winter and early spring. As winter arrives, a vortex of winds develops around the pole and isolates the polar stratosphere. When temperatures drop below -78C, thin clouds of ice, nitric acid and sulphuric acid mixtures form. Chemical reactions on the surface of ice crystals in the clouds release active forms of CFCs, leading to ozone depletion and the ozone hole appears. In spring, when the temperature begins to rise, the ice evaporates and the ozone layer starts to recover.

Website: www.earthobservatory.nasa.gov

Arctic clouds worsen ozone depletion

According to researchers at the Alfred Wegener Institute for Polar and Marine Research, Germany, if the upper reaches of the Arctic atmosphere get colder a predicted phenomenon of climate change then the rate of ozone depletion could be three times greater than presently estimated. Mr. Markus Rex and colleagues studied climate conditions in the Arctic over the past 10 winters to calculate how ozone destruction depends on the weather. The team found a surprisingly strong relationship between ozone loss and the amount of polar stratospheric clouds. These clouds form 20 km above the ground during winter and are sometimes called mother-of-pearl clouds because of their shimmering appearance. They provide reaction surfaces for chemicals that deplete the ozone layer. Chemical reactions in the clouds transform chlorine from industrially produced compounds into a reactive form that breaks apart ozone molecules.

Colder air in the stratosphere is thought to promote the formation of these clouds and the destruction of ozone. However, it has been hard to understand the scale of this problem. On average, the Arctic stratosphere has cooled barely perceptibly over the past few years, though the team states that wintertime conditions are getting more conducive to ozone destruction.

Website: www.nature.com

ODS PHASE-OUT IN INDIA

R&D for CFC substitutes

The cooperation between industry leaders in the refrigerant sector and the government, under the umbrella of the Montreal Protocol, has provided additional impetus to indigenous R&D efforts at developing CFC substitutes. As per the Montreal Protocol, all CFC products must be phased out by 2010. With regard to the emerging CFC substitutes scenario, Mr. S.C. Wadhwa, chief spokesperson of the Refrigerant Gas Manufacturers Association, opined that market development was subject to creating a sound domestic consumption base.

The Indian Institute of Chemical Technology (IICT) has been able to bench-scale some of the CFC substitutes developed and upgrade them to pilot scale through funds provided by SRF Ltd. and Navin Florin, along with the Department of Science and Technology as well as the Council of Scientific and Industrial Research. Mr. Wadhwa stated that although these technologies posed some integration problems, SRF and Navin plan to upgrade them soon to commercial scale.

Website: www.thehindubusinessline.com

Customs training organization in the Asia-Pacific

The National Academy of Customs, Excise and Narcotics (NACEN), through active collaboration ventures with the World Customs Organization and Asian Development Bank, is now poised to emerge as a major customs training organization in the Asia-Pacific. According to Ms. Parveen Talha, Director General of NACEN, training is very crucial for tax collectors in both customs and central excise. For example, NACEN has a programme with UNEP for training enforcement officers in ODS, as there is a need to inform the officers about the Montreal Protocol and the nations ODS phase-out obligations. This has helped NACEN not only to hold several sensitization programmes across the country, but also to acquire the expertise to train customs personnel from other Asia-Pacific countries.

Website: www.thehindubusinessline.com

IN THE NEWS

Trade route for illegal CFCs

The border between Afghanistan and Pakistan, already a key route for the heroin trade, is being used for smuggling CFCs. According to Mr. Salem Mutuwala, Director of Karachi-based Symphony Ltd., at least 20-25 Pakistani businesses were dealing in CFCs smuggled in as part of the heroin trade. He says that CFC smuggling routes originate from Afghanistan, responsible for a great portion of the heroin trade, or China. Mr. Mutuwala states that Some are Indian and some are strange manufacturing brands that we seem to have coming now. They seem to be East European or Russian. Though heroin trade is the main route for the ozone depleting chemicals, CFCs are also conveyed disguised in cylinders inside large containers.

The process by which CFCs are smuggled is sometimes a complex chain. Companies in the West produce the chemicals for export to countries where they are required under the basic needs production provision. CFCs

sold to perfectly legal brokers may find its way into less legitimate businesses. According to Dr. Ezra Clarke from the Environmental Investigation Agency, CFCs from legitimate production facilities are sold to brokers or intermediate countries. CFCs are then laundered on to black markets, where they can be smuggled. Investigations reveal that Dubai and Singapore are the most often used intermediate nations.

Website: www.newsvote.bbc.co.uk

China: Integrated packages for Montreal Protocol

At the 2003 International Forum on Phasing out of ODS in the polyurethane (PU) foam sector in China, UNIDO representative in China, Mr. Miranda da Cruz, declared that UNIDO has established a branch specifically to provide technical and related assistance for ODS phase-out in eligible countries. UNIDO projects therefore include activities related directly or indirectly to technology transfer, industrial safety, training of managerial and technical personnel, improvement of the quality of products for both the domestic and export markets, and strengthening institutional capacities for the sustainability of the individual sector being assisted. Equipment and services are also supplied to entrepreneurs. UNIDOs present portfolio in China for phasing out CFCs in the PU foams and refrigeration manufacturing sectors correspond to almost US$55 million or a phase-out of around 4,000 tonnes of ODS.

UNIDO has provided integrated packages for the required technical services and design of related policies and strategies with considerable achievements. Implementation of the umbrella project under the Foam Sector Plan is in line with recent trends of devolving greater responsibility to the governments. UNIDO and the State Environmental Protection Agency (SEPA) have developed a very innovative mechanism, based on the principles of industrial rationalization to assist small- and medium-scale companies to phase out CFCs in the PU foam sector. Under the joint implementation scheme, a well-balanced system for restructuring and consolidation within the groups of enterprises is pursued. As such, the mechanism helps fulfil the objectives of phasing out CFCs and also ensures the sustainability and competitiveness of future operations of the converted enterprises. UNIDOs achievements in implementing Montreal Protocol projects in China has opened many doors for it, and it has become the lead agency in designing the National Implementation Plan for POPs.

UNIDO in Action in Asia-Pacific, Vol. 1, No. 3, 2003

China to accelerate phase-out in refrigeration sector

The State Environmental Protection Administration (SEPA) of China is developing a Country Compliance Plan (CCP) and has advanced its schedule for ODS phase-out to 2007. The CCP will cover all ODS sectors, including refrigeration servicing and metered dose inhalers. UNEP DTIEs Compliance Assistance Programme (CAP) is assisting SEPA with the development of a Refrigeration Servicing Sector Strategy (RSSS), including the recent visit of the CAP Refrigerant Management Plan Officer to SEPAs headquarters.

The CCP, along with the RSSS draft, is anticipated to be submitted for consideration at the 43rd ExCom meeting this July.

Contact: Mr. Shaofeng Hu, Programme Officer (RMP Implementation), UNEP/ROAP, United Nations Building, Rajdamnern Ave., Bangkok 10200, Thailand. Tel: +66 (2) 2881 126; Fax: +66 (2) 2803 829; E-mail: hus@un.org Or Ms. Xiaofang Zhou, Senior Programme Officer, Division III, Foreign Economic Cooperation Office, SEPA, No. 115, Xizhimennei Nanxiaojie, Beijing 100035, China. Tel: +86 (10) 6711 6499; Fax: +86 (10) 6615 1776; E-mail: zhouxf@svr1-ek.unep.net

Ban on import of ODS

At a regional workshop on Ozone Layer Protection conducted in Pakistan, participants called for a worldwide

ban on the import of ODS and phasing out of chemicals that damage the ozone layer. The workshop was jointly organized by the Ozone Cell of the Ministry of Environment, UNEP and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). This event brought together experts and government officials from the environment ministries of Bangladesh, Sri Lanka, the Republic of Korea, India, Thailand and Pakistan. Issues such as licensing, capacity building of customs authorities and enforcement of regulations were discussed. Each nation shared its experience in reducing the presence of ODS and agreed on strategies to phase out these substances in compliance with the Montreal Protocol.

Website: www.dawn.com

Public-private partnership to tackle illegal ODS trade

A new alliance has been forged to tackle illegal ODS trade following a meeting of governments, international agencies, chemical producers and non-governmental organizations (NGOs). The workshop on Preventing Illegal Trade: Public-Private Partnership was organized by UNEPs Compliance Assistance Programme of OzonAction in the Regional Office for Asia-Pacific. This meeting brought together, for the first time, industry and government representatives from China, India, the European Union and Russia, as well as the World Bank and the NGOs Environmental Investigation Agency and Stockholm Environment Institute. The two-day workshop considered problems caused in Asia by the burgeoning illegal trade in ODS. Participants, representing 85 per cent of total global CFC production, committed themselves to greater cooperation and transparency in sharing information and intelligence to combat this menace.

The meeting proposed a system of information exchange between countries, specific actions on tackling illegal trade and follow-up bilateral and regional initiatives.

Contact: Mr. Tim Higham, Regional Information Officer, UNEP, Bangkok, Thailand. Tel: +66 (2) 2882 127

E-mail: higham@un.org

Website: www.uneptie.org

UNEP News Release ROAP 2004/3

This year is National Ozone Year in Sri Lanka

The Government of Sri Lanka has declared 2004 as National Ozone Year in recognition of important ozone protection milestones. These are:

The National Ozone Unit will complete 10 years of operation in July;

The nation will complete 15 years as a Party to the Montreal Protocol on 15 December; and

The Montreal Protocol will complete 17 years on 16 September.

Though Sri Lanka does not produce ODS, it uses a significant amount primarily in refrigeration and air-conditioning (RAC) servicing, agriculture and quarantine applications. Under the Multilateral Fund, the country is being provided with technical and financial assistance from the Government of Japan, UNDP and UNEP. The following activities have been scheduled by the National Ozone Unit to celebrate the National

Ozone Year:

Establish an Ozone Information Centre and a Refrigerant Management Centre in Parisarapiyasa, Battaramulla;

Conduct an awareness creation campaign for all target groups, i.e. school children, teachers, policy makers, NGOs, industrialists, etc.;

Organize a special briefing session for parliamentarians to create awareness on environment, and economic and policy matters on implementation of the Montreal Protocol;

Conduct a special awareness campaign at Sri Pada, Nallathanni, Kataragama, Madu church and Kandy during the festive seasons;

Organize an All-Island Quiz programme and poster competition;

Organize the International Ozone Day celebrations as a special event;

Train customs officers and appoint a Task Force to develop important regulations and prevent unauthorized imports of ODS;

Train RAC technicians on Good Practices in Refrigeration, covering the entire island, and provide necessary equipment and develop a plan for accreditation;

Develop a database for management of ODS;

Develop safety standards for all types of refrigerants, including hydrocarbons; and

Take action to actively implement the approved end-user incentive programme and methyl bromide phase-out project.

Contact: Dr. W.L. Sumathipala, National Coordinator, ODS Officer Montreal Protocol Unit, the Ministry of Environment and Natural Resources, Sri Lanka.

E-mail: unmpu@sri.lanka.net

Website: www.uneptie.org

Illegal imports of spurious refrigerants

In the Philippines, the Department of Environment and Natural Resources (DENR) has cautioned car owners about the proliferation of fake refrigerants that could mean a more costly replacement of a compressor for car air-conditioning units. The warning was issued by Environmental Management Bureau after the discovery of the strictly regulated Refrigerant 12, commonly known as Freon 12 or R-12, in 28 disposable cylinders mislabelled as R-134a, an ozone-friendly refrigerant, fitted in recent car models. The Philippine Ozone Desk reports that many service shops and contractors were being deceived as to the real content of the cylinders they purchased from their suppliers.

Website: www.malaya.com.ph

REFRIGRATION/AIR-CONDITIONING

Mobile air-conditioner based on HFC-152a

Red Dot Corp., the United States, has introduced the first mobile air-conditioning system to use the eco-friendly HFC-152a refrigerant, which also improves cooling capacity and decreases fuel use. The new technology complies with stringent regulations proposed by the European Commission. The new system employs hydraulic compressors and secondary loop technology to increase reliability and safety, as well as to lower the amount of refrigerant and energy required.

The company is scheduled to test in trucks the HFC-152a air-conditioning technology, which has the potential to reduce greenhouse gas emissions from this source by over 90 per cent. Red Dots technology is also suitable for air-conditioning in passenger vehicles.

Contact: Mr. Gary Hansen, VP Engineering, Red Dot Corp., United States of America.

E-mail: garyhansen@reddotcorp.com

Website: www.uneptie.org

Ammonia chilling plants

Cooling Tower Corp., India, is a pioneer and original manufacturer of ammonia-based water and brine chilling plants. The company is offering ammonia chilling plants with capacities varying from 10 TR to 2,000 TR for chill water application and from 10 TR to 100 TR, up to -50C, for brine chilling applications. These plants incorporate shell-and-tube water-cooled condenser-cum-receiver and shell-and-tube flooded type ammonia chiller-cum-surge drum. They are fitted with all the necessary controls and valves such as discharge check valve, hot gas valve, liquid valve, safety valve, purge valve, pressure gauge, pressure safety switch, liquid strainer, expansion valve, thermostat, digital temperature indicator, etc.

Optional items available include matching cooling towers, buffer storage tank, pumps, piping job, valves, fittings, insulation, and first charge of gas and oil.

Contact: Cooling Tower Corp., 40, GIDC Estate, Makarpura, Vadodara 390010, Gujarat, India. Fax: +91 (265) 2633 491/2642 337

E-mail: acs_brd@yahoo.co.in

Refrigerant monitor

MSA Instrument Division, the United States, offers MSA Chillgard RT refrigerant monitor for detecting R-245fa, a new low-ODP refrigerant, as well as over 60 of the most commonly used refrigerant gases, including ammonia, HCFCs, HFCs and CFCs. Chillgard detects down to 1 ppm, over a range of 0-1,000 ppm. Other monitoring ranges are also possible.

The refrigerant monitor incorporates advanced photoacoustic infrared (IR) sensing technology to detect individual refrigerants with high specificity, while maintaining the necessary level of sensitivity. Chillgard features reduced cross-sensitivity to other refrigerants, cleaning solvents and other common industrial

compounds that can cause false alarms with monitors based on less advanced technologies. Photoacoustic IR sensing technology is highly stable, reliable and more cost-effective than conventional IR measurement systems.

Chillgard offers a multi-refrigerant option and up to eight detection points, providing tremendous flexibility to meet specific application needs. An integrated sensor and control module enables this monitor to perform continuous sampling without the need to enter auto-zero mode.

Contact: Ms. Cecelia Weber, MSA Instrument Division, P.O. Box 427, Pittsburgh, PA 15230, United States of America. Tel: +1 (724) 7768 721; Fax: +1 (724) 7768 892;

Website: www.MSAgasdetection.com

Website: www.media.msanet.com

New hydrocarbon refrigerant

Thermofluid Technologies Inc., the United States, offers Red Tek-12a, a highly refined alkane/hydrocarbon product formulated and blended to replace R-12 refrigerant in existing installations with few, if any, modifications. The new hydrocarbon refrigerant has a boiling point of -34.7C at atmospheric pressure and a density lower than R-12. This, combined with the higher latent heat and thermal conductivity, has the desirable effects of reducing the weight of refrigerant needed to extract a specified amount of heat. Red Tek-12a is designed to be as close to the operating performance of R-12 systems as well as in new systems as a direct replacement for R-134a.

Red Tek-12a has a very short atmospheric lifetime, measured in weeks. When released into the atmosphere, the refrigerant breaks down into carbon dioxide and water. Moreover, this zeotropic formulation does not contain bromine or chlorine and as such has no ozone depletion potential. It is compatible with R-12 or R-134a systems involving:

Metal components

Compressor motor materials

Mineral and synthetic (ester and PAG) lubricants

Seals, gaskets and O-ring materials

Contact: Thermofluid Technologies Inc., 2413 E. Broadway, 141, Maryville, TN 37804, United States of America. Tel: +1 (888) 6769 380; Fax: +1 (865) 9830 068.

Website: www.redtek.ca

New air-conditioning unit

A group of companies based in Japan have jointly developed an air-cooled chiller unit that offers the worlds highest coefficient of performance, a remarkable 4.1/3.7 (cooling capacity 160/180 kW at 50/60 Hz), in the

field of air-cooled chiller units used for air-conditioning in buildings and factories. The system uses eco-friendly R-407c and new technologies to raise efficiency, save energy and lower operating costs.

Two types of products are available, a heat pump type (that can be used for both heating and cooling) and a cooling only type. The consortium of firms includes Hitachi Air-conditioning Systems, Tokyo Electric Power, Chubu Electric Power and Kansai Electric Power.

Website: www.japancorp.net

Ecological refrigerant

Solvadis cpc GmbH, Germany, has developed an ecological refrigerant based on the hydrocarbons propane, n-butane, isobutane and propylene. Aeron, which exhibits an especially high level of purity, can be used to replace CFCs and fluorocarbons used as refrigerants in heat pumps and refrigerating machines.

Contact: Solvadis cpc GmbH, Hentrichstrae 65, D 47809, Krefeld, Germany. Tel: +49 (2151) 52190; Fax: +49 (2151) 521 922

E-mail: mail@solvadis-cpc.de

Website: www.solvadis-cpc.de

New refrigerant alternatives

Glacier Gold Refrigerants of Canada is offering ultra-efficient replacements for both Freon (R-12) and R-134a refrigerants. Six ounces of Glacier GOLD-12a is equivalent to 18 oz of R-12 or 16 oz of R-134a. This alternative is -12.55C colder than R-12 and -9.22C colder than R-134a. Also, compressors need 30-40 per cent less energy.

Glacier GOLD-12a hydrocarbon refrigerants do not contain chlorine or bromine. Retrofitting or oil changes are not required in the case of properly operating systems based on R-12 or R-134a. The refrigerant is not harmful to the gaskets, seals, O-rings and hoses. R-502 and R-22 refrigerants used in air-conditioning systems can also be replaced by this new eco-friendly refrigerant, available in cylinders or cans.

Contact: Glacier Gold Refrigerants, Ontario, Canada. Tel: +1 (989) 3792 092/122

E-mail: rshill7@bignet.net

Website: www.glacier-gold-refrigerants.com

Package liquid chillers

RC Group, based in Italy, offers a wide range of packaged liquid chillers. Models in the FHR series, among others, feature screw compressor with cooling capacities ranging from 150 to 4,000 kW when using R-22 or R-407c refrigerants and 90 to 2,700 kW while operating on R-134a. Designed, tested and produced according to ISO 9001 standards, the chillers are equipped with built-in water-cooled condensers and total heat recovery systems. Key features include:

Fabricated using anti-corrosion materials;

Semi-hermetic screw compressor with oil separator and non-return valve on the discharge line;

Shell-and-tube evaporator with one gas circuit for each compressor, steel shell and removable copper tubes, insulated with closed-cell polyurethane;

MP99 microprocessor control system; and

IP42 electric board equipped with door lock main switch, microprocessor and auxiliary switches.

Website: www.videolife.kiev.ua

SOLVENTS

CFC-free cleaners

Wujiang Dingsheng Electron Co. Ltd., China, offers three new CFC-free cleaners IC-TS-OFNF, IC-Super Clear II and IC-TS-OO. The specially formulated hydrocarbon cleaners guarantee excellent cleaning effect for the following applications:

Cleaning PCB assembly after SMT reflow and wave soldering processes to remove the flux residue with ultrasonic vapour degreaser machine;

Removal of solder paste residue from stencils in SMT process;

Cleaning misprinted PCB to remove solder paste residue in SMT process; and

Cleaning metal parts for removing grease or oil on the surface.

Contact: Wujiang Dingsheng Electron Co. Ltd., No. 93, South Road of Jiangling, Wujiang City, Jiangsu Province, China. Tel: +86 (512) 6348 3260; Fax: +86 (512) 6348 3261

E-mail: solder@dingshengsz.com

Website: www.dingshengsz.com

Contact cleaners for electronics

Due-Ci Electronic s.n.c., Italy, offers new cleaners for use in the electronics industry. Safe on most plastics, these solvents do not contain CFCs, HCFCs or chlorinated solvents. The R-10 contact cleaner removes oxides from all kinds of electric and electronic contacts. It cleans and protects against moisture, corrosion and oxidation, while eliminating friction wear, sticking and squeaking parts. Not suitable for use on live electrical equipment, R-10 cleans and lubricates all kinds of metal contacts, relays, plastic embedded contacts, circuit breakers, fuse blocks, keyboards, etc.

R-11 contact cleaner is meant for cleaning and protecting electromechanical slide contacts, push buttons, switches, commutators, sockets, plugs, keyboards, etc. It eliminates creaking of potentiometers and assures deep and effective cleaning in linear and sliding contacts, avoiding current leakages. R-11 is designed to

dissolve and remove oxidation from electrical contacts and a hydro-repellent agent in it prevents oxidation process. It is not advised for use on live electrical equipment.

G-22 dry contact cleaner is a specific cleaner and degreaser for the most precise and delicate electronic equipment and sensitive components. It evaporates completely without leaving behind any residue. G-22 removes a wide variety of soils, including dirt, old grease, oxides, oil, dust and fluff from electrical and electronic units, controls, bearings, rheostats, switches, PC boards and office equipment. This ozone-safe cleaner is very effective for cleaning recording magnetic heads. It is safe for use on most plastic and rubber parts.

G-20 dry contact cleaner is an extremely pure solvent that removes grease, dirt, oil, lint and other residues from electronic parts. It evaporates quickly without leaving any residue. It is an excellent degreaser for PC boards, before and after soldering the components, and does not affect any insulating coating. This ozone-safe solvent is suitable for cleaning metal housings, and telephone equipment, fax machines, remote controls, computers, relays, switches, etc.

Contact: Due-Ci Electronic s.n.c., Strada del Casalino 11, I-37127 Verona, Italy. Tel: +39 (45) 916 251; Fax: +39 (45) 8343 294

E-mail: info@duecielectronic.it

Website: www.duecielectronic.it

Multi-purpose precision cleaner

OceanSolve, South Africa, offers a multi-purpose precision cleaning solvent for use in equipment such as vapour degreasers, aerosols, hot or cold dip-baths, ultrasonic cleaners and cold cleaning. The precursor to the major component to this solvent originates from the ocean. The new solvent has a very low ODP and GWP, and an atmospheric lifetime of 11 days. The easily recyclable OceanSolve offers the following benefits:

It typically lasts 3-4 times longer than chlorinated solvents in bath and vapour degreaser applications;

Needs less energy than most solvents;

Can be more easily retained in a vapour degreaser; and

Can be used in existing equipment.
Key features of the non-inflammable OceanSolve include:

Extremely low non-volatile residue makes it suitable for precision applications;

Free from CFCs and HCFCs;

Non-carcinogenic and as such is much safer than many commonly used chlorinated solvents;

Relatively fast drying, which allows for quick cleaning operations; and

It has a manufacturer recommended occupational exposure limit of 100 ppm, which is much higher than

normal chlorinated solvents.

OceanSolve is compatible with common metals and alloys, plastics and elastomers.

Contact: E-mail: mail@bromineafrica.co.za

Website: www.bromineafrica.co.za

Electronic contact cleaner and degreaser

Terand Industries Inc., the United States, offers E-tronic contact cleaner that has been designed to replace CFCs, PFCs and other HCFCs with high ODP values in a variety of applications. E-tronic is an environmentally sensible, ultra-pure HCFC aerosol solvent propelled with HFC-134a. Its solvency, non-inflammability and other physical properties make it an ideal aerosol for general and precision electrical and electronic cleaning and degreasing. The rapidly evaporating, residue-free solvent used in E-tronic is thermally stable, non-inflammable and non-detrimental to a range of plastics, rubber, etc.

Website: www.cpcaerosols.com

New CFC-free solvents

Servisol, the United Kingdom, offers a range of solvents for use in precision cleaning and heavy degreasing. These CFC-free solvents remove a wide range of soiling, evaporate completely, offer good material compatibility with varying surface contact times and leave no residue. The list of solvents include:

Video 40 (75 ml) and Video 40/2 (200 ml): Used for cleaning tape heads and disk drives, they ensure crisp and clear performance by reducing wear and removing moisture from delicate parts;

De-Flux 160 (200 ml) flux remover and PCB cleaner: Removes all organic/inorganic fluxes and residue from PCBs and electronic components;

Coldklene 110 (200 ml): A powerful degreasing agent for cold cleaning of electrical equipment. It quickly disperses grease, wax, oil, tar and other carbonaceous deposits;

Aero Klene 50 (200 ml) electronic cleaning solvent: Suitable for dry contacts and switches, PCBs, relays, potentiometers, etc.;

Label remover 130 (200 ml): A highly effective solvent for removing self-adhesive stickers and labels. It quickly neutralizes adhesion and bonding of labels to facilitate clean and easy removal. Suitable for use on rollers, casings, containers, cabinets and many other non-absorbent surfaces;

CD 150 (200 ml): A specialized blend of cleaning agents that has been formulated for use on all audio, video and computer CDs. It quickly removes light soiling, e.g. fingerprints, leaving the CD clean and dry to ensure clear reading and optimum performance; and

IPA 170 (400 ml, non-aerosol): A universally recognized electronic cleaning solvent. It forms an azeotrope with water for effective removal of moisture from parts and components.

Contact: Servisol, Wylds Road, Bridgwater, Somerset TA6 4DD, United Kingdom. Tel: +44 (1278) 424

200/727272; Fax: +44 (1278) 425644

E-mail: technical@servisol.co.uk

Website: www.servisol.co.uk

New organic solvent

Lyondell Chemical Co., the United States, offers a unique non-HAP, potentially VOC-exempt organic solvent with versatile performance and negligible photochemical reactivity. Tertiary butyl acetate (TBAc) is designed to solve many compliance hurdles faced by manufacturers and end-users of formulated products. It can be used alone or in solvent blends for applications such as coatings, adhesives, industrial cleaners and degreasers.

TBAcs physical properties include broad solvency range, an intermediate evaporation rate, low density and a flash point well within accepted industry parameters. This unique combination of properties makes TBAc an ideal candidate for solvent replacement in many applications. It is a potential alternative for a variety of HAP solvents and VOCs, including aromatics (toluene and xylenes), ketones (MEK, MIBK) and other esters as well as ozone depleters such as methyl chloroform and CFC-113. TBAc is not toxic by inhalation or skin absorption and only slightly toxic by ingestion.

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

Website: www.lyondell.com

AEROSOLS

Inhaled corticosteroid

Aventis S.A., France, plans to sell the global rights to Azmacort (triamcinolone acetonide) inhalation aerosol to Kos Pharmaceuticals Inc., a speciality pharmaceutical firm based in the United States. Azmacort, an inhaled corticosteroid, is indicated as a prophylactic treatment for asthma patients aged six years and above. It is also prescribed for asthma patients who require systemic corticosteroid administration, where adding Azmacort may reduce or eliminate the need for systemic corticosteroids.

On launching an Azmacort HFA formulation, Kos will pay Aventis an annual royalty on net sales.

Contact: Aventis S.A., Headquarters, Espace Europeen de IEntreprise, 16, Avenue de IEurope, 67917 Strasbourg, Cedex 9, France. Tel: +33 (3) 8899 1100.

Website: www.aventis.com

Compressed air filler for safer spatter control

Stevens Industrial Services (SIS) of the United Kingdom has moved forward in its environmentally sound products policy with the installation of a new filling machine that obviates the need for CFC propellants. The Works range of weld spatter control products will now be filled into cans using compressed air, making SIS the first anti-spatter supplier to use this specially designed dispenser. The Works range is also environmentally

sound because it does not contain the health-damaging and carcinogenic chemical, dichloromethane, unlike many other spatter control products on the market.

The new dual chamber system, which is now in operation, can easily fill both compressed air single chambers and compressed air dual chambers for a bag-on-valve system within the aerosol. Once emptied, The Works containers can be safely disposed of in normal refuse. This new machine uses under-the-cup crimpers, making it suitable for use with compressed gases, such as those within The Works range.

Contact: Stevens Industrial Services, Littleburn Industrial Estate, Langley Moor, Durham DH7 8JE, United Kingdom. Tel: +44 (191) 378 1786.

Website: www.processingtalk.com

FOAMS

New pentane technology

Dyplast Products, the United States, offers ISO-25 pentane process line. Based on patented technology that uses pentane as a blowing agent, ISO-25 delivers superior quality and properties including excellent structural integrity, workability and friability. It is rated at Class A (25/50) for flame spread and smoke density based on certified tests conducted at the Factory Mutual Research Facility.

ISO-25 is an unfaced, rigid polyisocyanurate foam insulation suitable for a wide range of applications and is the insulation of choice for cold storage, freezer and cryogenic applications. ISO-25 is also ideal in many piping and vessel applications in process facilities for LNG, pharmaceutical, petrochemical complexes, etc. It has the highest R-value to thickness ratio of any commercially available insulation, besides being highly moisture-resistant, strong and lightweight.

Contact: Dyplast Products, 12501 NW 38th Avenue, Miami, FL 33054, United States of America. Tel: +1 (305) 9210 100; Fax: +1 (305) 6878 013

E-mail: info@dyplastproducts.com

Website: www.dyplastproducts.com

New polyolefin foam

Zotefoams plc., the United Kingdom, offers closed-cell cross-linked polyolefin foam. This product is unique in that it is manufactured using a nitrogen-expanded production process to achieve pure foam of superior structure. Other products developed by the company include Plastazote foam (launched in 1961 as the worlds first-ever closed cell cross-linked polyethylene foam), Evazote and Supazote foams (both are based on ethylene copolymers) and Propozote foam (a closed cell 100 per cent polypropylene foam). They are all fully free of CFCs, HCFCs and VOCs. These high-performance materials offer the automotive designer and specifier several outstanding properties, including:

Inertness/purity and lightness in weight;

Toughness, flexibility and resilience;

High degree of energy absorption;

Excellent chemical and water resistance;

Thermoformability, employing standard vacuum-forming or heat impression moulding techniques;

Ease of fabrication, using well-known techniques;

Wide operating temperature range (up to 130C with certain grades);

Do not cause staining of paint finishes;

Do not corrode metal parts; and

Good UV stability.

In thermoforming applications, Zotefoams range offers the following benefits: deeper draw ratios made possible by the superior cell structure, odour-free as a result of the absence of chemical residues and no distortion. Densities from 15 kg/m3 up to 120 kg/m3 are available. Automotive applications for these versatile materials are:

Gaskets and seals;

Water shedders inside vehicle doors;

Crash protection and energy management components;

Insulators for AC components; and

Returnable transit packaging for components in manufacturing plants.

Zotefoams range offers effective replacements for established materials such as neoprene, expanded polystyrene, polyurethane foam, PVC foam, wood composites, mineral wool, etc. and is finding new applications where strong colours, softness, stiffness, uniform cell structure and chemical inertness are key considerations.

Contact: Zotefoams plc., 675, Mitcham Road, Croydon, Surrey CR9 3AL, England, United Kingdom. Tel: +44 (20) 8664 1600; Fax: +44 (20) 8664 1616

E-mail: info@zotefoams.com

Website: www.sovereign-publications.com

Blowing agent for thermoset foams

DuPont, the United States, offers Formacel Z-4 blowing agent for all polyurethane foams such as appliance foams, polyisocyanurate board and integral skin foams. The low-boiling blowing agent has a vapour pressure of 82 psig at 25C and offers several advantages in appliance and polyisocyanurate board applications. Formacel Z-4 does not condense in the foam cells at the low application temperatures, thus assuring high cell gas pressure and excellent foam dimensional stability. Moreover, the insulation value of these foams will not be reduced at low temperatures owing to cell gas condensation.

Formacel Z-4 is compatible with HIPS and ABS plastic liners used in appliances and will not cause blisters or stress cracking.

Contact: DuPont, Global Headquarters, DuPont Building, 1007, Market Street, Wilmington, DE 19898, United States of America. Tel: +1 (302) 7741 000

E-mail: info@dupont.com

Website: www.dupont.com

New family of rigid PU systems

Foam Supplies Inc., the United States, has developed a family of rigid polyurethane (PU) systems that utilize an alternative blowing agent. The EPA SNAP-approved blowing agent, Ecomate, has zero ODP and GWP. Tests have demonstrated that Ecomate is an ideal HCFC-141b replacement and offers thermal efficiency on par with or better than HCFC-22 and HFC-134a systems. It requires minimal or no equipment, plant or production alterations. A major feature of Ecomate is its thermal efficiency. At present, Ecomate is being used in low-temperature appliance applications such as refrigerators, drink dispensers and ice machines.

Website: ozo_foams.htm

New foam technology

BASF Corp., the United States, offers sustainable spray polyurethane foam engineered building envelope systems that are durable, energy efficient and renewable. These systems are manufactured using Zone3 zero-ozone depleting technology. Developed to replace HCFC-141b, Zone3 blowing agent is approved by EPAs SNAP programme. Spray foam systems based on Zone3 offer superior low-temperature performance, significantly stronger compressive strength and easier, more efficient application to roof details such as vents and penetrations. Other features include:

Extended building life;

Lower life cycle cost;

Energy efficiency;

Quick and simple installation;

Seamless protection;

Superior wind uplift resistance;

Self-flashing; and

Fits all shapes of deck, including domes, geometric shapes, etc.

BASF is the only firm to offer complete engineered building envelope system, including Walltite insulating air barrier systems, Elastospray spray PU foam roofing systems, a full system roof warranty and a single source supply of silicone, urethane, polyurea and acrylic coating solutions for the roofing market.

Contact: BASF Corp., Headquarters, 3000, Continental Drive - North, Mount Olive, New Jersey 07828 1234, United States of America. Tel: +1 (973) 4262 600.

Website: www.basf.com

New technology for open-cell and closed-cell PS foams

Reifenhauser, Germany, has developed REIcell process to produce foamed sheet from thermoplastic raw materials in a single step through a simple, reliable and eco-friendly method. Owing to the high flexibility of the line concept, it is possible to produce various thicknesses and densities as well as various foam structures and surfaces. The surface finish of the sheet can be further improved using the REIcell co-extrusion method.

REIcell process is based on the direct gassing technology. In the extruder, the polymer melt is continuously mixed with a blowing agent at high pressure. The defined pressure relief at the outlet of the round-section die leads to evaporation of the blowing agent and foaming of the film web. Intensive air-cooling of the melt web ensures a homogeneous foam structure and well-closed surfaces. Special raw material formulations allow the production of specific open-cell foams to be used as liquid absorbing foamed film in packaging. At the heart of the line is the Reitruder, a specially designed co-rotating twin-screw extruder. When processing polystyrene (PS) and polypropylene, output of the REIcell lines range up to 50 kg/h with the Reitruder RZE 43 and up to 500 kg/h with Reitruder RZE 110.

Contact: Dr. Ulrich Berghaus, Management of Sales and Engineering, Troisdorf, Germany. Tel: +49 (2241) 481 557; Fax: +49 (2241) 481 741

E-mail: Ulrich.Berghaus@reifenhauser.com

Website: www.reifenhauser.com

HALONS

Fire suppression technology for industrial oil cookers

In Canada, researchers working on a Fire Risk Management Programme at the Institute for Research in Construction (IRC) have demonstrated that fine-droplet water mist can successfully put out commercial cooking oil fires and prevent re-ignition. Industrial oil cookers are used in food processing facilities to deep-fry food products such as chicken, fish, potato chips and doughnuts. With oil varying in quantity from hundreds to tens of thousands of litres, the fire can spread rapidly over the oil surface to form a large fire. Though carbon dioxide-based extinguishers are presently used to control such fires, it cannot bring the oil below its auto-ignition temperature and prevent re-ignition. Chemical extinguishing agents are not considered as an alternative since they are not approved for use in food processing facilities.

Tests have shown that the IRCs two water mist systems were effective in extinguishing cooking oil fires with short extinguishing times. The fine water droplets penetrated the fire plume and reached the oil surface. Oil temperature quickly decreased with water mist discharge. No burning oil was splashed outside the cooker and no cooking oil re-ignited in the pan. Effectiveness of the water mist systems depended on the spray pattern and coverage, water density distribution and water spray momentum.

Contact: Dr. Zhigang Liu, Institute for Research in Construction, Canada. Tel: +1 (613) 9905 075; Fax: +1 (613) 9540 483

E-mail: zhigang.liu@nrc-cnrc.gc.ca.

Website: www.pmengineer.com

New extinguishant developed in Japan

The Agency of Industrial Sciences and Technology, Japan, has developed and patented a method to put out fires by applying a gaseous fire extinguishing composition comprising, as an active component, a polyfluoro-tertiary amine. The polyfluoro-tertiary amine compound can be either in a gaseous or liquid state at room temperature. It has a lower boiling point than halon extinguishing agents.

Website: www.patft.uspto.gov

Extinguisher with patented carbon dioxide overcharge

Minimax GmbH & Co. KG, Germany, is offering new fire extinguishers that incorporate patented carbon dioxide (CO2) overcharge. Minimaxol is an adhesive, covering, stable foam, which is suitable for burning liquids and surface fires. With its very effective additives, foam water mixture in the Minimaxol fire extinguisher does not produce an extinguishant cloud that impedes visibility. Minimaxol extinguisher is an effective and nearly residue-free alternative to powder extinguishers used in Class A and B fires. The patented CO2 overcharge is available with 6 l and 9 l extinguishant and as frost-proof version up to -30C. In fire classification A, the combination of cooling and barrier effect is used; water lowers temperature below the inflammation point and during evaporation a coat of salt crystals builds up and prevents the fire from flaring up again. In fire classification B, a sliding film and foam layer stops oxygen supply and prevents re-inflammations and the occurrence of toxic vapours. Minimaxol is suitable for burning liquids and surface fires.

The firms water fire extinguisher with patented CO2 overcharge is available with 6 l and 9 l extinguishant. In case of glowing substances of fire classification A, the extinguishing effect of water is based on its heat binding capability. Water cools the burning substance below the inflammation point and thus disturbs the thermal reaction of the fire, extinguishing it. This extinguishant can be used in paper and cardboard warehouses, sales and exhibition areas, textiles, etc.

CO2 fire extinguishers do not leave any residues and is usable even on sensitive technical devices. CO2 uses, in connection with extinguishing sprays, the suffocation effect in case of liquid fire classification B substances or fire classification B substances becoming liquid. CO2 is not electrically conductive. This system is available in 2 kg and 5 kg units for use on electrical and electronic systems, super-clean and clean rooms, areas with special hygienic requirements, chemical industries, sensitive rooms and systems.

Contact: Minimax GmbH & Co. KG, Industriestrae 10/12, 23840 Bad Oldesloe, Germany. Tel: +49 (4531) 803-0; Fax: +49 (4531) 803 248

E-mail: info@minimax.de

Website: www.minimax.de

FUMIGANTS

Chemical alternatives to methyl bromide for strawberries

In Spain, researchers have investigated into the use of the soil fumigants chloropicrin, 1,3-dichloropropene, dazomet, metam potassium, metam sodium and dimethyl sulphide, in combination with different films, as replacements for methyl bromide soil fumigation in strawberry nurseries. During the four-year study, the fumigants were applied prior to planting. Verticillium wilt and crown rot were the main diseases. Results have shown that chloropicrin, 1,3-dichloropropene and dazomet offered the same effectiveness as methyl bromide fumigation in the control of strawberry nursery diseases. Moreover, 1,3-dichloropropene and methyl bromide, applied at 50 per cent rate under virtually impermeable film, demonstrated effective disease control.

Website: www.apsnet.org

Protecting dried fruits and nuts

Researchers in the United States have studied the use of granulovirus (GV) isolated from the Indian meal moth (IMM) for protecting dried fruits and nuts. In 1999, AgriVir LLC obtained the patent rights and began producing GV dust formulation in commercial quantities. Dust formulations of GV are envisioned as a protectant against infestation, preventing economic damage for extended periods. The study objectives include:

Reduce infestation of IMM in dried fruits and in-shell or shelled nuts by topical or complete coverage application of AgriVir-GV;

Determine attractiveness of the formulation components as regards to IMM oviposition and larval survival; and

Determine whether potential methyl bromide alternative fumigants (methyl iodide, phosphine, propylene oxide, carbonyl sulphide and sulphuryl fluoride) inactivate GV, if fumigation is warranted.

Results have shown no indication that IMM adults are attracted to any of the actual components of the GV formulation for oviposition. However, when the formulation is mixed with a ground wheat germ carrier, as with dry applications of the product, the wheat germ attracts ovipositing females and also increases survival of the pest. As long as the GV is infectious, this may actually enhance its efficiency as the wheat germ acts to stimulate feeding and ingestion of the GV capsules. If the virus becomes inactivated, the presence of wheat germ may actually encourage and support IMM infestation of the treated commodity. With regard to inactivation of GV, it was observed that like methyl bromide, methyl iodide and propylene oxide also inactivates or kills GV. However, phosphine, carbonyl sulphide and sulphuryl fluoride did not affect the activity of the formulated GV.

Small-scale lab tests simulating long-term storage of almonds have shown that GV batches (AgriVir-C1) continued to provide excellent protection in reducing both IMM populations and damage to the commodity for up to nine months. Though large-scale tests did not yield the desired outcome, significant reductions were found in IMM population and damage for a majority of the application methods tested. AgriVir-GV is a microbial pesticide and its efficacy is dependent on the number and viability of GV capsules present (active ingredient). Virus capsules are heat labile and a proportion continually loses viability over time.

Contact: Dr. Patrick V. Vail, United States Department of Agriculture, Agricultural Research Service, 9611 S. Riverbend Avenue, Parlier, CA 93648, United States of America.

Website: www.cdpr.ca.gov

Controlling pests in flourmills

A team of researchers in the United States have investigated into the use of heat as a potential methyl bromide alternative for the control of pests in flourmills. The effect of high temperatures was assessed against 10 pest species of flour and flourmills Ephestia kuehniella, Tribolium castaneum, T. confusum, Cryptolestes turcicus, Ptinus tectus, Sitophilus granarius, Gnatocerus cornutus, Tenebrio molitor, Liposcelis bostrychophila and Acarus siro in the presence and absence of modified atmospheres and inert dusts.

It was observed that temperatures exceeding 47C maintained for 24 h, or 44C held for 48 h, killed all stages of all the afore-mentioned pests. The presence of up to 30 per cent carbon dioxide in the atmosphere did little to reduce target temperatures or treatment times. However, the efficacy of inert dust treatments was significantly enhanced above 30C, achieving complete control of flour beetles and grain weevils within 24 h at 40C, at dosages down to 1 g/m3.

Website: www.hgca.com

Eco-friendly fumigants for horticultural crops

In Valencia, Spain, crop rotation is a very old tradition, with 3-4 crops per year, and a typical farm is flood irrigated. Crop rotation begun by an escarole crop is followed by potato and watermelon. The frequently included earth almond Cyperus sculentus (Xufa) acts as a real weed for the next crop. Researchers studied the following disinfestation treatments:

Non-fumigated control;
Standard MB PE 60 g/m2;
MB VIF 30 g/m2;
Solarization + manure 5 kg/m2;
Solarization + MS (N-Methyl dithiocarbamate sodic 40 per cent p/v) 36 g/m2;
Telone C35 mechanical application 40 g/m2; and
Telone II (1,3-dichloropropene 93 per cent p/p) 18 g/m2 + MS 108 g/m2.

MB in treatments 2 and 3 were applied by hand and the VIF sheet was Orgalloy. Treatments 2, 4, 5 and 7 used standard PE (200 gauge) as a sheet for fumigation. In treatment 4, a mixture of 75 per cent sheep and 25 per cent chicken manure was used. It was incorporated into the soil using a tiller, before covering with plastic for solarization. Treatment 6 Telone C35 was applied mechanically. Treatments 4, 5 and 7 were irrigated under the plastic sheet, while treatments 5 and 7 had the fumigant applied through irrigation water. In treatment 7, Telone II was applied in the first flood and a week later MS with the second flood.

Results on survival of Fusarium spp. from small pieces of roots indicated good control at 10 cm depth for all

treatments, except treatments 4, 5 and 7 where it was not complete at 30 cm. During the first crop (escarole), the incidence of C. sculentus and C. rotundus was very high, especially in control treatment. A moist weather at the end of the crop, during bleaching of plants, favoured the progress of Sclerotinia minor, which affected the plants. Control treatment was specially affected by the rot disease; to the contrary, the best treatments were 2 and 7. Nevertheless, individual weight of escaroles did not show differences between 1 and MB treatments (2 and 3). No statistical differences were found with respect to potato yield, because of the absence of pathogens affecting this crop. Grafted plants of watermelon were more productive than non-grafted ones.

Website: www.ivia.es

Multi-purpose soil fumigant

Tessenderlo Kerley Inc., the United States, is offering a multi-purpose soil fumigant. Sectagon 42 (metam sodium) is a fast-acting, contact biocide fumigant that effectively suppresses nematode populations, fungi, tough annual weeds and soil-borne pathogens on food, fibre and ornamental crops. The fumigant can replace methyl bromide. It can be applied prior to planting virtually any crop where pest-free planting beds are desired.

Contact: Tessenderlo Kerley Inc., Corporate Headquarters, 2255 N. 44th Street, Ste, 300 Phoenix, AZ 85008, United States of America. Tel: +1 (602) 8898 300; Fax: +1 (602) 8898 430

E-mail: info-tki@tkinet.com

Website: www.tkinet.com

New sterilant gas

In Australia, the University of Canberra and CSIRO Division of Entomology have reached an agreement to commercialize a worldwide patent for a sterilant gas. Ethanedinitrile gas, a potential alternative to methyl bromide, is particularly effective in the disinfestation of soil and timber. A longer-term prospect is in the sterilization of surgical equipment. Contact: Mr. Robin Poke, Manager, Public Relations, University of Canberra, Australia. Tel: +61 (408) 687 104.

Website: www.canberra.edu.au

Alternative solution to methyl bromide

Studies undertaken in Greece have shown that a control programme involving the fumigant Condor has been effective in eradicating nematodes and has an indirect action on fungi and weeds. This methyl bromide alternative has shown that areas heavily infested by nematodes could be used for cultivation and the population of easy weeds and use of soil fungicides declined.

Website: www.minagric.gr

PUBLICATIONS

Lost in Transit Global CFC Smuggling Trends and the Need for a Faster Phase-out

The global nature of the illegal trade in CFCs and the role played by transit countries in diverting CFCs on to the black market is revealed in this report. Singapore and other significant transit points have strong economies

founded on their role as major trade hubs. However, these countries do not have adequate mechanism to monitor the movement of CFCs through their ports.

Contact: Environmental Investigation Agency, P.O. Box 53343, Washington DC 20009, United States of America. Tel: +1 (202) 4836 621; Fax: +1 (202) 4838 626

E-mail: info@eia-international.org

Website: www.eia-international.org

R-744: Thermophysical Properties of Refrigerants

The booklet is a must-read for industrialists and engineers (computations involved in the design of refrigeration and heat-transfer equipment) as well as for teachers and students. It provides a basic equation for each refrigerant (R-134a, R-22, R-123, R-717 and R-14), tables on saturated states, physical properties of the refrigerant, etc.

Global and European Regulations on CFCs,HCFCs and HFCs

This booklet presents global (Montreal Protocol and its amendments) and European regulations (European regulation No. 2037/2000, ECCP) applying to fluorocarbons. It provides summarizing tables and summaries, and includes addresses of websites where the full texts are available.

For the above publications, contact: International Institute of Refrigeration, 177, Boulevard Malesherbes, Paris 75017, France. Tel: +33 (1) 4227 3235; Fax: +33 (1) 4763 1798.