

# ***VATIS Update Ozone Layer Protection .Sep-Oct 2005***

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## THE SCIENCE OF OZONE LAYER

### Ozone hole update

Atmospheric circulation over the Antarctic continent is in its winter state. There is widespread ozone depletion over the continent, with ozone amounts over 50 per cent below normal for this time of the year in places. Lowest ozone levels are nearer 100 DU, with most areas of the edge region below 200 DU. Lowest ozone areas are over the base of the Antarctic Peninsula and Weddell Sea. As of 9 September, stratospheric clouds have been observed at Rothera and Vernadsky stations.

Temperatures in the Arctic stratosphere were cold enough for stratospheric clouds to form until mid-March. Very low ozone levels (230 DU) were recorded over the United Kingdom from 18th to 21st March. A rapid spring warming then took place and it is now too warm for such clouds to exist in the Arctic stratosphere. Generally, ozone levels are declining towards the normal autumn minimum.

Website: [www.antarctica.ac.uk](http://www.antarctica.ac.uk)

### Hole in ozone layer growing to largest-ever size

The Japan Meteorological Agency reports that the ozone hole above Antarctica is growing and may become the largest ever. According to the agency, the hole expanded rapidly in mid-August reaching 26.73 million km<sup>2</sup>, exceeding last years, and may expand further.

Website: [www.japantoday.com](http://www.japantoday.com)

### Antarctic ozone hole larger

The World Meteorological Organization (WMO) reports that the winter hole in the Antarctic ozone layer appears to have grown from last year but is still smaller than in 2003. The agency's top ozone expert added that seasonal depletion of the protective gas layer, which filters harmful ultraviolet rays that can cause skin cancer, may become more pronounced in the near future before mitigating. Meteorological data reveal that last winter

was warmer than in 2003 but colder than in 2004. At this stage, it looks like this years ozone hole will be quite average or a little above average, stated Mr. Geir Braathen, WMOs ozone expert. The Geneva-based WMO, which has 181 member states, bases its analysis on data collected from satellites, ground-based observations and balloons that have been launched into the atmosphere.

Website: [www.heraldsun.news.com.au](http://www.heraldsun.news.com.au)

## Ozone layer on the mend

In the United States, researchers monitoring the Earths atmosphere for the National Oceanic and Atmospheric Administration (NOAA) report that the ozone layer has stopped shrinking and may start recovering over the next several decades. While the ozone layer has started to thicken in some parts of the world, it is still well below normal levels, state researchers. These recent findings were based on analyses of satellite records and surface monitoring instruments.

Scientists have lauded the 1987 Montreal Protocol as the catalyst that prevented further destruction of the ozone layer, which is critical to life on Earth since it shields Earths denizens from excessive amounts of harmful ultraviolet radiation from the sun. These early signs point at one of the strongest success stories of international cooperation in the face of an environmental threat, declared NOAAs administrator Mr. Conrad Lautenbacher.

Website: [www.emagazine.com](http://www.emagazine.com)

## Future of ozone layer bright

The European Space Agencys Envisat satellite monitors global ozone layers and analysts have announced that data from mid-August indicate that the southern hole is huge, covering an area roughly the size of Europe, or ten million square kilometres. This is the third largest recorded area for this time of year in the past ten years, topped only by the figures from 1996 and 2000. However, despite the current doom-laden forecast, predictions for the long-term future look good.

In the United States, scientists analysing data from satellites and ground-based stations during 1978-2002 have published a study revealing that we have now reached the turning point and levels are beginning to creep back up. If current trends continue, atmospheric ozone will have recovered to pre-CFC levels by 2050.

Website: [www.edie.net](http://www.edie.net)

## ODS PHASE-OUT IN INDIA

### 11th International Ozone Day

The 11th International Day for Preservation of the Ozone Layer was celebrated to commemorate the epoch-making day of signing the Montreal Protocol on Substances that deplete the Ozone Layer. The Minister of State for Environment and Forests, Mr. Namo Narain Meena, in his inaugural address said that over the last 12 years India has implemented more than 300 projects for phasing out about 11,000 ODP tonnes of production

and 12,000 ODP tonnes of ODS consumption. He attributed this success to the active role taken by industries, government authorities, technical institutions, experts and NGOs. The minister also added that by adopting prohibition of financing or retro-financing by banks and financial institutions for investments in ODS-based technology and notification of the Ozone Depleting Substances (Regulations and Control) Rules 2000, dependence of the industry on ODSs was reduced substantially.

Additionally, on this occasion, various awards were distributed for exemplary work in the field of afforestation, taxonomy, wasteland development, Hindi writing on environment and related subjects. The minister even inaugurated an expo on ozone-friendly products and also released a poster, brochure, sticker and the 7th edition of The Montreal Protocol: Indias Success Story. An album containing a stamp, first day cover and brochure was presented to Ms. Soumya Saxena, winner of the first prize in painting competitions conducted by the Ministry of Environment and Forests.

Website: [www.pib.nic.in](http://www.pib.nic.in)

## GACL to phase out CTC production

Vadodara-based chemicals major Gujarat Alkalies and Chemicals (GACL) has committed itself to a performance agreement with the central government to phase out production of carbon tetrachloride (CTC) for non-feedstock applications by 2010. In return, GACL will receive about US\$9.15 million as compensation from the central government. Company officials are confident that the production phase-out will not affect the companys bottom line.

The firm has a capacity to manufacture 20 t/d of CTC at its Ranoli facility near Vadodara. CTC has applications as ingredient in fluorocarbon refrigerants and propellants, for grain fumigation and flour bleaching, as solvent in chlorinated rubber manufacturing and in petroleum refining industry, and as grease removing agent for machinery and electrical equipment. CTC is a colourless, non-inflammable liquid with moderately strong ethereal odour and is slightly soluble in water.

The CTC sector plan proposed by the Government of India is aimed at reducing CTC production and consumption to a level consistent with the nations obligations under the Montreal Protocol. As per the CTC phase-out schedule applicable to India, production and consumption of CTC are to be reduced by 85 per cent in January 2005 and 100 per cent in January 2010.

Website: [www.businessstandard.com](http://www.businessstandard.com)

## Air India becomes first

Indian airline to align with UNEP Air India, Indias international carrier, has become the first airline in the country to align with the United Nations Environment Programme (UNEP), an international body working with governments of various countries to protect our environment. Some of Air Indias environment friendly initiatives include a full-fledged effluent treatment plant as part of the chemical cleaning workshop. Even fire extinguishers containing halons are being removed from the aircraft and sent to a vendor on the expiry date for recycling.

Air India also plans to adopt an eco-friendly vapour absorption system for the air-conditioning plants, to avoid

usage of CFCs. Director-Engineering of Air India, Mr. Babu Peter, stated that a core group has been formed within the company to interact with UNEP. Future plans include formulating programmes such as identifying crust areas where improvements could be immediately made and countrified. The countrys flagship carrier has as such provided a platform for other airlines and set the ground rules for the Indian aviation sector.

Website: [www.indiadaily.com](http://www.indiadaily.com)

## IN THE NEWS

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### MDGs include ozone layer protection

The Millennium Development Goals (MDGs), drawn from the United Nations Millennium Declaration, constitute an unprecedented promise by world leaders to address as a single package, peace, security, development, as well as human and fundamental rights. A recent United Nations report highlights progress achieved worldwide towards meeting the MDGs by 2015, including MDG 7, Ensure environmental sustainability.

Ozone protection under the Montreal Protocol is identified as an area where progress is being made towards achieving the MDG 7 objectives. UNDP, UNEP and the World Bank are among the 25 international organizations that contributed to this landmark report.

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E-mail: [nick.nuttall@unep.org](mailto:nick.nuttall@unep.org)

Website: [www.uneptie.org](http://www.uneptie.org)

### Building on success and facing the challenges ahead MLF

The Multilateral Fund (MLF) is dedicated to turning around the deterioration of Earths ozone layer. Its success was highlighted at a recent meeting of MLFs Executive Committee in Montreal, where it was reported that projects financed by the Fund have so far eliminated consumption of 243,207 t/y of ODS. MLF projects are extraordinarily cost-effective 1 kg of ODS can be phased out for less than US\$5 of MLF finance. A typical project can be completed within 33 months of financing approval. In spite of the success of the Fund to date, many challenges still lie ahead. As per the Montreal Protocol, the last 50 per cent of the main categories of ODS in developing countries must be phased out between 2005 and 2010.

The Executive Committee approved over US\$23 million in new projects for developing countries to phase out an additional 6,500 t of ODS. It also agreed to finance a total of US\$3.1 million for a comprehensive plan to assist Egypt to completely phase out the use of CFCs in the refrigeration sector by 2010 the deadline set by the Montreal Protocol. Another US\$2 million in MLF support will go to Brazil for a project that will lead to the total elimination of the use of methyl bromide. The Committee also put into place procedures for verifying national ODS reduction targets in multi-year projects financed by the Fund. These procedures will assist in

confirming that the agreed reduction targets have been fulfilled, so that the Committee could approve further disbursements of funds to the projects in a transparent process with full accountability to contributing countries.

Contact: Ms. Julia A. Dearing, Information Management Officer, Secretariat of the Multilateral Fund for the Implementation of the Montreal Protocol, #1800, McGill College, 27th Floor, Montreal, Quebec, Canada H3A 3J6. Tel: +1 (514) 2821 122; Fax: +1 (514) 2820 068

E-mail: [secretariat@unmfs.org](mailto:secretariat@unmfs.org)

Website: [www.multilateralfund.org](http://www.multilateralfund.org)

## WB aid to phase out use of CFC gases in Pakistan

The World Bank (WB) will further facilitate phase-out of ozone depleting CFC gases in Pakistan by providing technical and financial assistance to enterprises. In this regard, WB has acquired the services of Simpson Wires (Pvt.) Limited. Many industries in Pakistan import CFC gases for commercial use. Efforts are on to minimize the use of such gases in a phased manner, in compliance with the nations commitment. In the first phase, use of CFC gases was frozen at the level of the financial years from 1995-96 to 1996-97 and targets were set to reduce the volume of imports by up to 50 per cent till 1st January 2005. In the second phase, from 2007 to 2010, the volume of such imports would further be reduced to 85 per cent of the frozen quantity.

Website: [www.dailytimes.com.pk](http://www.dailytimes.com.pk)

## Fund for ozone layer protection

South Chinas Shenzhen county will receive about US\$2.4 million by the end of this year, and even more financial aid in the future, from the United Nations Multilateral Fund. According to Mr. Paul Krajnik, chairman of the executive committee of the organization, Shenzhen is not just a modern city but a green area. Its successful performance in eliminating ODS can serve as a good example for other Chinese cities. As of now, there are no Shenzhen-based factories manufacturing ODS substitutes. Mr. Krajnik promised that the Fund would invest more in Shenzhens R&D efforts to speed up ODS elimination by developing ODS substitutes.

Website: [www.en.chinabroadcast.cn](http://www.en.chinabroadcast.cn)

## Training programme for customs officers

In the Maldives, two workshops to train customs officers on import, monitoring and control of ODS have been completed successfully. The workshops were organized under the refrigerant management plan, jointly by the Environment Research Centre and UNEP. Certificates were awarded to the participants. UNEPs Regional Coordinator noted that as customs officers now play a major role in the import of ODS, their involvement in other environmental conventions programmes is rising.

Website: [www.maldivesinfo.gov.mv](http://www.maldivesinfo.gov.mv)

## Ruling on Freon use fails to muster support

In the Philippines, the Land Transportation Office had announced plans to not register vehicles manufactured in 1999 and earlier that use Freon in their air-conditioning units. This proposal has not found favour with the Association of Taxi Operators in Metro Manila (ATOMM). ATOMM President Ms. Leonora Naval stated that this scheme will only add to the current sufferings of small operators and drivers. She suggested that instead of phasing out 1999 model and below vehicles, owners should be advised to maintain their cars well to make them environment friendly. Instead of CFCs, owners are being encouraged to use HFCs for their air-conditioning requirements.

Website: [www.mb.com.ph](http://www.mb.com.ph)

## NOUs team up to address compliance challenges

With the 85 per cent reduction target for CFC consumption less than two years away, National Ozone Units (NOUs) are increasingly active in forming bonds with their peers in neighbouring countries to undertake innovative approaches for fulfilling compliance targets set by the Montreal Protocol. Ozone officers from Maldives and Sri Lanka convened one such extraordinary meeting, during 17-19 June 2005, as part of South-South Assistance facilitated by UNEP DTIEs OzonAction Programme and UNEPs ROAP Compliance Assistance Programme team.

According to MOP Decision XV/37, Maldives will be importing ODS from 2006 to meet its domestic needs. As Maldives is a low-volume consuming country (LVC), import of ODS from large-scale traders or producing countries is difficult. Therefore, to comply with the MOP decision, under this cooperation, Sri Lanka will be supplying small quantities of ODS to Maldives. Linked in this way, it is essential for the NOUs of both countries to closely cooperate and coordinate.

The two NOUs have identified procedures to initiate and adopt harmonized legislative and regulatory mechanisms for ODS imports and exports within the existing trade framework. Regarding ODS import and export controls, the nations agreed to:

Establish systematic information exchange between customs authorities and the NOUs;

Share their import and export registration forms for further improvement at their respective ends as well as exchange information with the NOUs of exporting countries;

Exchange information on licensed imports between the two NOUs; and

Work with the CAP Policy and Enforcement Officer to analyse and share information on exports from China and India in the region with the data on imports.

Sri Lanka also proposes to share information on the development of its database to facilitate exchange of information on import quotas, list of importers, licensing systems and their framework of a nationwide ozone network.

Mr. Atul Bagai, Regional Coordinator (Networking), South Asia, Compliance Assistance Programme, Regional Office of Asia and the Pacific, UNEP, Bangkok, Thailand. Tel: +66 (2) 2881 662

E-mail: [bagai@un.org](mailto:bagai@un.org)

Website: [www.unep.fr](http://www.unep.fr)

## Sharp decline in the use of ODS in Korea

The Republic of Korea has reduced ODS use by more than 80 per cent during the past 12 years, as part of efforts to comply with the United Nations regulations. The nation's consumption of such substances was 5,573 ODP tonnes in 2004, down 81 per cent from 28,953 ODP tonnes in 1992, according to the Ministry of Commerce, Industry and Energy. ODP tonne is a unit representing the amount of anti-ozone contents found in chemicals or other industrial substances, including Freon gas and carbon tetrachloride (CTC).

Website: [www.asia.news.yahoo.com](http://www.asia.news.yahoo.com)

## Viet Nam fully implements Montreal Protocol

Over the past decade, Viet Nam has eliminated around 250 t of CFCs and fulfilled its international obligations under the Montreal Protocol on Substances that Deplete the Ozone Layer, reports Mr. Luong Duc Khoa from the Department of International Cooperation under the Ministry of Natural Resources and Environment (MNRE). Mr. Khoa said before the 1990s, the country had annually consumed around 500 t of CFCs, 4 t of halon and nearly 400 t of methyl bromide.

Mr. Khoa added that Viet Nam officially signed the Vienna Convention for Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer in January 1994. In 1995, the Prime Minister approved Viet Nam's National Programme on Eliminating ODS, which was then considered a basis for the Multilateral Fund to provide financial assistance and technology for the country. Since then, Viet Nam has received over US\$4 million in aid and technology from the Fund for the programme, Mr. Khoa said. For having a low ODS consumption level, below 0.004 kg/capita/year, and meeting the deadlines for phasing out ODS, Viet Nam enjoys priority assistance and has been receiving non-refundable aid and technology through projects in various fields from the United Nations Development Programme as well as the World Bank.

Website: [www.vnagency.com.vn](http://www.vnagency.com.vn)

## China drafts law on ozone protection

According to the State Administration of Environmental Protection (SEPA), China, a legislation phasing out ODS is expected to be passed within the next two years. SEPA disclosed the latest progress of the legislation, still in its draft stage, at two major forums. To date, there are around 100 documents issued by different government departments to deal with ODS phase-out, but there is no national law, which includes all the relevant terms and specifies punishment. Lack of legal reinforcement has resulted in risk-taking producers and traders taking advantage of the many existing loopholes. Prof. Wang Canfa from the China University of Political Science and Law, who is part of the drafting team, expressed that the legislation is based on one principle to adjust the macro industry policy to ensure the cost of illegal use of ODS is much higher than for those who abide by the law.



Illegal international trade of products containing ODS, particularly among developing nations, is a difficult problem to deal with. Mr. Atul Bagai, South Asia coordinator of the United Nations Environment Programme (UNEP) suggested that an ODS licensing system be adopted. Regional information sharing is important. ODS exporting and importing countries can sign an agreement to ensure only those meeting certain requirements get the license to trade in ODS, Mr. Bagai stated. Mr. Volkmar Hasse, an expert from the German Technology Centre, recommended that certified training be included in the nations legislation to guarantee that those in charge of eliminating ODS are technically qualified.

Website: [www.scoop.co.nz](http://www.scoop.co.nz)

## LCCI in Pakistan to create awareness on damaging CTC

In Pakistan, the Lahore Chamber of Commerce and Industry (LCCI) plans to conduct seminars and workshops for creating awareness among industrialists about the damaging effects of carbon tetrachloride (CTC), an ozone depleting substance used as a cleaning and processing agent in various industrial sectors. LCCI President Mr. Misbahur Rehman said that as a signatory to the Montreal Protocol, Pakistan has to complete phasing out the use of ODS.

Mr. Iqbal, chief executive of IN Consult, said that a number of industries have benefited from equipment, technical and financial assistance, in the form of a grant, provided by the Multilateral Fund. He said that owing to the commitment of the government, restrictions on the CTC imports had already been imposed and the tariff had been revised to promote ozone-friendly substitutes.

Website: [www.dailytimes.com.pk](http://www.dailytimes.com.pk)

## Phase-out of polluting refrigerants in China

In China, Shenzhen county has launched a new campaign to substitute ODS refrigerants with nationally certified alternatives. Production, storage and sale of refrigerators, air-conditioners, automobiles and refrigerating equipment that contain CFC, an ODS commonly used in the refrigerant industry, have been forbidden across Shenzhen. The city will commence replacing CFC-containing refrigerants with environmentally friendly options in central air-conditioners or industrial refrigerating systems. The replacement work is scheduled to end by 1st July 2007. Maintenance companies that have to use CFC in repair works must be equipped with recycling facilities, starting 1st January 2006 to prevent CFC leakage.

Since 1998, Shenzhen has almost staved off major ODSs like CFCs, HCFCs and halons, which are normally used in LCD cleaners, hair spray, pest spray and fire extinguishers. However, the use of CFC refrigerants is still being continued in some brands of air-conditioning units and electric home appliances. There are 14 electronic display firms in Shenzhen that received over US\$2.43 million from the Multilateral Fund to end the use of ODS-containing rinse. Since China became a signatory to the Vienna Convention, it has received US\$790 million as aid.

Website: [www.news.xinhuanet.com](http://www.news.xinhuanet.com)

## REFRIGERATION/AIR-CONDITIONING

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## Modular chillers

In Japan, large air-cooled chillers developed by Toshiba Carrier, jointly with Tokyo Electric Power, are gaining in popularity. The new Flex Module Chiller is a high-efficiency air-cooled chiller, which features energy and space savings, as well as more versatility in design and maintenance. It has the industrys largest cooling capacity and module linkage system. By combining 8, 10 or 12 base modules (25 RT each), the Flex Module Chiller can provide 200, 250 or 300 RT capacity, thus corresponding to a water or ice thermal storage system for electric power load levelling. A reciprocating compressor which works with the new refrigerant R-407c in each module is subjected to capacity control for optimized operation. With its enhanced part-load performance and seasonal COP as high as 4.8 (at 50 Hz), the system has realized about 23 per cent more energy savings compared with the companys earlier system (consisting of three Model RUA-SB35501H-A air-cooled chillers).

As a machine for large commercial applications, the new system has operating costs comparable to or lower than that of a competitive gas-fired absorption chiller. Its compact base module linkage design has helped realize space saving. Installation space required for the 300 RT system, for example, has been reduced by about 34 per cent compared with that for three units of 100 RT air-cooled chiller.

Website: [www.jarn.co.jp](http://www.jarn.co.jp)

## Dalian Sanyo completes GHP production line

A production line for gas-engine heat pumps (GHPs) with an annual output of 10,000 units has been set up at Dalian Sanyo Refrigeration Co. Ltd. (DSR), China. This is the first large-scale GHP production line ever constructed in the nation. Chinas first 20 hp GHP using R-407c refrigerant was produced at DSR. With the implementation of the West-East Natural Gas Transmission Project, GHPs are being encouraged by many local governments. The production line covers an area of 5,000 m<sup>2</sup> and advanced technologies such as rotary working position and computer-controlled tracking and testing systems are utilized. The GHPs use natural gas or liquefied petroleum as the energy source to achieve cooling and heating. Other advantages include high-efficiency and low running cost.

Website: [www.allchemi.com](http://www.allchemi.com)

## GHP systems with top COP

ECO7 Series from Mitsubishi Heavy Industries (MHI), Japan, comprises high-efficiency gas heat pump (GHP) air-conditioners that feature the industrys highest COP of 1.59. The new series has realized a sizeable 23 per cent improvement in efficiency, compared with the earlier series, by adopting a next-generation, high-efficiency scroll compressor developed jointly with three major city gas companies Tokyo Gas, Osaka Gas and Toho Gas.

MHI has also added the industrys first replacement model using R-410a and large capacity 24 hp type to the line-up to meet a wide range of demand for commercial uses such as large stores, schools, hospitals and mid-/small-sized office buildings. ECO7 is a fully remodelled successor series to ECO6 and consists of six types, from 7 hp (22.4 kW) to 24 hp (67.0 kW). This series can also realize higher reliability by closely reacting to cooling/heating load with sophisticated capacity control and the introduction of a rotational starting system.

Website: [www.jarn.co.jp](http://www.jarn.co.jp)

## Visteon plans R-744 air-conditioning system

According to [awknowledge.com](http://awknowledge.com), Visteon will beat Valeo, Behr, Denso, Delphi and other competitors to the market with an air-conditioning system using CO<sub>2</sub> (R-744 in engineering parlance) instead of the current standard refrigerant R-134a. R-744 transfers heat more efficiently than R-134a, allowing same-size systems to cool cabins more rapidly, or to be downsized without affecting performance. Current car air-conditioning systems are charged with an average of 756 g of R-134a. Future EU legislation is expected to mandate R-744 systems.

Contact: Website: [www.visteon.com](http://www.visteon.com)

Website: [www.autoindustry.co.uk](http://www.autoindustry.co.uk)

## SOLVENTS

### Sealed solvent cleaning system

Ultrasonics Ltd., the United Kingdom, is offering a new sealed solvent cleaning system. Though the Solvac cleaning system can operate with any non-inflammable solvent, it has been particularly designed for use with HFE or HFC types of solvents in mind. Solvac has a built-in Load Lock System that prevents emissions from escaping. This technology unlocks the potential for the use of new-generation solvents like HFEs and HFCs.

Solvac is a fully automated unit with digital touch screen for easy operation and can be pre-set to complete many different cleaning functions. It can be used as a simple vapour cleaner or facilitate more precision cleaning with the use of high-performance 132 kHz ultrasonics. A workload, including drying, can be processed in 3-5 minutes.

Contact: Ultrasonics Ltd., Leaward House, 33, Stamford Road, Geddington, Kettering, Northants NN14 1BB, United Kingdom. Tel/Fax: +44 (1536) 746 520

E-mail: [ultrasonics@btconnect.com](mailto:ultrasonics@btconnect.com)

Website: [www.ultrasonicsuk.com](http://www.ultrasonicsuk.com)

### Metal cleaner, degreaser and flux remover

Ecolink, the United States, offers a new solvent degreaser based on n-propyl bromide chemistry. Hypersolve NPB is an ideal alternative for traditional chlorinated solvents. Featuring physical properties and cleaning efficiency similar to 1,1,1-trichloroethane, Hypersolve has a very low ozone depletion potential (0.002) and no flash point. Solvency, handling and drying characteristics are similar to TCA. Applications include metal, electronic and precision cleaning, cold cleaning and vapour degreasing. Hypersolve easily removes difficult contaminants such as oils, greases, adhesives, solder fluxes and resins. Advantages offered by Hypersolve include:

Near drop-in replacement for TCA that can be used in new or existing equipment meeting current standards;

Ozone depletion potential is about 0.019-0.027, atmospheric lifetime approximately 15 days;

Reduced evaporative losses;

Fast drying, similar to TCA;

Good penetration into intricate matrices, holes, crevices, honeycomb tubes, etc.;

Efficacy and cleaning performance equivalent to TCA;

Not readily hydrolysed in the presence of water;

Less corrosive than HCl;

Cannot form phosgene (highly toxic compound) on decomposition as do chlorinated solvents;

Stable composition in vapour degreaser. Can be distilled and recovered;

Not regulated as inflammable;

Not subject to regulation under SARA, HAP, RCRA (SNAP approval by EPA pending);

Better toxicity profile than TCE; and

Cost-effective performance as compared with HFCs and HFEs.

Application areas include automotive parts cleaning, precision cleaning, surface wipe cleaning, and adhesive and sealant removal.

Contact: Ecolink, Corporate Headquarters, 2227, Idlewood Road, Tucker, GA 30084, the United States. Tel: +1 (770) 6218 240; Fax: +1 (770) 6218 245

E-mail: [info@ecolink.com](mailto:info@ecolink.com)

Website: [www.ecolink.com](http://www.ecolink.com)

## Nature-based cleaner/degreaser

Westkal Ltd., Canada, is offering a nature-based cleaner/degreaser as an alternative to petroleum-based, fluorinated and chlorinated solvents. The unique WORX Roughneck high-performance degreaser and cleaner is ideal for industrial and commercial cleaning. It can efficiently dissolve and remove grease, oil, tar, crude oil, paint/undercoating overspray lubrication fluids, organic oils/fats, paraffin, adhesives, etc. Roughneck has received the NSF International Mark of Approval as a degreaser and carbon remover for food cooking, utensils and other associated surfaces in and around food processing areas (cleaned area needs water rinsing before food contact).

The zero-ODP Roughneck contains high levels of terpene hydrocarbons derived from naturally occurring, renewable sources. Also, it has an advanced blend of surfactants, emulsifiers and a de-emulsifying agent that releases the waste oil within minutes once the job is executed, an attractive feature for reclaiming purposes and oil/water separators. Terpene solvents and additives in Roughneck are non-chlorinated, oxidize very rapidly and, as such, have a short atmospheric lifetime of 48 h.

Contact: Westkal Ltd., #4057, 10467-80 Ave., Edmonton, Alberta, Canada T6E 4S8.

E-mail: [info@worxbest.com](mailto:info@worxbest.com)

Website: [www.worxbest.com](http://www.worxbest.com)

## Non-ODS solvent/degreaser

ICEUS Inc., the United States, offers a 100 per cent volatile and eco-friendly solvent/degreaser tested and proven to exacting industrial standards. Techsolv-EF is a moderate strength, operator-safe, non-ozone depleting, engineered solvent blend. It has been designed to accomplish 80 per cent of normal industrial applications. Techsolv-EF evaporates completely in 5-10 minutes when wiped or blown to a thin film, leaving less than 100 ppm non-volatile residue. In open containers, its evaporation rate is similar to that of water. Techsolv-EF has no CFCs, HFCs, HAPs or SARA 313 reportables and carries an NPCA-HMIS rating of 1 (slight health hazard). It has a mild citrus odour and has zero ODP rating.

Techsolv-EF is based upon a formula that began its industrial testing in 1989. It has passed strict compatibility testing on metals, plastics, paints, coatings, laminations, rubbers, etc. Techsolv-EF can easily remove hundreds of different industrial contaminants in various industrial processes and cleaning applications, such as wipe on/wipe off, dip tanks, spray applications, etc.

Contact: ICEUS Inc., 305-B Scarlet Blvd., Oldsmar, FL 34677, United States of America. Tel: +1 (813) 8542 777; Fax: +1 (813) 8542 662

E-mail: [sales@iceus.com](mailto:sales@iceus.com)

Website: [www.iceus.com](http://www.iceus.com)

## Mould release products

EMI Plastics Equipment, the United States, offers EMI mould releases that have been specially formulated to provide high levels of user and environmental safety. They do not contain Class I ODSs. Additionally, Mold Releases 74 and 75 do not contain Class II ODSs or HCFCs. Neither chlorinated solvents such as methylene chloride or 1,1,1 trichloroethane are present nor are CFC propellants or solvents used. The latest products include:

The all-natural cleaner/degreaser cleans metal, tools, machinery, engines and auto parts. Often replaces 1,1,1-

trichloroethane, methylene chloride, mineral spirits and fluorocarbons. Made entirely from a highly refined extract of citrus fruits, the cleaner/degreaser dries fast, without leaving any residue. It is safe to use and can easily replace hazardous chlorinated and petroleum distillate cleaning solvents.

The thin-film anti-rust spray is ideal for overnight and weekend rust protection of plastic and rubber moulds and tooling. Free from silicone and chlorinated solvents like methylene chloride or 1,1,1 trichloroethane, it protects steel as well as other metals.

Silicone mould release complies with FDA rules as a release agent in the manufacture of food contacting materials. It ensures fast and easy part removal from moulds, improves part appearance while reducing defects caused by sticking and is formulated to provide high levels of user and environmental safety.

Contact: EMI Plastics Equipment, 28300, Euclid Avenue, Wickliffe, Ohio 44092, United States of America.  
Fax: +1 (216) 5354 823

E-mail: [Sales@EMIplastics.com](mailto:Sales@EMIplastics.com)

Website: [www.emiplastics.com](http://www.emiplastics.com)

## Rapid degreaser

Bore Techs Blast Degreaser is a fast-acting solvent formulation designed to effect the quick removal of oils, greases and powder residues from all metal surfaces. This blend of synthetic and natural solvents provides optimum solvation of even the toughest oils. Blast does not contain trichloroethane, CFCs or HCFCs.

Blast is excellent for cleaning surfaces prior to application of PTFE-based lubricating oils and greases such as Bore Techs Gun Oil, Tef-Dri and Extreme Temperature Grease. Deep solvent cleaning with Blast allows maximum benefit from the metal to polymer bonding offered in these products. Blast can be used in other applications like cleaning reloading dies of factory preservatives or lube build-up. Bore Techs Blast, as with any solvent, should be used with adequate ventilation and should not be exposed to open flame, sparks or other sources of ignition. Blast will not affect any gun bluing, parkerizing, plating or other metallic finish.

Website: [www.boretech.com](http://www.boretech.com)

## AEROSOLS

### Innovative excipients for CFC-free inhalers

Excipients for both suspension as well as solution formulations can be used to increase MDI delivery efficiency, increase dosing range and impart sustained release properties. 3M offers proprietary excipient technology to increase the range of molecules that can be successfully formulated for pulmonary delivery by increasing the number of formulating options. Contact: 3M Corporate Headquarters, 3M Centre, St. Paul, MN 55144 1000, the United States.

Website: [www.3m.com](http://www.3m.com)

## Dry powder formulation and inhaler devices

Vectura Limited, the United Kingdom, offers three proprietary pulmonary technology platforms in dry powder (DPI) formulation and inhaler devices. These include: Aspirair: Active DPI device technology; Gyrohaler: Passive DPI device technology; and Powderhale: DPI formulation technology. Aspirair is a proprietary inhaler technology designed to allow delivery with high lung penetration and low variability, a feature essential for drugs that are intended for systemic delivery. The high-performance device is conveniently sized, simple to use and economical compared with other active inhalers. Aspirair delivers DPI formulations of both large and small molecules, either in the form of a pure drug particle or in combination with an excipient. Aspirair generates an aerosol plume, triggered by a patient's inhalation, which is significantly slower than most inhalers currently available. As such, the amount of drug deposited unintentionally in the mouth and throat, which is subsequently swallowed rather than reaching the lungs, is reduced.

Gyrohaler is a novel, cost-effective, multi-unit dose DPI device that has been designed to deliver DPI formulations of drugs that act locally in the lung. It is designed to target the market occupied by the latest generation of multi-dose inhalers, like the Diskus device from GlaxoSmithKline, which are capable of storing and delivering a month's supply of doses. The compact Gyrohaler is easy to use and has a small number of moulded parts, in order to allow short device development times and competitive manufacturing costs. The device is intended to be disposable after one month and is designed to have aerosolization traits competitive with existing marketed devices.

Powderhale is Vectura's patented technology that facilitates high lung penetration of inhaled dry powders with low dose variability. This is achieved by incorporating an additional pharmacologically inactive excipient, known as a Force Control Agent (FCA), with the active drug component or the carrier-based formulation. Examples of patent-protected FCAs include magnesium stearate and L-leucine. Powderhale provides the capability to deliver a consistent fine particle dose of drug, close to the nominal delivered dose. As such, benefits are feasible in deaggregation and aerosolization, as well as in bulk powder handling and metering of the formulation. In addition, Powderhale provides a higher degree of intra-dose uniformity, which is an increasingly crucial consideration for regulators in approving pharmaceutical products in general and inhaled products in particular.

Contact: Vectura Ltd., 1, Prospect West, Chippenham, Wiltshire SN14 6FH, United Kingdom. Tel: +44 (1249) 667 700; Fax: +44 (1249) 667 701

E-mail: [enquiries@vectura.com](mailto:enquiries@vectura.com)

Website: [www.vectura.co.uk](http://www.vectura.co.uk)

## New MDPI

Novolizer, from Viatri GmbH and Co. KG of Germany, is a multi-dose dry powder inhaler (MDPI) that offers unique inhalation manoeuvre control and feedback features in an easy-to-use hand-held unit. Novolizer ensures that the inhalation manoeuvre is performed correctly, through sound, visual and sensorial indications. The scope for over- and under-dosing is virtually eliminated. Multiple feedback mechanisms indicate correct inhalation technique.

CFC-free and refillable, Novolizer uses a cyclone effect for particle deagglomeration in order to achieve effective lung deposition. It is also simple to operate, than many other devices in daily practice, making it easier for children and the elderly to use.

Contact: Viatris GmbH and Co. KG, Benzstrae 1, 61352 Bad Homburg, Germany. Tel: + 49 (61) 7288 801;  
Fax: +49 (61) 7288 82740

E-mail: [info@viatris.com](mailto:info@viatris.com)

Website: [www.viatris.com](http://www.viatris.com)

## FOAMS

### New metering system

Hennecke Machinery Group, the United States, offers HK-R 5000 metering unit that has been designed for the discontinuous production of foam blocks. HK-R 5000 processes CFC-free BAYNAT foam blocks and other polyurethane foams with basic 1:2 or 2:1 formulation where high shot output and high shot weights are required. Advantages to the BAYNAT headlinings include:

Lightweight with a possible density of 20 to 35 kg/m<sup>3</sup>;

It is self-supporting, with a high degree of dimensional stability;

Remains stable under heat;

Has noise reducing effects; and

Resistant to buckling and breaking during fitting.

The individual components are circulated through the mixhead before the shot. This means that fresh material with the required pressure level is always in stand-by mode. The components are then let into the mixhead at exactly the same time, which prevents any lead or lag occurrences. Optimum mixing results are achieved using the stirrer mixhead with its hydraulically controlled injectors. The long mixing chamber (with adjustable mixing chamber pressure) allows even difficult raw materials to be processed. It creates a bubble-free and laminar source flow, which ensures a very good, reproducible block structure.

The machine is operated in discontinuous mode for economic reasons. Further developments of the conventional technology guarantee material savings of up to 15 per cent.

Contact: Hennecke Machinery Group, Bayer Material Science, 100 Bayer Road, Pittsburgh, PA 15205, United States of America. Tel: +1 (412) 7773 633; Fax: +1 (412) 7773 692



E-mail: [poly.hennecke@bayer.com](mailto:poly.hennecke@bayer.com)

Website: [www.henneckemachinery.com](http://www.henneckemachinery.com)

## Cyclopentane type blending polyether

Shandong Dongda Chemical Industry (Group) Co., China, offers DCP-401 polyols, a kind of blending polyether polyols. DCP-401 is used to produce cyclopentane type polyurethane foaming heat insulation layer for refrigerators and iceboxes. It has excellent fluidity and the foam density is well-distributed under low temperature. The foam has measurement stability, cohesiveness and drawing of patterns in a short time. DCP-401 polyols can be used in high-pressure foaming machine as well as low-pressure foaming units. The density viscosity after blending with cyclopentane cyclopentane weight: 12 density: 1.02 g/ml viscosity.

Contact: Shandong Dongda Chemical Industry (Group) Co., No. 21 Xincun East Road Zhangjiaidan District Zibo City 255028, Shandong Province, China. Tel: +86 (533) 2159 999; Fax: +86 (533) 2150 666

E-mail: [chem@dongdagroup.com](mailto:chem@dongdagroup.com)

Website: [www.dongdagroup.com](http://www.dongdagroup.com)

## Renewable resource-based foam insulation

Apex Foam Industries, the United States, offers a non-ozone depleting, renewable resource-based SPF open-cell foam insulation. The Earthseal Foam .5 replaces the use of costly petroleum-based polyols with those found in native, renewable resources such as sugar cane and corn.

Fibreglass (batts or blown), cellulose and spray polyurethane foam (SPF) are the three traditional major building insulation products offered. Because of low initial product and installation costs, fibreglass and cellulose have dominated the home-insulation market in the past. These savings come at the cost of long-term performance and payback. SPF offers higher overall performance and payback (it can reduce HVAC requirements by a ton/12,000 Btu or more), but lacks in widespread customer awareness and has high installed expenses. Earthseal Foam .5 with its renewable resource-based, proprietary, non-processed polyol technologies reduces the material cost by as much as 35 per cent over alternative products made with petroleum-based polyols.

Apex Foam Industries Earthseal Foam offers the original benefits of SPF. Utilization of agricultural products eliminates petroleum and other toxic by-products, and exceeds the federal government procurement standards for building materials. According to Mr. Jeffery Soto, marketing director for Apex, Earthseal Foam is the first fully agriculturally based, light-density, open-cell foam. Other benefits include resistance to pests, water, mildew and mould.

Contact: Website: [www.apexfoam.us](http://www.apexfoam.us)

Website: [www.buildingonline.com](http://www.buildingonline.com)

## New polyether polyol

Nanjing Hongbaoli Co., Ltd., China, offers H4110R polyol that is used for production of refrigerator and freezer thermal insulation layer. Mixed with cyclopentane and reacted with isocyanate, this rigid foam usually has homogenous distribution of density, little cells, high compressive strength, dimensional stability in low temperature and low thermal conductivity. This product can be used in both high-pressure and low-pressure foaming machines.

Contact: Nanjing Hongbaoli Co., Ltd., No. 128, Taian Road, Gaochun County 211300, Nanjing, China. Tel: +86 (25) 5735 0188/0238; Fax: +86 (25) 5738 5588

E-mail: [market@hongbaoli.com](mailto:market@hongbaoli.com)

Website: [www.hongbaoli.com](http://www.hongbaoli.com)

## Urethane foam blowing

Dow methylene chloride, from the United States-based Dow Chemical Co., is an efficient, versatile and economical alternative to fluorocarbon-11 in urethane foam blowing applications. Soft, ultra-soft and moulded foam processors can profit greatly from the raw material cost benefit, as well as the expert technical support available with all Dow products. Specially intended for use in polyurethane foam blowing operations, this product decreases the potential for discolouration and scorching of foam due to heat generated in the polyurethane reaction.

Contact: Dow Chemical Co., the United States.

Website: [www.dow.com](http://www.dow.com)

## HALONS

### Aerosol systems as halon alternative

Marine Fire Safety, the United Kingdom, is offering a cost-effective and efficient alternative to the use of halons in fire extinguishers. FirePro fire extinguishing aerosol systems employ the very latest generation of stable non-pyrotechnic SBK aerosol-forming compound, which upon activation is transformed into a rapidly expanding, highly efficient and effective extinguishing aerosol. Based on potassium salts, the aerosol attacks fires physically and chemically. Compared with halons, FirePro requires about 75 per cent less quantity per cubic metre.

FirePro comes as a non-pressurized container, which is safe for transportation, installation and maintenance. It is non-corrosive, making it ideal to protect expensive and delicate machinery. Its non-toxic nature makes it safe for use in manned areas. Suitable for use on class A, B and C type fires and electrical equipment, FirePro has no electrical conductivity up to 24,000 V.

Contact: Marine Fire Safety, 62, Hilltop Lane, Chaldon, Surrey CR3 5BG, United Kingdom. Tel: +44 (1737) 642 375; Fax: +44 (1737) 649 906

E-mail: [info@marinefiresafety.co.uk](mailto:info@marinefiresafety.co.uk)

Website: [www.marinefiresafety.co.uk](http://www.marinefiresafety.co.uk)

## Breakthrough fire suppression technology

In the United States, Eclipse Aviation Corporation that manufactures Eclipse 500 very light jet, has introduced PhostrEx fire suppression system, another major innovation for the Eclipse 500 jet. Eclipse Aviations PhostrEx, which will be certified for use on the Eclipse 500, addresses various drawbacks of halon fire suppression systems. Some of the benefits offered by the innovative PhostrEx include:

**Lightweight and more effective:** PhostrEx is much more potent than halons. Two teaspoons of PhostrEx are equivalent to 2 cups of halon. The total PhostrEx system weight is approximately 90 per cent less than a traditional halon system

**Low maintenance costs:** The PhostrEx system is much less complex than halon systems and is designed to be maintenance-free for 10 years. Overall life cycle costs for the PhostrEx system are projected to be approximately one-tenth that of a halon system

**Proven in extensive testing:** Eclipse has tested PhostrEx in nearly 200 actual fires identical to those that might occur in aircraft engines; and

**Environmentally friendly:** PhostrEx has zero ozone depletion potential and does not contribute to global warming. When PhostrEx is released from its hermetically sealed canister, it works in less than one-tenth of a second, combining with moisture in the air and quickly becoming inert. This rapid reaction with moist air and surfaces, prevents the agent from being transported to the stratosphere where ozone depletion could occur. In a fire, PhostrEx decomposes 1,000 times more rapidly than halon and undergoes three sequential losses of bromine atoms, which are the power behind this extinguishant.

Contact: Mr. Andrew Broom, Eclipse Aviation Corporation, United States of America. Tel: +1 (505) 7241 369

E-mail: [Andrew.Broom@Eclipse.Aviation.com](mailto:Andrew.Broom@Eclipse.Aviation.com)

Website: [www.eclipseaviation.com](http://www.eclipseaviation.com)

## New fire extinguishing system

Inert gas systems are the safe, natural way to extinguish a fire. Proinert from Fike Corp., the United States, offers all the benefits of inert gas systems with several significant design improvements. Proinert is safer and more economical than any other inert gas systems on the market. The Proinert Inert Gas System has a superior valve outlet that automatically reduces the pressure at discharge and the system provides a constant flow rate. Most inert gas systems discharge from the nozzle into the protected space with a high surge flow rate, creating a potentially hazardous pressure peak. Also, installation costs and up to 60 per cent savings on venting

hardware are feasible. Important benefits of the Proinert Inert Gas System include:

Safe discharge at a constant pressure;

60 per cent less venting area required, translating to reduced system cost;

Minimizes room venting problems;

No excess extinguishant means less expense and less risk; and

Reduced piping costs.

Contact: Fike Corporation, World Headquarters, 704 S. 10th Street, Blue Springs, MO 64015, United States of America. Tel: +1 (816) 2293 405; Fax: +1 (816) 2289 277

E-mail: [fpssales@fike.com](mailto:fpssales@fike.com)

Website: [www.fike.com](http://www.fike.com)

## Replacement for halon-1211

Summit Environmental Corporation Inc., the United States, offers a SNAP-certified substitute for the globally banned halon-1211. FlameOut is UL-listed #7P21 for Class A and B fires. Inside the Class B (fuels) listing is UL 162 for encapsulation and emulsifications of hydrocarbons. FlameOut is listed on the United States Forestry Services 5100-307 for fire suppression foams. It is the only non-toxic product listed by the Forestry Service and the only Class Certified product by the American Bureau of Shipping. FlameOut has a NPCA HMIS non-hazardous toxicity index rating of 0-0-0-3.

Website: [www.biz.yahoo.com](http://www.biz.yahoo.com)

## Non-magnetic fire extinguisher

Tyco Fire and Security, the United States, has introduced Ansul Cleanguard non-magnetic fire extinguisher as a halon-1211 replacement. The portable fire extinguisher is intended for use in hazard areas that require reliable, safe and portable non-magnetic fire suppression in hazard applications, like Magnetic Resonance Imaging (MRI) rooms and other sensitive areas. Cleanguard can be safely discharged in the presence of a patient, will not deplete ozone and is lower in toxicity than other halon alternatives.

Cleanguard product line is effective in extinguishing all Class A, B and C fires, a feature not available in competing halon replacements such as CO<sub>2</sub>, and offers protection against re-ignition. Discharged as liquid droplets that flash into a stream of gas, the extinguishing agent penetrates the fire area and stops the combustion process through heat absorption and chemical interaction. Contact: Mr. Jim Cox, the United States. Tel: +1 (715) 7357 411; E-mail: [jimcox@tycoint.com](mailto:jimcox@tycoint.com); Or Ms. Renae Leary. Tel: +1 (561) 9814 711; E-mail: [rleary@tycoint.com](mailto:rleary@tycoint.com). (Website: [www.ansul.com](http://www.ansul.com))

## FUMIGANTS

### Methyl bromide alternative for fruit and nut fumigation

In the United States, a scientist has developed an alternative to methyl bromide (MB). Dr. Juming Tang is working on a non-chemical post-harvest pest control strategy for fumigation of agricultural commodities that can be used as an alternative to MB in international trade. Dr. Tang's method combines conventional heating and a short radio frequency heating period, with fruits moving and rotating in a water flume. This method effectively heats fruits while still maintaining quality.

Dr. Tang's work focuses on the fumigation of harvested commodities, mostly with dried fruits and nuts, and has gained support from USDA and the California Department of Agriculture. Dr. Tang developed the WSU Heat Block System, now being used as a unified method in four USDA stations and in Israel for studying insect thermal mortality. The significance of this project is that scientists from different stations and countries can compare insect mortality data without shipping live and often quarantined insects across borders.

Website: [www.impact.typepad.com](http://www.impact.typepad.com)

### Controlling soil-borne pests and weeds in spring tomato

Researchers in the United States have conducted field studies to determine the impact of mulch types combined with soil fumigants on spring tomato yields and on soil-borne pests and weeds. Mulch types were either black, low-density polyethylene film (0.038 mm thick) or black paper mulch. The fumigants used were:

Methyl bromide + chloropicrin (67/33 per cent, respectively) at a rate of 400 kg/ha;

Chloropicrin at 400 kg/ha plus the herbicide pebulate at 4.5 kg/ha;

1,3-dichloropropene at 325 kg/ha + chloropicrin at 67 kg/ha (83 & 17 per cent, respectively) plus pebulate at 4.5 kg/ha; and

Metam sodium at 485 kg/ha plus pebulate at 4.5 kg/ha.

Results indicate that all fumigants with either mulch type had higher tomato yield and more effective soil-borne disease and purple nutsedge (*Cyperus rotundus* L.) control than the non-fumigated control. Paper mulch appeared to be a valuable alternative for controlling purple nutsedge with no fumigants and low-volatility fumigants, such as metam sodium, whereas plastic mulch might retain high-volatility fumigants, such as methyl bromide, longer, thus increasing efficacy.

Website: [www.ansinet.org](http://www.ansinet.org)

### Blindingly effective mulch

In the United States, researchers are investigating the potential of using a new type of mulch in controlling pests. On a tomato field, the brand new type of plastic mulch has been spread over young plants to eliminate pests. It is so shiny that field workers have to wear sunglasses or risk burning their eyes. The mirror-like material is plastic, but with a thin layer of aluminium sprayed over it. Tests have shown that this metallic film holds the controversial fumigant MB against the soil longer, reducing the amount needed with typical black or white plastic mulch.

Taylor Fulton Farms is the first grower to commit to spreading this highly reflective material over its entire tomato production area. West Coast Tomato, another large Palmetto-based grower, will try out the new mulch product on roughly 10 per cent of its acreage. West Coasts choice of high-barrier film is a product from Europe called Virtually Impermeable Film, which goes by the acronym VIF. Taylor Fultons choice is Metalized Film, made by a Canadian company. Before the film, growers had to use roughly 160 kg/acre of MB. Now, they require about 80 kg/acre. However, the film products are more expensive. A roll of normal plastic costs about US\$90, while the new material is priced at around US\$225, but the film comes in longer rolls.

Website: [www.bradenton.com](http://www.bradenton.com)

## MB alternative for greenhouses and seed beds

Researchers in Greece are investigating the use of methyl bromide alternatives for weed control in greenhouses and seed beds. Soil application of metam sodium or dazomet and soil solarization (alone or in combination with chemicals) are the MB substitutes being evaluated. Metam sodium has a good efficacy against the annuals *Digitaria*, *Alopecurus*, *Echinochloa*, *Chenopodium*, *Lamium*, *Portulaca*, *Poa*, *Amaranthus* and *Stellaria*, and against the perennials *Taraxacum*, *Convolvulus*, *Cynodon* and *Sorghum*. Dazomet can effectively control the annuals *Amaranthus*, *Chenopodium*, *Bilderdykia*, *Digitaria*, *Portulaca*, *Sinapis*, *Striga* and the perennials *Convolvulus*, *Cynodon* and *Sorghum*. However, both of these chemicals are expected to be less acceptable among growers as they have a number of serious disadvantages compared with MB. These are:

They must be applied in large quantities, a difficult proposition;

They depend on irrigation for their activation after application;

They have a reduced effectiveness against some common weeds (*Solanum* and *Cyperus*);

They are readily leached, which increases the potential for groundwater contamination; and

They have a short residual activity, thereby implying a short lasting weed control efficacy.

Solarization has been found to be very effective against a wide spectrum of weeds, with the exception of the annuals *Amaranthus retroflexus*, *Portulaca oleracea*, *Xanthium strumarium* and *Avena sterilis*, and the perennials *Convolvulus*, *Cynodon* and *Sorghum*.

Therefore, at present, phasing out of MB will make weed control in greenhouses and seed beds much more difficult, and weeds will probably become a serious problem for greenhouse growers in the coming years.

Website: [www.minagric.gr](http://www.minagric.gr)