Functional excellence and environmental protection are guiding principles…

…while protecting bridges from bad weather, providing quality print, increasing the life of our cars, making new medicines possible, offering hygiene in the home – the 'invisible' but essential ingredients – solvents – are also seeking to minimise their impact on the environment.

To do this the European solvents industry is committed to reducing impacts such as emissions and conserving resources by providing ever more efficient solutions for its customers.

Reducing cost and benefiting the environment

Solvents are a critically important ingredient for a variety of industrial processes because they hold the key to both product performance and business competitiveness. Enhanced performance and cost efficiencies generally result in environmental benefits.

Already much progress has been made to improve environmental performance, and actions put in place in recent years will continue to have effects over the next decade. For example, improved solvent management and solvent efficiency means that on average it now takes only half as much solvent to produce a finished object as it did in 1980. Such developments combined with on-going research, as well as meeting stringent legislative standards, mean even further improvements can be expected. But exploring the way in which modern solvents are used today shows clearly the progress being made.

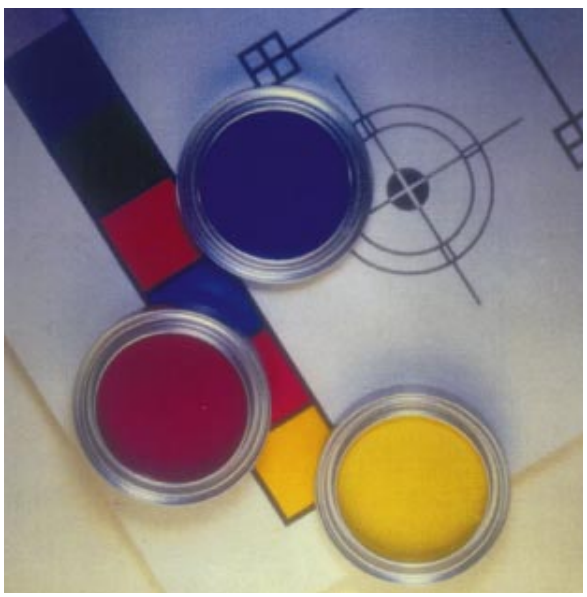
Reduced energy consumption, lower manufacturing costs…

- **Solvent based paints and inks mean faster, more controlled evaporation. This in turn reduces the drying temperature required and the time needed to dry, resulting in higher productivity with less energy use.**
- **The coatings inside our food cans ensure food protection and safety. The solvents used to help produce the coating give both a high quality film and provide energy reducing fuel consumption during manufacturing. During evaporation the solvents are recaptured in direct-fired ovens to help fuel the process, conserving other fuel resources and reducing costs.**

Conserving resources, reducing product cost…

- **Electrostatic paint spraying is the most efficient spray process from an environmental and cost point of view because it minimises the total amount of paint required and reduces spray waste dramatically. Solvent based paints make this technique possible because they are electrical insulators and confer this property to the paint.**
- **Solvent based herbicides increase their success rate simply by making the agrochemical water-resistant, covering foliage efficiently and reducing dramatically the total amount of herbicides and pesticides sprayed.**

Increased efficiency, lower maintenance costs…



- **Solvents can extend the life of products greatly through durable protective coatings – this means less corrosion and hence a longer life for objects as diverse as cars and bridges. It even means solvent based adhesives provide the most durable shoe soles!**

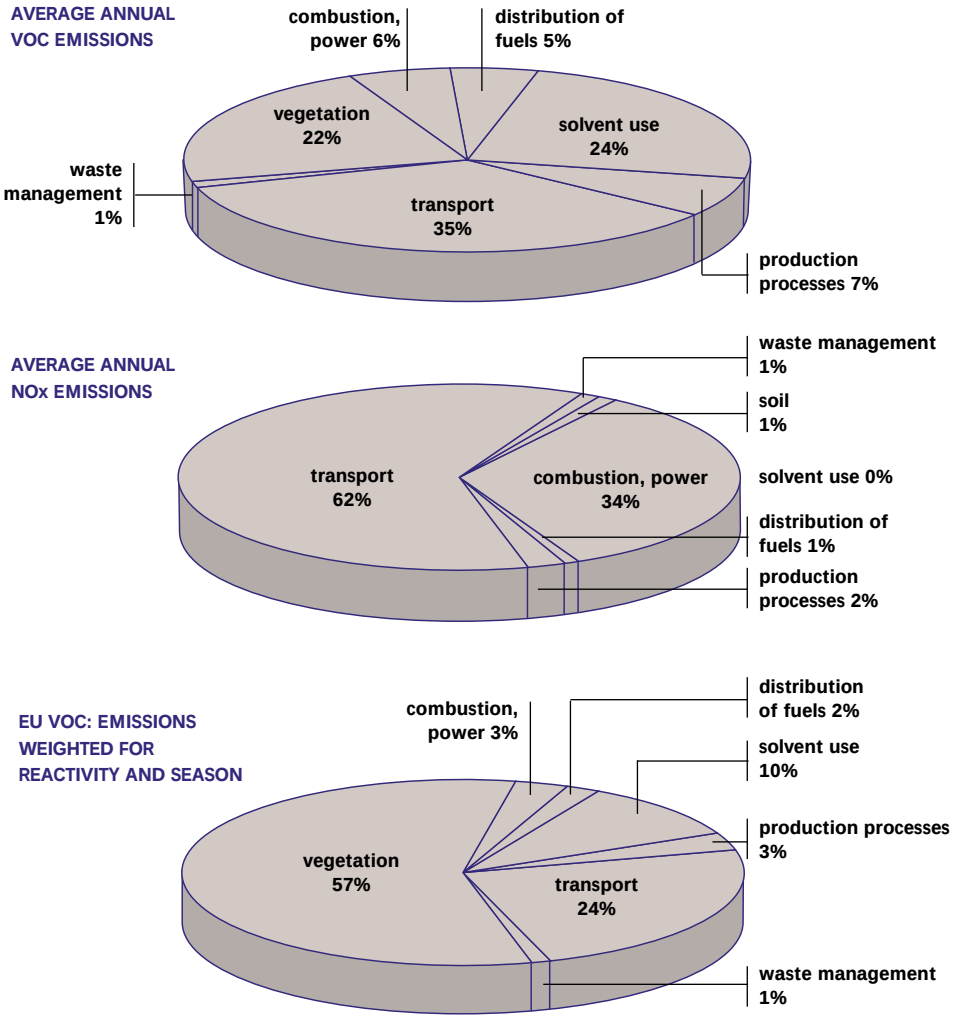
While conserving resources is an on-going priority so is emission control and, in particular, air quality. If solvents are emitted to the atmosphere they are VOCs. VOCs have the potential to contribute to summertime smog and this is the main environmental issue for oxygenated and hydrocarbon solvents.

Every product and every living organism has an impact on our environment

The smell of the forest is nothing more or less than a mix of organic chemicals – often called volatile organic compounds or VOCs. Obviously these are not harmful in their own right but if VOCs mix with nitrogen oxides (NOx) from power stations and transport emissions then sunlight can drive a reaction to produce ground level ozone. This is a component of summertime smog. It is for this reason that NOx and VOCs are sometimes referred to as ozone 'precursors'.

There are two types of ozone – stratospheric ozone in the earth's outer atmosphere and ground level ozone.

- **Stratospheric ozone is vital for human health, filtering out harmful ultraviolet rays. It is important to understand that oxygenated and hydrocarbon solvents play no part whatsoever in the stratospheric ozone problem. This is because they, like natural VOC emissions, are cleaned rapidly from the lower atmosphere by photochemistry. This means they never reach the stratosphere.**
- **In contrast, ground level ozone in the troposphere is a key component of summertime smog and leads to poor air quality, which can have a harmful effect on human and plant life.**



VOCs and the environment

Air quality in Europe has been improving for several years, and will continue to improve as a result of existing measures. A number of industries are engaged actively in helping to meet air quality targets. The solvents industry is playing its part in looking at man-made contributions to ground level ozone and has already made significant progress in reducing emissions.

Understanding the full role of man-made VOCs is vitally important in assessing what further actions should be taken. This will ensure Europe as a whole gets the best environmental benefit for every ECU it spends on achieving improvement.

This pie chart shows how many tonnes of NOx and VOC from each source are produced annually. But this is only part of the story – the number of tonnes emitted is only one of three factors. The other two are:

- **The season; because ozone peaks are a summertime problem.**
- **VOCs all have different properties. For example, solvents, in general, cause less ozone than an equivalent amount of the main natural VOC that comes from trees called isoprene.**

Taking all three factors into account puts the issue of solvents emissions into perspective, and highlights some of the difficulties faced in addressing summertime smog.

Looking simplistically at the data could lead to the incorrect conclusion that solvents emissions represent 24 per cent of the problem.

In reality it is somewhat different. We need to consider all ozone precursors – man-made and natural VOCs, then different potency, and NOx. When this total picture is assessed the contribution made by solvents is recognisably much smaller than first imagined.

This explains why focusing simply on Europe – wide reductions of man-made VOCs alone is an inefficient approach and will not achieve the cost/benefit desired. A broader perspective is needed.

Reducing ground level ozone requires a broad perspective

Time of year, geographical location and the amount of NOx in the atmosphere also are contributing factors:

- **Ground level ozone is highly reactive and therefore only persists in the atmosphere for a few days. Because the reaction requires sunlight, levels rise during the day and decline at night.**
- **Ground level ozone is a seasonal, summer phenomenon associated with hotter, sunnier climates. Cities notorious for photochemical smog problems include Athens, Los Angeles and Mexico City.**

A range of measures are being developed on an EU-wide basis, to limit VOC and NOx emissions.

The effect of these measures means that in the future, ozone peaks will be a localised problem occuring only at certain limited times of the year.

For example, in a small area in Northern Europe and a number of southern European cities, notably Athens.

Ozone levels 1990

Ozone levels 2010, with the addition of EU measures agreed or currently being progressed in EU Council of Ministers

- **1996 data shows that in most parts of Europe air quality targets were not exceeded. Where they were, this rarely happened for more than five days in the year. Nevertheless, there are some areas where it is exceeded for up to five days per year, and a number of urban centres where targets were exceeded for between five and ten days. Industry and European Commission attention is focused on reducing these occasions still further.**
- **These incidents coincide with dry, hot periods when natural VOC sources increase.**
- **NOx levels influence ground level ozone greatly. In areas such as Scandinavia, where NOx levels are extremely low, the level of VOC is not really relevant because there is insufficient NOx for VOCs to react with to create problem levels of ozone. On the other hand, in the Mediterranean, where there are high levels of NOx, levels of natural VOC are so high that they react and create ozone regardless of the levels of man-made VOCs.**

The cost of reducing emissions needs to be in proportion to the environmental gain

If the cost to industry of meeting targets forces unnecessary closures and job losses it will not benefit Europe as a whole.

Applying the same measures across Europe to limit ozone levels in a few localised areas cannot be a sensible use of our stretched environmental resources.

Without doubt, a more targeted approach should be taken. This means locally-designed measures. In Southern Europe, projections show that NOx controls could achieve more effective results compared with additional VOC measures, simply because of the dominant role natural VOC emissions play in the summer.

The cost of VOC emission reduction is huge. The University of Karlsruhe, on behalf of the European Commission, estimated that it will cost some 70 billion ECU to implement the Solvent Emissions Directive across Europe. Other studies have come to a similar conclusion, including the industries own estimate of 80 billion. Cost and gain need to be balanced so a targeted programme can achieve maximum results in the areas of most need.

Minimising emissions

For over 25 years the solvents industry has been investing to meet future needs. This investment has been substantial;

- *new production facilities* – to make more efficient solvents
- *research and development* – to produce new solvents, formulations and ways to manage their use
- *technical support* – to help customers improve their own systems and understand the options for controlling emissions
- *independent environmental research* – to understand the impact of our products and identify the most efficient ways to minimise this impact.

There are a large number of practical aspects to be taken into account in selecting an emission control option for solvent containing products:

- **type and size of process**
- **existing or new production**
- **product quality/property**
- **capital availability and staff skills**
- **local site factors**
- **the particular mix of solvents being used... and many more**

It is therefore essential that a flexible approach be taken when choosing the relevant abatement technology to take account of individual plant circumstances. A rigid, hierarchical approach would reduce the plant operator's ability to take local conditions into account, increase cost substantially and could reduce total environmental improvement.

Finding solutions – guarding efficiency while using less total product

Good housekeeping is the most obvious route...

Using less, accompanied by technical innovations, can greatly enhance success. For example, recent technological advances such as the High Volume Low Pressure spray gun allow paint to be more precisely targeted – less overspray means less waste and better resource efficiency.

Emission abatement is the most widely used VOC control option...

We all use abatement in our everyday lives without even knowing – for example catalytic converters in our cars. Industrial scale versions offer an equivalent control option for large solvent users – they are known as VOC oxidation units.

Using solvents again and again...

In some applications, used solvent can be collected and reprocessed either to be recycled or to be reused in a different application. For example, isopropanol used in pharmaceutical synthesis can be redistilled and turned into wintertime car windscreen de-icer.

Reformulation – changing the solvent mix

- **By changing the solvent mix or recipe for a particular application it is often possible to maintain performance but with a lower potential to contribute to ground level ozone.**
- **Another approach is to control the rate of evaporation to make emission control easier. This means creating a blend of solvents to meet the appropriate evaporation 'pace'.**
- **In some instances, low solvent technologies are being developed and used successfully. 'High solid' paints and water-based paints are well known examples. These low solvent options still rely on a certain amount of solvents to ensure performance.**
- **Reducing solvent content needs to be balanced with functional performance. If, for example, the substitute product is less durable, it will require earlier replacement and greater maintenance, resulting in increased use of resources. This may negate the environmental benefits.**
- **Assessing the pros and cons is a complex process. Life cycle analysis of solvent and substitute products demonstrates generally that weighing up the environmental benefits is not a black and white process. One particular environmental impact may be reduced only to increase impact in another area. Therefore, substitution of solvents can also result in substitution of environmental impacts.**

Acting on Environmental Care

The solvents industry has been, and is, actively addressing concerns about environmental performance, in particular air quality.

Air quality in Europe is improving and will continue to improve as a result of existing measures from many industries.

Europe has been tackling the issue for the last twenty years, with directives targeting industries that cause emissions from the auto and oil industries through to manufacturing industries, which are solvents users.

Laws throughout Europe limit all types of emissions.

The proposed directive for solvents emissions will further limit VOCs by 2007.

Solvent manufacturers are committed to working with industry partners to develop existing and new methods of emission monitoring and abatement techniques to enhance improvements made already. Managed responsibly, solvents do not present an environmental risk.

The solvents industry is committed to protecting and enhancing the future of its products by ensuring that solvents are used to their best advantage from the beginning to the end of their life. ***Product stewardship*** **is a guiding principle and ensures that customers understand how to work effectively with solvents in order to achieve the highest standards of health, safety and environmental protection. The industry helps its customers review performance of areas as broad as labelling, storage and handling to ventilation, monitoring and emission control system selection.**

A sustainable future with solvents depends on everyone in the chain: those making and using solvents, those regulating for the environment and those enjoying the end products. The aim must be to deliver the triple goals of clean air, resource conservation and economic well being.

European Solvents Industry

Hydrocarbon & Oxygenated Solvents

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