



The Newsletter of the European Solvents Industry Group

OZONE SPECIAL: BACK TO BASICS! + **QUIZ: WIN A LUXURY WEEKEND!**

Ozone – Beyond the fog of misconceptions

In your daily lives, you may often hear references to the worsening air quality in Europe. This is not, however, strictly the case today. For some time now, ozone peak levels have been reducing in the EU, mirroring industry's initiatives to reduce ozone formation contributors (ozone precursors), such as NO_x and VOCs. According to EMEP¹, between 1990 and 2000, there has been a reduction of 30% in VOCs.

"In Western Europe, the reductions (in ozone formation contributors) resulted mainly from the introduction of catalysts on new cars, and implementation of the Solvents Directive in industrial processes and other uses of solvents." (European Environmental Agency²)

While solvents emissions in the EU have dropped substantially, it is still regarded as one of several factors contributing to the formation of ground level ozone, or, as it is commonly referred to, summertime smog.

In this feature, we would like to explain some of the background relating to ozone and EU legislation, while at the same time dispel some of the myths around this subject.

Firstly we will focus on ozone (O₃) which can be found both near to the ground and also high up in the stratosphere. At the level of the stratosphere, it creates a protective layer that helps stabilise the earth's temperature and protect humans from excess UV (ultra-violet) rays. Too little ozone in the stratosphere (the ozone hole) will lead to excess UV exposure for humans.

Hydrocarbon and oxygenated solvents, i.e. covered by ESIG, play no part in the ozone hole problem in the stratosphere.

At ground level, ozone (sometimes called tropospheric ozone) is also found but at much lower concentrations (about 60,000 times lower). This type of ozone, which can be found in the air that we breathe, is an element of photochemical summertime smog (a yellow haze). There is always a level of naturally occurring ozone in the air. When tropospheric smog reaches too high a concentration it can cause eye irritation and respiratory problems particularly for those with asthma.

At ground level, ozone or smog can be found in certain places on hot sunny days. Ozone at ground level is a result of the combined reaction between VOCs, NO_x, heat and sunshine.

So what exactly are VOCs? VOCs (Volatile Organic Compounds) are organic chemicals that get into the air. VOCs are a result of emissions from human activities (such as transport and industrial operations), as well as natural emissions from trees and plants, e.g. the smell of freshly cut grass is due to natural VOCs emitted by grass. Natural VOCs represent around 80% of the total VOC emissions in the world³.

¹ EMEP (Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe) emission data report, EMEP/MSC-W Note 1/2002, of July 2002

² "Europe's Environment: the 3rd assessment" (EEA, p.122, §5.2.3, 2003)

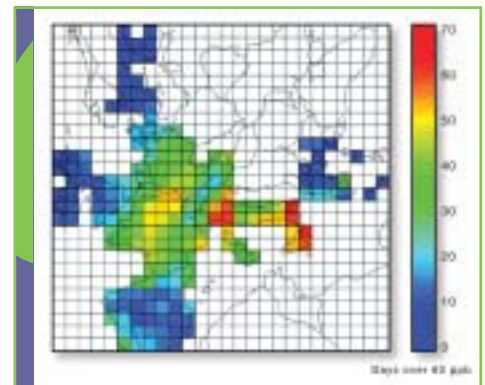
³ - Environment Protection Agency (1996) – Emission Reports for Base 90;

- www.marama.org;

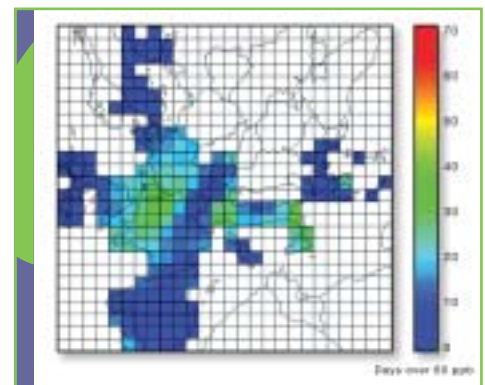
- Dr. Ing. Norbert Metz, BMW AG Traffic and Environment, "World Wide Emissions 1980 to 1996 and future trends", 1998

The ozone maps of Europe:

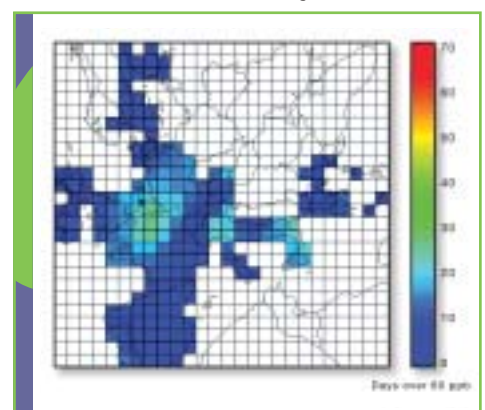
Map 1: Exceedences of 60 ppb ozone limit in 1990



Map 2: Exceedence of 60ppb ozone limit in 2010 based on implementation of National Emission Ceilings Directive

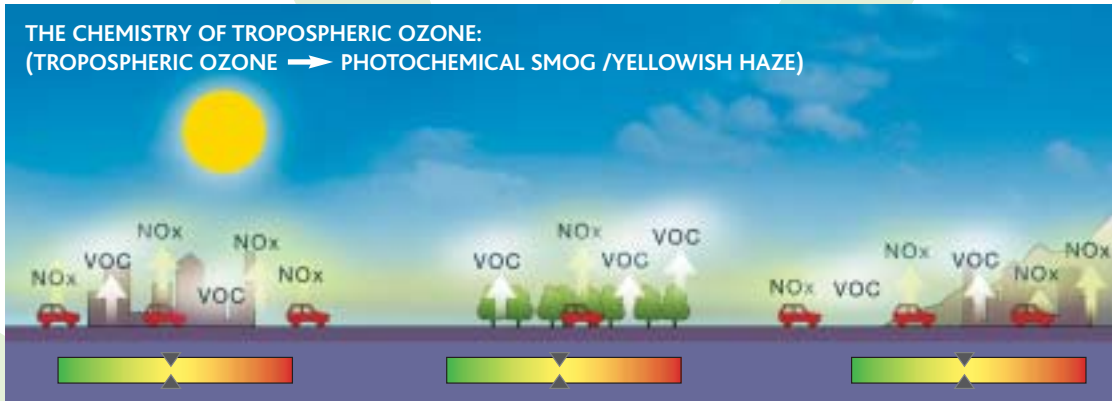


Map 3: Exceedences of 60ppb ozone limit after VOC emission reductions beyond current NEC

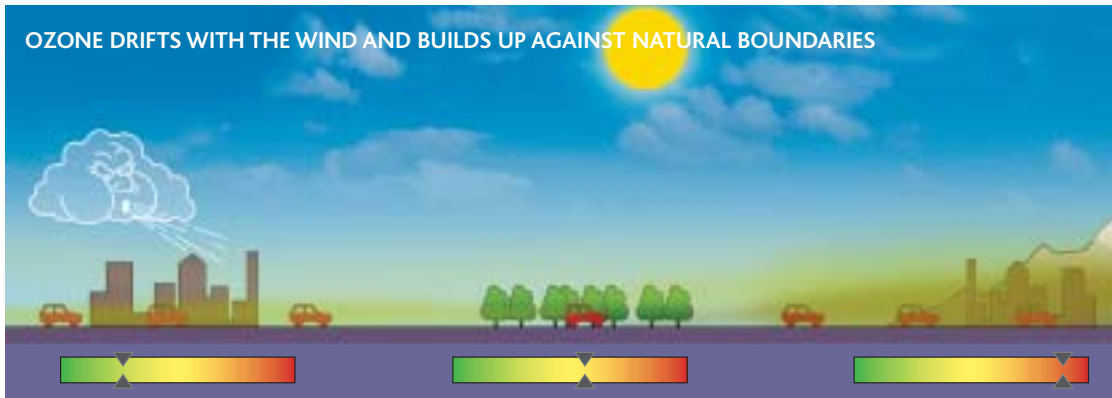


OZONE lifecycle

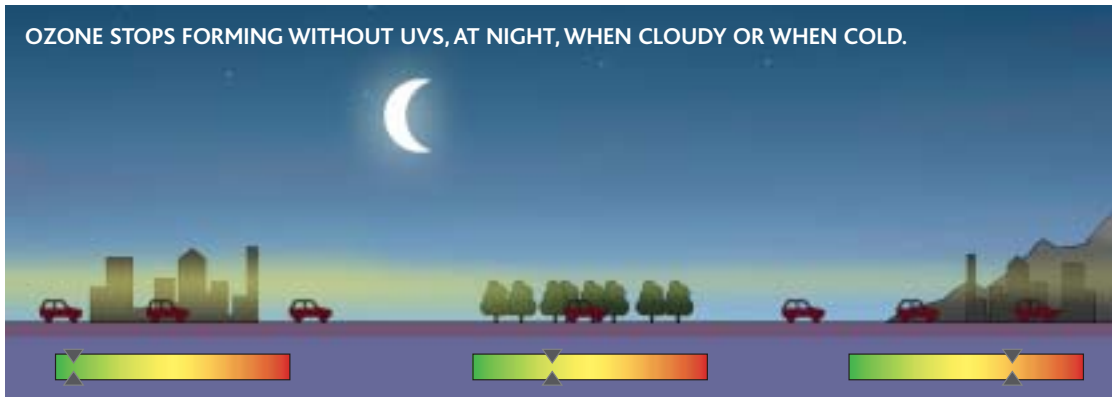
Approximate ozone level



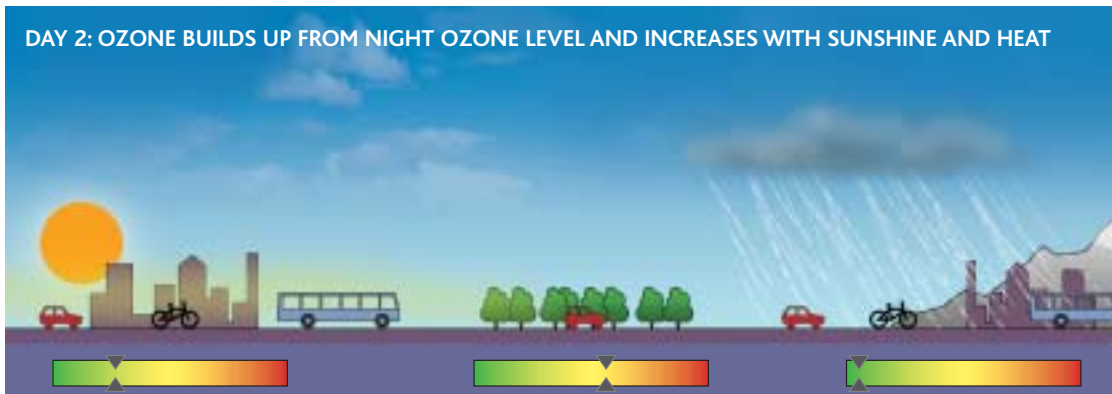
Tropospheric ozone forms in the low atmosphere, ground level, when NO_x and VOCs react with sunlight and heat. Stratospheric ozone keeps the earth warm and protected from excessive UVs.



Forests and agriculture emit large amounts of natural VOCs that cannot be reduced. The highest ozone levels are often reached in rural areas down-wind of cities. Even if the man-made VOCs were absent, you would still have ozone pollution in the presence of NO_x and sunshine.



Tropospheric ozone reaches its peak in the afternoon and its lowest level at night. If the next day is also sunny the build up will include the ozone left after the night and thus the second day may have a higher level of ozone¹.



Tropospheric ozone can only accumulate over a few days. However as soon as it rains or there is wind, ozone disappears or is dispersed.

CONCLUSION: Reducing man-made VOCs only marginally reduces ozone because of the large quantities of natural VOCs. Thus, to reduce tropospheric ozone, it is more efficient to reduce NO_x with temporary and geographically targeted measures.

¹(Boubel, R.W., D.L. Fox, D.B. Turner, D.A. Stern (1994). Fundamentals of air pollution. Academic Press, San Diego, California, USA)

And what is NOx? This is an abbreviation for the oxides of nitrogen (nitrogen oxide and nitrogen dioxide). NOx is the prime pollutant required to create ozone. In its absence, there is no ground level ozone formation. NOx is present in emissions from vehicles (especially those that do not have catalysts) and power stations.

The amount of ozone that is generated during sunlight in a polluted area depends on the ratio of VOCs to NOx present. The ratio of VOCs to NOx determines which is the controlling pollutant. In most of Europe we have reached the point where NOx is the pollutant that controls the amount of ozone ("NOx limited"). Further reductions of man-made VOCs would be ineffective since natural ("biogenic") VOCs represent the largest proportion present. Reducing NOx would appear to be the most effective way to continue to reduce ozone in the EU.

European Legislation

The European institutions have agreed a number of measures to limit NOx and VOCs emissions across the EU. Specific to solvents, these include the Solvent Emissions Directive in 1999 which reduced VOCs emissions from solvent industrial uses by 67% versus 1990 levels, the Large Combustion Plant Directive in 2001, and the Integrated Pollution Prevention and Control Directive in 1996. The National Emission Ceilings (NEC) Directive (2001) sets upper limits for each Member State for the total emissions in 2010 of four components: SO₂, NOx, VOCs and ammonia. In 2002, the EU also adopted a directive that sets the ozone target values for 2010 (60 ppb) that are not to be exceeded on more than 25 days per year (see maps).

The current European air quality legislation will reduce the emissions of VOCs from approximately 15 million tons (1990) to 6.4 million tons (for EU Member States by 2010).

Delivering results across Europe

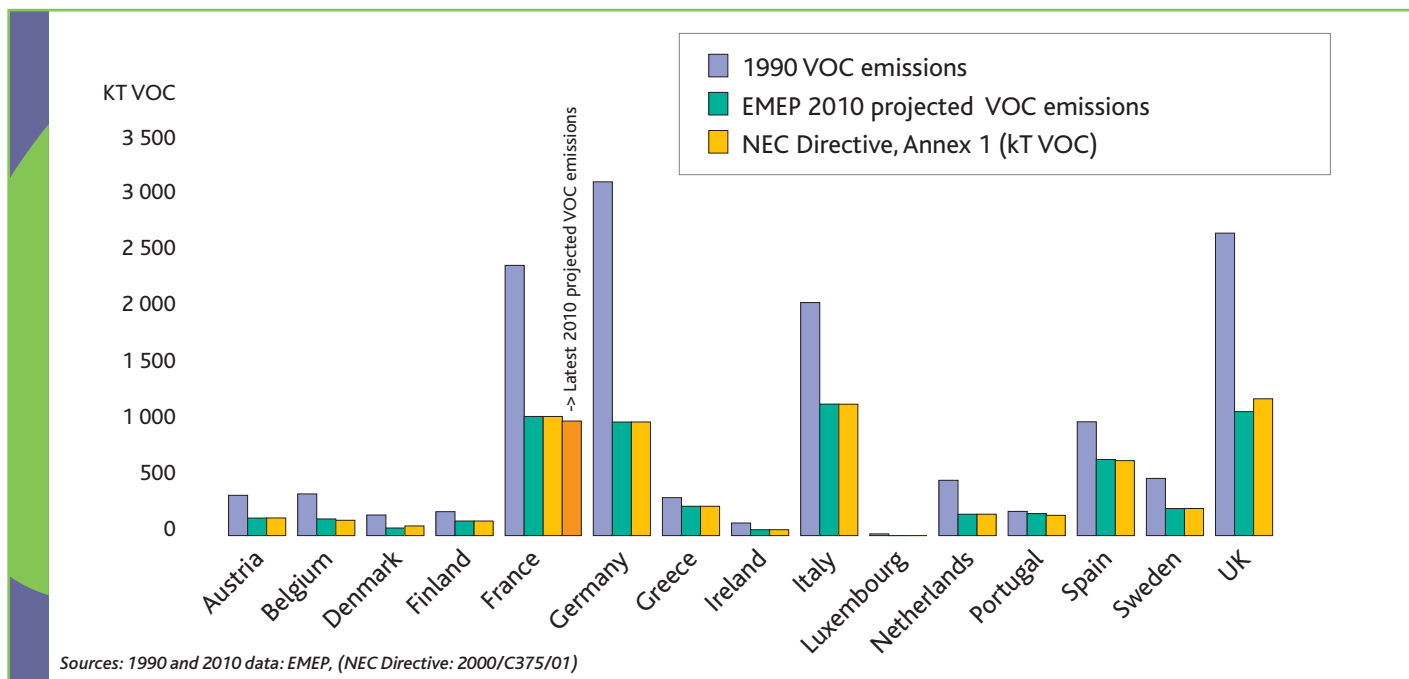
In the European Commission air quality model or "RAINS model", the ground-level ozone is mapped according to colour (red: high number of days above target, dark blue: in compliance with target). The "RAINS model" indicates that, rather than affecting all of Europe, ground-level ozone is now confined to certain parts. This situation is illustrated in maps 1, 2 and 3.

Under the present legislation, the majority of the EU Member States have met the VOCs requirements. Industry has been a key contributor in meeting these VOCs requirements in the Member States.

In conclusion, we see that many steps have been taken to limit the contributors to ozone formation. However, for most of Europe, further reduction of man made VOC emissions will have little or no impact on ozone formation as the comparison between map 2 and 3 illustrates. Therefore, we should aim to implement effective measures by using local temporary methods as well as reducing NOx emissions.

Disclaimer: The content of this Newsletter is based on simplified scientific information and it is not claimed to be exhaustive. ESIG has compiled this information very carefully and offers it in utmost good faith. This information is believed to be correct. Nevertheless, ESIG makes no representations or warranties as to the completeness or accuracy of any of this information. ESIG will in no event be responsible for damages of any nature whatsoever resulting from the use or reliance to the information contained in this Newsletter. For more thorough explanations, please refer to the following reference documents: "Rethinking the Ozone Problem in Urban and Regional Air Pollution", National Academic Press, ISBN-309-04631-9, 1992 authored by the National Research Council, USA, and the 3rd environment assessment of the European Environment Agency (2003) (www.eea.eu.int).

Evolution of man-made VOC emissions:



CALENDAR

07/07/03

Proposed directive on VOC content limits in decorative and vehicle refinish coatings- European Parliament Environment Committee - deadline for amendments

08/09/03

Proposed directive on VOC content limits in decorative and vehicle refinish coatings - EP Environment Committee vote

22-26/09/03

Proposed directive on VOC content limits in decorative and vehicle refinish coatings - EP vote

Summer 2003

Data gathering and submission for IPPC BREF on "Surface Treatment using Solvents"

Autumn 2003

IPPC review - Commission expects a review after the report on DG Environment communication and internet consultation

10/03

European Week for Safety & Health at Work "Dangerous Substances – handle with care"

24-25/11/03

The Environmental Performance of EU Industry- Conference

QUIZ

We are all familiar with the concept of ozone/smog pollution which is formed when VOCs (for example solvent emissions) mix with NOx (for example vehicle exhaust fumes) in the presence of sunlight. Test your general knowledge on air quality in the quiz below:

1. Which statement about ozone is false?

- a) Ozone stops UVs (ultra violet rays) from giving you skin cancer
- b) Ozone can increase breathing problems
- c) Ozone can be found in the stratosphere and in the troposphere
- d) Ozone has no effect on humans (it only smells unpleasant)

2. What is the yellowish haze over some cities?

- a) VOCs
- b) Vehicle exhaust
- c) Photochemical smog (composed mostly of ozone and particulate matter)
- d) Ozone

3. Have European ozone peak levels reduced since 1990?

- a) Yes – Ozone peak levels have been reducing since 1990
- b) No – Ozone peaks have stayed the same
- c) No – Ozone levels have increased since 1990

4. What are some of the health effects that the EU ozone Air Quality Limits aim to protect against?

- a) Giving people headaches and acne
- b) Giving people eczema
- c) Giving people eye irritation and shortness of breath
- d) Giving people a range of allergies in particular hay fever

5. Do today's hydrocarbon and oxygenated solvents affect the hole in the ozone layer?

- a) They are the principal cause of it.
- b) They play no part in forming the ozone hole
- c) About half of the problem is due to these solvents
- d) Solvents generate ozone which helps repair the ozone layer

6. Which statement on the fate of pollutants is true?

- a) Under normal conditions, VOCs degrade into CO₂ and water and do not accumulate in the atmosphere
- b) Ozone pollution disperses when it rains or is windy
- c) The atmosphere cleans itself of VOC emissions within hours or days
- d) All of the above

ANSWERS: 1.D/; 2.C/ (OZONE IS COLOURLESS); 3.A/ (SEE EEA 3RD REPORT) 4.C/; 5.B/ (THE STRATOSPHERIC OZONE HOLE IS CAUSED MAINLY BY CHLORINE AND FLUORINE CONTAINING PRODUCTS SUCH AS CFCs, AND NOT BY HYDROCARBON AND OXYGENATED SOLVENT EMISSIONS); 6.D/ (OZONE DOES NOT BUILD UP OVER TIME, IT IS REGULARLY CLEANED FROM THE ATMOSPHERE) 7. D./; 8.D./; 9.A./

7. At world level what percent of VOCs is man-made?

- a) Around 80%
- b) About 50%
- c) Less than 30%
- d) Less than 15%

8. What are the National Emissions Ceilings?

- a) They are the total mass of pollution each country emits
- b) They are the total mass of all pollutants each EU country is allowed to emit per month
- c) They refer to the altitude at which clean air starts
- d) They are future limits for NOx, VOCs; SO₂ and ammonia emissions

9. Which of these comments about acid rain is true?

- a) Hydrocarbon solvents and oxygenated solvents do not cause acid rain
- b) Hydrocarbon solvents and oxygenated solvents cause acid rain
- c) VOCs are the principle cause of acid rain
- d) Forest fires cause acid rain

BONUS Question

Win a weekend stay at a Hilton hotel of your choice!

10. Which method would most efficiently reduce ozone in Europe?

- a) Reduce SO₂
- b) Reduce man-made VOCs to zero
- c) Reduce NOx significantly
- d) Reduce natural VOCs to zero

If you would like to win a night at a Hilton hotel of your choice, please return the answers of the quiz (e.g. 1/A 2/B 3/C etc.) together with the above decider question before 18 September 2003 by email to loredana.ghinea@mpeurope.be. The winner will be notified by email before 1st October 2003. The quiz is open to all residents of the European Union who are at least 18 years old. Each participant will receive the rules of the competition by email once they have submitted their answers. The rules can also be requested in advance by sending an email to above email address.



Answers

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