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AIR QUALITY: EXPLORING THE INACCURACIES OF VOC EMISSION CALCULATIONS



Over the past decade, the Solvent Emissions Directive has ensured substantial reductions in volatile organic compounds (VOCs) from solvents, and this alone has helped to reduce ozone levels (see Solutions 21). However, air quality models used to calculate ozone concentrations are only as accurate as the emission inventories they use.

Solvent VOC inventories are particularly difficult to assess, with large industrial sources being measured and smaller sources based on sales simply recorded. VOC emission inventories used in ozone air quality models remain inaccurate, overestimating some sources and underestimating others. ESIG has been developing a methodology that takes into account volumes given by producers, with the aim of obtaining a more realistic picture. When this methodology is applied, the contribution of VOCs from solvents is shown to have the smallest impact on European ozone, compared to mobile and biogenic sources.

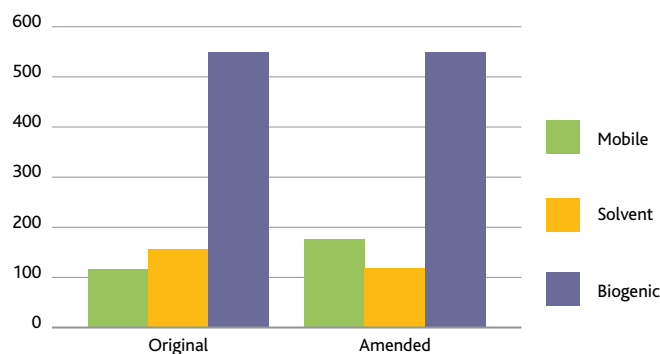
One example of the inaccuracy of calculations can be found in estimates of VOCs from mobile sources (exhaust gases from vehicles). The main model used in the development of air quality policies in Europe (EMEP ozone model) utilises a set of inventories provided by the EU27 member states for both VOCs and NOx (nitrogen oxides). Mobile source inventories are calculated by assessments of vehicle distribution and their emission factors. "Super emitters" (vehicles which may not have been serviced), representing 10% of vehicles, can contribute up to 50% of all vehicle emissions. Gasoline cars can lose their catalyst efficiency after 80,000 km and exhaust VOCs can increase by 40%. However, the EMEP model does not take these super emitters into account, meaning that mobile source VOCs may have been underestimated by some 50%.

Similarly, recent publications on European biogenic emissions have shown that estimates of these emissions can vary greatly depending on model used, and measurement technique applied, which can alter natural VOC emission values.

VOCs from solvents have substantially decreased, leading to a reduction in European ground level ozone. For the original EU15 Member states, this amounted to a solvent VOC reduction of more than 1.4M tonnes (>30%) by 2008, based on 1990 levels*. Recent calculations by ESIG demonstrate that not all solvents sold are emitted into air, as is assumed in some solvent inventories: the figure is at most 80% and most of the remainder is incinerated as liquid waste.

ESIG's approach to solvent VOC inventories considers total solvent sales for the EU15 reported in 2003 (confidential). Assuming that sales did not change significantly over the period 2003-2008, emissions due to solvents represented about 30% of the published National Emission Ceilings non-methane VOC emissions for the original EU15. Total solvent VOC inventories were evaluated as 2.7M tonnes for 2006 for the EU27. In these calculations on ozone, the upper estimate of 2.7M tonnes was adopted.

EU27 ozone estimate 2006 (relative ozone scale)



The ozone contribution from each of the three sectors - biogenic, solvent and mobile sources - can be estimated by taking their ozone potentials (POCPs) and emitted VOC masses into account for the EU27. POCPs were calculated by Professor Richard Derwent as: biogenic =70; mobile =69; solvents =44 (POCPs are all relative to ethylene which has a POCP of 100). Relative ozone values using the original and modified EMEP VOC inventories are represented in the figure above.

* For more information please visit: [http://www.esig.org/uploads/ModuleXtender/Publications/101/Solutions%2016%20-%20Summer%202006%20\(EN\).pdf](http://www.esig.org/uploads/ModuleXtender/Publications/101/Solutions%2016%20-%20Summer%202006%20(EN).pdf)

According to these results, the level of ozone from biogenic sources in 2006 was over five times that of solvent sources, and three times that of mobile sources. In real terms, the solvent contribution to European ozone is small, accounting for approximately 12% of European ozone.

In conclusion, biogenic VOC sources remain the major contributor to European ozone due to their greater volume (60% of the

total) as well as their reactivity. Taking POCPs into account, the relative contribution from the three sources (biogenic, mobile and solvent) is 65%, 22% and 13% respectively. VOC emission inventories used in ozone air quality models remain inaccurate, and future emission controls therefore need to be revisited. ESIG will be exploring these uncertainties further.

REGULATORY UPDATE: KEY DEVELOPMENTS FOR THE SOLVENT INDUSTRY

Keeping abreast of key EU and international legislation is essential for the solvent industry if it wishes to remain ahead of the curve. The next four years will produce five significant regulatory developments for ESIG members. Three of these – the National Emission Ceilings Directive (NECD), the Directive on the limitation of VOCs due to the use of solvents ("Solvents Emissions Directive") and the Directive on the limitation of emissions of VOCs in certain paints and varnishes ("Decorative Paints Directive") – together constitute the Air Quality Package.

1. European Air Quality Package

Air pollution has been one of Europe's primary political concerns since the late 1970s and the European Union has since developed and implemented a number of legislative instruments to improve air quality. For many years now, the solvent industry has also been committed and actively contributing to improving air quality in Europe, and has been closely following scientific developments on air pollution. The upcoming revision of legislation comprising this package will set the regulatory framework over the coming years, and has been deemed an EU priority for 2013, the "Year of Air Quality".

Revision of the European Air Quality Package has been postponed

by the European Commission until early 2013. In the meantime, however, the European Commission is launching a wide consultation process, which will include:

- An initial online public consultation focusing on experience with and improvements to existing air quality legislation.
- Establishment of a stakeholder group.
- Dedicated workshops and events covering particular themes, with possible links to ongoing initiatives such as research projects.
- Dialogue with international organisations, such as the WHO and United Nations Economic Commission for Europe (UN-ECE).

National Emission Ceilings Directive

European Environment Commissioner, Janez Potocnik, has stressed that revision of the 2001 NECD should benefit from synergies with other policy measures in the pipeline, such as evaluation of the 6th Environment Action Programme (EAP), climate change policy, a range of industrial and technological policies and the Gothenburg Protocol. The European Commission is expected to start its preparatory work, including a public consultation, in mid 2012.

Decorative Paints Directive

The knock-on effect of the delay in the NECD review means that revision of another important piece of legislation, the **Decorative Paints Directive**, is also being delayed.

Revised Industrial Emissions Directive (IED)

In its drive to simplify EU legislation and cut red tape, the European Commission took advantage of the Integrated Pollution Prevention and Control (IPPC) Directive review to combine seven directives into one single clear and coherent legislative instrument, the **Revised Directive on Industrial Emissions**. These directives are:

- IPPC
- Large Combustion Plants Directive
- Waste Incineration Directive
- Solvent Emissions Directive
- 3 Titanium Dioxide Directives

With regard to regulatory status, the European Parliament and the Council of the European Union reached an agreement on the revised IED, which came into force in December 2010. The aim of the directive is also to strengthen application of best available techniques, stimulating eco-innovation, and reduce administrative burdens for both companies and authorities. Simplification of the legislation also proposes new objectives for PM2.5 (fine particulate matter) reduction, an air pollutant that is a potential concern for human health when levels in air are high.

2. Gothenburg Protocol on Long-Range Transboundary Air Pollution

The UN-ECE region and the European Union work closely together on legislation on air quality. The **Gothenburg Protocol to the 1979 Geneva Convention on Long-Range Transboundary Air Pollution**, which regulates emissions ceilings in the UN-ECE region, is currently under revision and is expected to be finalised in December 2011. UN-ECE experts are focusing on the four main annexes and proposing new annexes on particulate matter (dust) and - most recently - on the solvent content of products. The EU

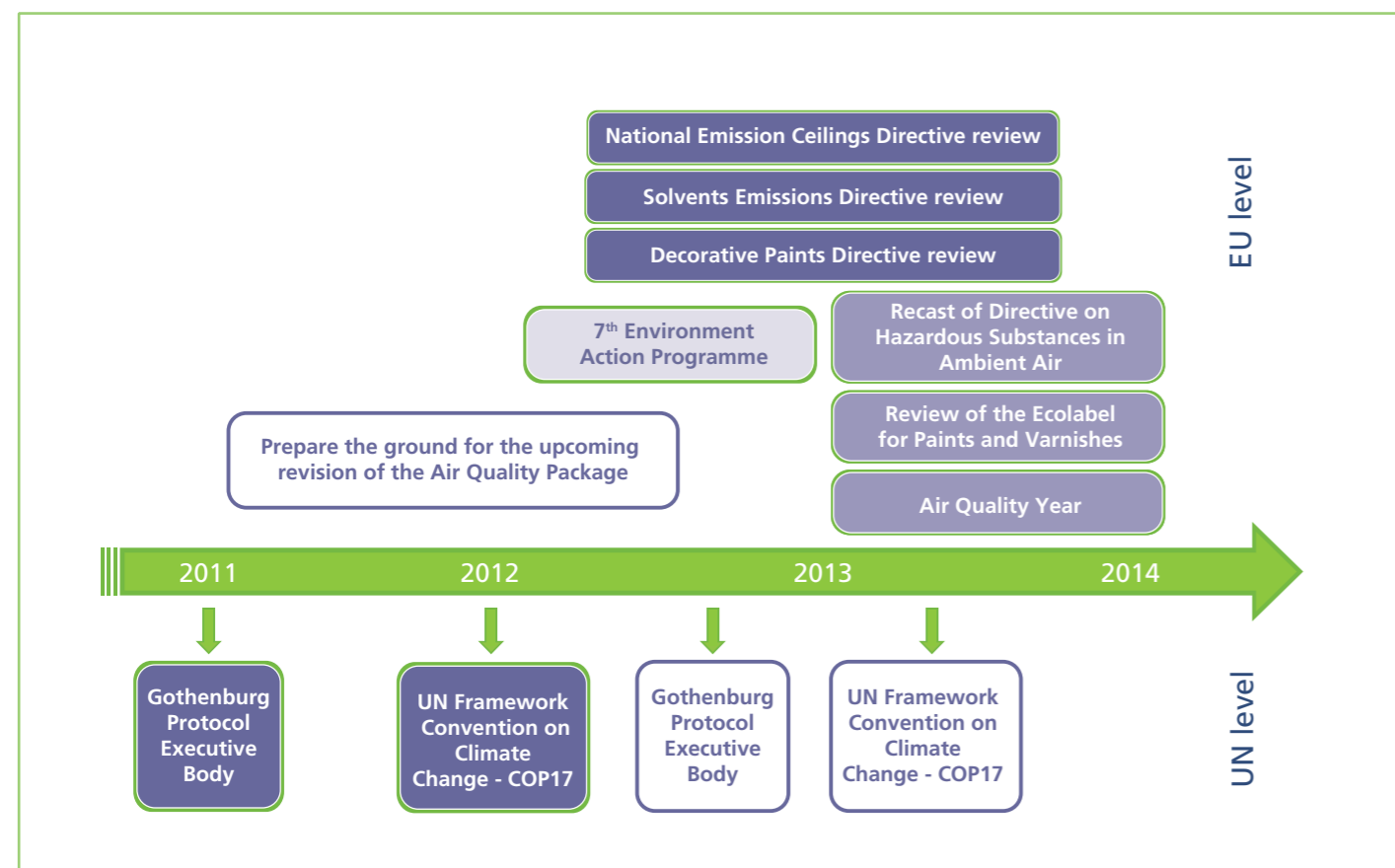


is supporting a proposal for the addition of a new annex on limit values for solvent content of products. Any final UN-ECE decision will require adaptation of existing European legislation, including the NECD.

3. Review of the 6th Environment Action Programme (EAP)

Finally, the EU is also assessing the 6th EAP through a process of stakeholder consultation. The EAP includes seven thematic strategies on air, waste prevention and recycling, marine environment, soil, pesticides, natural resources and urban environment. The current assessment will feed into preparations for a new plan post-2012.

ESIG will continue to actively contribute to the scientific and political debate and will keep "Solutions" readers posted about future developments.



ESIG COOPERATION WITH TRADE UNIONS



In a joint declaration dated 7 February 2011, the European Mine, Chemical and Energy Workers Federation (EMCEF) and the European Chemical Employers Group (ECEG) strongly encouraged all their members across Europe to use ESIG's product stewardship material on the safe use of solvents.

This recommendation underlines the three organisations' joint commitment to health and safety in the workplace, which is also a common objective of the European Sector Social Dialogue Committee of the Chemical Industry, hosted by the European Commission. Over the past 18 months, ESIG has had the opportunity to actively contribute to the social dialogue: ESIG's Director General, Dorothee Arns, was twice invited to present the industry's product stewardship programme to the plenary, and all delegates had ample opportunity to view ESIG brochures and other safety material, such as posters and DVDs, available in up to 17 European languages.

The response was very positive and, in a second step, the dialogue process anticipates active feedback from national trade unions and employers' groups on potential future joint projects or other areas of cooperation, including the development of further media.

In this context it should also be mentioned that, since November 2010, ESIG's safety media have been an official vocational training element in the area of paints, coatings and laboratory applications in several European countries and beyond. Some governmental occupational health and safety institutes have even translated English versions into their respective national languages. The first copies available in this series are Hebrew translations of ESIG DVDs on "Static Electricity" and the "Safe Use of Solvents", also accessible at www.esig.org, kindly contributed by the Israel Institute for Occupational Safety.

ESIG's safety material on solvents is electronically available from the ESIG homepage: <http://www.esig.org/responsible-care>; hard copies of all media can also be obtained free of charge by mail from the secretariat: esig@cefic.be.

ESIG wishes to thank all stakeholders for their invaluable contributions and looks forward to further extending this type of health and safety cooperation in the future.

APPLICATIONS CLOSE FOR THE 8TH EDITION OF THE ESIG PRODUCT STEWARDSHIP AWARD



The application process for the 8th edition of the ESIG Product Stewardship Award this year closed on 31 May, 2011. ESIG would like to thank all those who submitted applications and wish them good luck with their entries.

As a next step, the award submissions will be assessed over the summer by an independent expert panel of judges, consisting of senior representatives from the European Commission, the European Parliament, media and trade associations

specialised in health, safety and environmental issues - either trade associations other than ESIG or associations specialised in health, safety and environment issues.

Established in 1999, the ESIG Product Stewardship Award is designed to showcase and reward excellence and continuous improvement in the use of solvents. The initiative is part of the industry's commitment to responsible and ethical management of solvents throughout their lifecycle.

The prize-giving ceremony will take place within the framework of the annual Cefic Responsible Care Conference in Brussels at the end of September, 2011.

For more information, please visit: www.esig.org

GENERIC EXPOSURE SCENARIOS (GES) - FREQUENTLY ASKED QUESTIONS AND ANSWERS (FAQs)

As part of its proactive commitment to support Responsible Care® in the use of solvents throughout the supply chain, ESIG has recently developed a FAQs section on the GES.

These FAQs were developed to help downstream solvent users and will be regularly updated to take into account any new relevant questions that may arise. They are now available on the ESIG website: <http://www.esig.org/en/regulatory-information/reach/ges-library/faq>

The REACH regulation obliges manufacturers and importers of chemical substances sold in quantities of more than 10 tonnes per year and classified as dangerous to develop GES as part of their registration. These scenarios describe conditions which, if followed, ensure that the substance can be used safely (i.e. without harm to humans or the environment), and which are required to be communicated to downstream users in an annex to the extended safety data sheets.

In addition, all ESIG substances were registered under REACH within the deadline of 1 December, 2010.

In 2008, ESIG started to develop a thematic approach to GES, in cooperation with several downstream user associations (AISE for soaps and detergents, CEPE for paints and coatings, FEA for aerosols, FECC for distribution and FEICA for adhesives and sealants). This standardised catalogue, which fully meets REACH requirements, is intended to help ESIG members by simplifying the process of submitting exposure scenarios as part of their REACH obligations. It has been endorsed by the European Chemicals Agency and is being rolled out to other industry sectors by Cefic, the European Chemical Industry Council.

In addition, ESIG/ESVOC currently share the GES developed for solvents via a GES library, available from the ESIG website: http://www.esig.org/regulatory_information/REACH/ges-library-3/

BEST PRACTICE GUIDELINES ON GLOVES IN ADDITIONAL LANGUAGES

As part of its mission to promote safety in the workplace and best practices in the use of solvents, ESIG regularly produces, reviews and updates a range of tools and materials to support solvent users in their daily work. To this end, in 2010, ESIG developed guidelines on the safe use of gloves for the handling of solvents, the fifth in a series of best practice guidelines (BPGs).

In response to overwhelming demand, these popular brochures and posters have now been translated into German, Spanish, French and Italian. All BPGs are available for download from the ESIG website: www.esig.org

On these pages, visitors can also find other useful ESIG materials like brochures, posters, DVDs and the ESIG newsletter "Solutions". They can be easily accessed and downloaded from: www.esig.org, or ordered free of charge from the ESIG secretariat: esig@cefic.be.



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For further information, please visit our website at www.esig.org or contact:

EUROPEAN SOLVENTS INDUSTRY GROUP,
CEFIC, Avenue E. Van Nieuwenhuysse 4,
B-1160 Brussels

Tel: +32 (0)2 676 72 69 • Fax: +32 (0)2 676 72 16 • E-mail: esig@cefic.be