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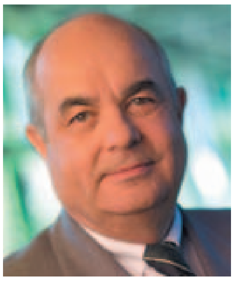
Foreword



Wilhelm Bonse-Geuking
Chairman, CONCAWE

At the end of this year, Jean Castelein will leave CONCAWE as he reaches his well earned retirement from formal business life. Jean joined CONCAWE in December 2000 and has presided over an important period of activity for the association. The REACH proposal on chemical safety triggered a major programme of risk assessment for petroleum products that has more than doubled CONCAWE's budget. In the area of air quality, CONCAWE has provided important input to the Clean Air for Europe (CAFE) programme. Meanwhile, the revised Fuels Directive is making sulphur-free road fuels a reality, while the growing focus on alternative fuels gave rise to the Biofuels Directive and the definitive European 'Well-to-Wheels' study undertaken jointly by CONCAWE, EUCAR and the European Commission's Joint Research Centre.

We should also take this opportunity to recognize Jean's unceasing and successful efforts to mobilize the combined potential of CONCAWE and EUROPIA (the European Petroleum Industry Association) to the common benefit of our entire industry. Jean has every reason to be proud of the achievements of CONCAWE during his tenure. We are very grateful for his skilful, knowledgeable and dedicated work at the helm of the association and we wish him well at the start of the next phase of his lifetime activities.

As we bid farewell to Jean, we also extend a warm welcome to Alain Heilbrunn as he takes over the role of Secretary General of CONCAWE. On this occasion, it is appropriate to reflect for a few moments on the challenges ahead for both Alain and his team.

The principal credentials of CONCAWE lie in the area of Health, Safety and the Environment and no subject has grown more in importance to citizens, politicians and civil society alike over recent years. Since its inception forty years ago, CONCAWE has consistently sought to widen its portfolio to include all aspects of HS&E of importance to society. In this respect, I can see three major issues that CONCAWE will need to embrace and manage over the next few years:

- The prospect of Climate Change is moving rapidly up the civil and political agenda around the world and especially in Europe. The consequences of changing weather patterns are potentially serious, even if still subject to considerable scientific uncertainty. Precautionary measures appear justified but the impact on both our industry and the broader economy needs to be carefully assessed. Our industry needs to play a leading and constructive role to meet the challenge of balancing the cost and the corresponding benefits through new technologies and market mechanisms.

- Concerns over the long-term availability of energy, at a reasonable cost and through secure channels, are also moving higher up the agenda of many governments around the world. Again, appropriate technologies and market mechanisms are needed to assure our societies that this energy supply challenge can be met without major economic disruption.

- The ever-increasing public demand for protection from the potentially harmful effects of both natural phenomena and human activities, will lead to a continually deepening focus on health, particularly for the most vulnerable sections of the population.

The oil industry in the European Union is well positioned, through the shared expertise and skills of CONCAWE and EUROPIA, to influence the scientific, technical and public policy debates on all these issues in a productive and responsible manner. Through working together in close collaboration, our two organisations can form a highly effective platform for representing the contribution of our industry as the most important supplier of energy in Europe for many years to come.

Contents

Cost Benefit Analysis

Some basic concepts and issues

As our society becomes more sophisticated, complex and integrated, societal issues are increasingly interlinked and these relationships are also better recognised. Legislation has to follow suit and the impact of legislative measures needs to be considered within a whole complex system. Invariably the legislator will be faced with many different options to choose from.

Generally, new legislation imposes new constraints on some parts of society, entailing additional costs or loss of revenue. This has to be weighed against the potential benefits that the measures are meant to bring about. A Cost Benefit Analysis or CBA must therefore be part of a sound legislative process. This seemingly straightforward statement, however, hides a complex reality. CBA can be considered at different levels of sophistication. Questions need to be answered and choices made at every step of the process.

The Clean Air For Europe (CAFE) programme aims at an integrated assessment of the role of multiple factors on air quality and related health and environmental effects in Europe. CBA has been made part of this assessment and a specific methodology is being developed. CONCAWE is closely involved in the process.

In this article we use an example from daily life to highlight the concepts and main challenges associated with analysing costs and benefits, and look at how these play out in the case of the CAFE programme.

Options to fulfil a need: getting from A to B

Imagine you have found a new job which requires you to travel from A to B and you need to select a means of transport. You are faced with a whole range of options e.g. public transport, a car, a motorcycle, a bicycle or travelling by foot. Then more choices may need to be made: first or second class on the train, buying a new or second-hand car, leasing, etc. Being a sensible person you want to choose the 'best' option. But how can you define what you mean by 'best'?

At this point, it is important to realise that personal preferences, prejudice, emotional or political reasons may lead you to reject certain options at the outset or even make a choice up front. In this case further analysis or discussions are redundant, but you may have missed an opportunity to select the 'optimal' solution.

Costing the options

Cost is a ubiquitous parameter in our lives. Our means being limited, this is invariably one of the first factors that we consider. Because cost is so pervasive we are quite good at estimating it and data to help us is usually at hand.

After collecting all the relevant cost information, you can simply select the means of transport that is cheapest for your situation and go for that option. This approach could be called a ***cost-effectiveness analysis***.

Identifying the benefits: what do I get for my money?

Although all the means of transport you are considering will get you from A to B, each of these options will have a number of benefits and drawbacks associated with it, e.g. perceived safety, level of protection from adverse weather conditions, travel time, risk of delays, noise level, maintenance and servicing issues, environmental impact, ease of use, availability outside working days, and so on.

Making an exhaustive list of all these 'benefits' is actually quite difficult. It is easy to overlook one of the aspects. Personal preferences will also play an important role, and

what is perceived as a benefit by some might be construed as irrelevant or even as a drawback by others.

Trying to rank your options taking these benefits into account is even harder. They are usually qualitative rather than quantitative, so comparing them is likely to be a subjective process where, again, personal preferences play an important role.

At any rate this 'benefit identification' stage needs to be done with an open mind, avoiding predetermined opinions and choices.

Valuing the benefits

Money is the standard exponent of value. If we can assign a monetary value to benefits that we intuitively feel have different worths, we have a common objective metric for calculating benefits (positive or negative) and also for comparing them with costs. This approach constitutes a full cost benefit analysis and it is claimed by some to provide an objective comparison of all options.

So far so good, but this is actually where the problems start. If identifying benefits can be a difficult and subjective exercise, allocating a monetary value to them is even more arduous. For example a shorter travel time would be seen by most of us as a benefit, but what is it worth? Using your hourly pay rate may be an option, but you are unlikely to get more money if your travel time is reduced. So you may get to spend more time with your family? But how much is this worth? Clearly, whatever the methodology adopted, value judgements have to be made.

Faced with these questions, economists sometimes try to measure the value of non-monetary benefits in terms of lost (or gained) income or incurred (or saved) expenditures (e.g. medical costs).

Another common approach is based on a seemingly clear concept: the value of any 'product' is nothing other than the amount of money that people are willing to pay for it. We simply have to ask people, by means of a survey, what they are prepared to pay for, in this case, a twenty minute saving in travel time, and this enables us to find a monetary value of a unit of time. This is referred to as the willingness-to-pay (WTP) value.

Even in the best of circumstances, with a carefully designed public survey, sound statistical analysis, etc., results are usually very dependent on the questions actually being asked, how they are formulated and on the sample of the population selected. WTP cannot therefore be construed as constituting an objective measure of the value of a certain item. At best it can be considered as an indication with a large range of uncertainty that calls for an extensive sensitivity analysis.

In practice these issues are often confounded by the fact that the reporting of the results of such surveys lacks transparency, leaving out essential details of the methodology used.

Bringing in risk

If assigning a monetary value to a benefit can be difficult, the problem is even more acute when it comes to valuing risk.

Most activities entail an element of risk, for instance a health risk, risk of accident, disease or even death. In our simple example this could be the risk of having an accident. The CBA methodology leads us to evaluate the change in such risk between options, and to put a monetary value on that change. This implies, of course, that the risk can be identified.

There are two points which make a monetary valuation of these classes of benefit very difficult when using the willingness-to-pay approach. Firstly, the abstract concept of risk or change in risk is often difficult for people to fully understand. Experience has shown that using a survey technique to get people to put a value to certain changes in risk can lead to results with a very large spread and which are sometimes even clearly inconsistent, if not meaningless.

The second is actually an ethical issue: when valuing the change in risk in terms of health or mortality, one is often faced with such concepts as the Value of a Statistical Life (VOSL) or the Value of a Life-Year (VOLY). Although it can be argued that these are not an attempt to place a value on actual human life, it is clear that the CBA methodology raises some deep-running ethical issues and controversies, which are still being debated in literature.

Broadening the scope

In your endeavour to find the preferred way to travel to work, you may have opted for a relatively expensive option because you valued highly aspects such as comfort, time, etc. Your analysis of this particular issue led you to spend extra money on this, but you have not necessarily considered what else you could have done with that extra money (e.g. a holiday, new clothes or a donation to charity). This was outside the scope of your investigations and has therefore been ignored. If you had considered some of these broader options at the time, the outcome might have been different.

This illustrates another issue with CBA in that, although it appears to use an all-inclusive approach to analyse the different options, it actually always limits attention, not only to known benefits, but also to a certain specific context. Making a balanced decision still requires a sense of judgement which tries to take the whole picture into account.

CBA in the context of the CAFE programme

The objective of the CAFE programme is to analyse the combined effects of the various sources of air pollutants on air quality and its consequent effects on health and the environment, before proposing additional measures to alleviate these consequences. CBA is an important part of the CAFE programme. However, all the issues discussed above have also to be dealt with in this context.

The actions required to put air quality improvement measures in place will be clearly identified e.g. reduction of emission limits for stationary or mobile sources, more stringent fuel specifications etc. They will translate into new physical installations, plants, systems. It will therefore be possible to estimate the costs, expressed, e.g. in terms of capital expenditure, operating costs, etc. with a reasonable degree of certainty.

Estimating the benefits is much more challenging. The first challenge is to estimate the magnitude of the effects. The level of emissions will depend on many factors such as the economic activity, the performance of emission control systems, consumer choices, etc. Translation of emissions into air quality parameters requires complex modelling at the EU level, which itself carries a large degree of uncertainty. The relationship between levels of pollutants and actual health or environmental effects is notoriously difficult to establish with any degree of certainty. The required epidemiological studies are lengthy and fraught with methodological difficulties when attempting to isolate the effect of one particular factor from a myriad of others.

The second challenge is to assign a monetary value to the estimated health effects. The willingness-to-pay methodology has been proposed in the context of CAFE, bringing with it all the complex issues described in the previous sections.

In such a process preconceived ideas and value judgements will inevitably play an important role, although not explicitly. Rigorous analysis and full transparency of the process are essential if an unbiased result is to be reached.

In any case, it is clear that the uncertainty attached to the benefits will always be much higher than that attached to the costs. It is crucial that the impact of such uncertainty be evaluated. The use of appropriate sensitivity scenarios is essential. The same methods as those used to address the uncertainties in the Commission's Integrated Assessment Modelling approach (IAM) within CAFE could perhaps also be applied to the CAFE CBA.

Another temptation is to use the exercise to include other aspects such as visibility, damage to buildings, etc. which are not directly relevant to the CAFE project, i.e. the impact of emissions on air quality and related health effects. The CAFE scope and methodology are already extremely complex and the effort should not be diluted by including these other aspects.

Conclusions

While CBA is a conceptually attractive methodology, it is difficult to apply in practice. The costs of compliance with measures can generally be estimated with a reasonable degree of confidence and accuracy. Benefits, on the other hand, are often difficult to identify or to relate to the proposed measure with any level of certainty, and are frequently intangible. The CBA methodology therefore quickly finds its limits when it comes to attributing a monetary value to such benefits. In the context of CAFE the impact of air quality on human health and the real societal benefits associated with the reduction of certain air pollutants is a case in point. Taken out of context, CBA results can create a false sense of clarity and precision. Making balanced decisions about air quality measures with the overall aim of minimising risk for society as a whole calls for sound judgement and good communication between all parties involved.

The cost-effectiveness of NO_x abatement in European refineries

Checking the consistency of data

In 2001, the UN-ECE set up the 'Expert Group on Techno-Economic Issues' (EGTEI) tasked with providing a comprehensive review of the European cost and effectiveness database for the abatement of emissions to air (SO_2, NO_x, VOCs and Particulate Matter). The main goal of this work was to provide updated information for the Integrated Assessment Models (primarily the IIASA RAINS model) used in the development of Protocols under the UN-ECE Convention on Long-Range Transport of Air Pollutants (CLRAP). These same Integrated Assessment Models, together with the underlying databases, are also central to the European Commission's Clean Air For Europe (CAFE) programme.

Various industry sectors, including the oil industry represented by CONCAWE, have contributed to the work of EGTEI by providing data for the review and updating process. This article outlines the input that CONCAWE has provided on NO_x abatement measures and how the figures compare with the current representation of such abatement measures within the RAINS model.

Overall approach

The approach that CONCAWE took in developing its input was largely driven by the recognition that the development of robust data on cost-effectiveness (e.g. €/tonne NO_x removed) required not only reliable data on cost but also representative data on 'effectiveness'. The latter called for detailed information on the type and characteristics of combustion equipment encountered in European refineries as well as an understanding of the unabated levels of NO_x emissions from such units. This in turn required information on the fuels and levels of combustion air preheat used in these systems.

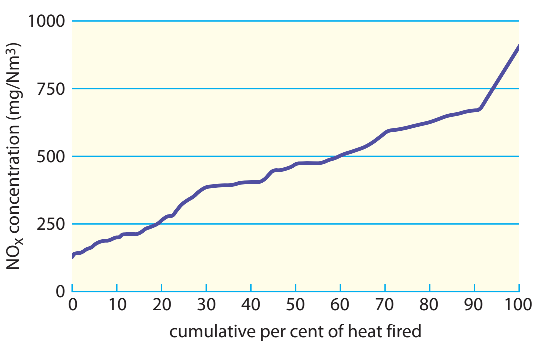
Data from a comprehensive survey of nine European refineries provided the necessary input into this effectiveness assessment. This survey contained detailed data on more than one hundred individual combustion units varying in size from a few MW to more than 100 MW. Detailed physical and operational data for each unit included: the unit size and the type of burner installed; the quantity and characteristics of each fuel burned (e.g. for liquid fuels, the bound nitrogen content); the level of combustion air preheat; and the actual vs. design throughput.

These data allowed the unabated NO_x emission levels from each of these units to be determined. The detailed methodology was subsequently incorporated into the soon-to-be-published CONCAWE EPER toolkit for European Refineries[1]. The resulting distribution of unabated NO_x concentration across the units in the survey is given as Figure 1 below.

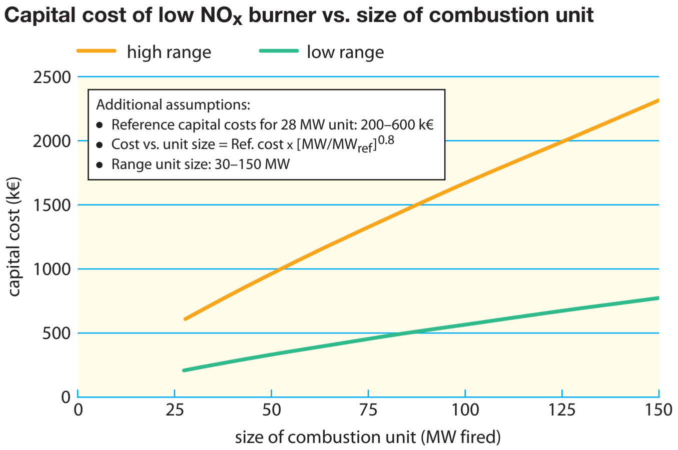
This figure clearly illustrates the importance of understanding the range of abatement potential amongst the various combustion units found in European refineries. Here the unabated concentration of NO_x varies from

Figure 1
Variation in uncontrolled NO_x concentration in surveyed refineries (as a function of overall heat fired)

For a given percent reduction potential, the actual tonnage of NO_x removed could vary by up to a factor of 6 between the lowest and the highest emitter.



1 *'Method estimates NO_x from combustion equipment'* Oil & Gas Journal, *June 21, 2004, pp. 48/52*



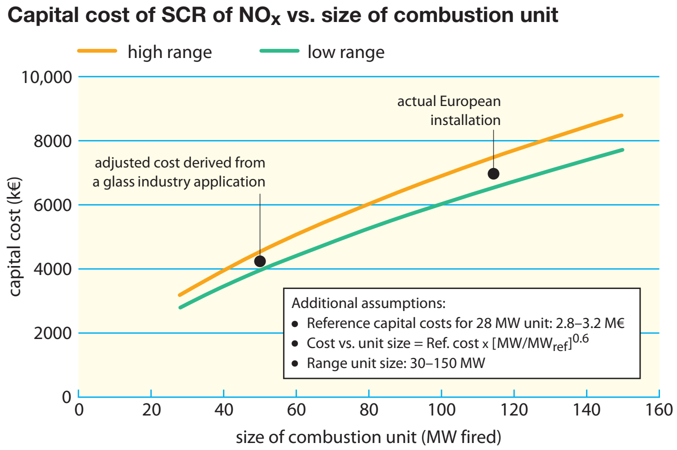


Figure 2 (above left)
The significant cost variation for LNB technology reflects the different levels of sophistication of this technology.

Figure 3 (above right)
For SCR, a narrow range exists between the high and low cost curves.

about 150 to some 900 mg/Nm^3: for a given percent reduction potential, the actual tonnage of NO_x removed could vary by up to a factor of 6 between the lowest and the highest emitter!

Source of cost data

In 1999 CONCAWE published a comprehensive report on available techniques for emissions abatement in European refineries[2] as a contribution to the development of the so-called 'Refinery BAT REF'[3] document required under the IPPC Directive. This CONCAWE report covered many aspects of available abatement technology, including cost data for NO_x abatement technology.

In developing input to EGTEI on the cost of NO_x abatement measures, the costs were applied to the range of unit sizes in the survey discussed above. Figures 2 and 3 show the resulting distribution of costs by unit size for the application of Low NO_x Burners (LNB) and of Selective Catalytic Reduction (SCR)[4] respectively. The 'high' and 'low' curves represent the extremes of the range of costs provided in CONCAWE's report no. 99/02. The additional assumptions used for the development of the cost vs. unit size curves are shown on the figures.

Costs of LNB technology

Figure 2 shows a significant variation in cost for LNB technology between the high and low curve reflecting the variation in the level of sophistication of this technology; from simple staged air or staged fuel systems[5] to flue gas recirculation technology.

Costs of SCR technology

Figure 3 shows a narrow range between the high and low cost curves for SCR. These curves are essentially derived from US-based data since, at the time of publishing CONCAWE report 99/02, there were no SCR systems installed on combustion units in European refineries. Since that time, a unit has been installed on a large oil-fired process furnace in a refinery in The Netherlands. The installed cost of this SRC unit is also shown on Figure 3 and is within the range of the cost curves generated from the CONCAWE data.

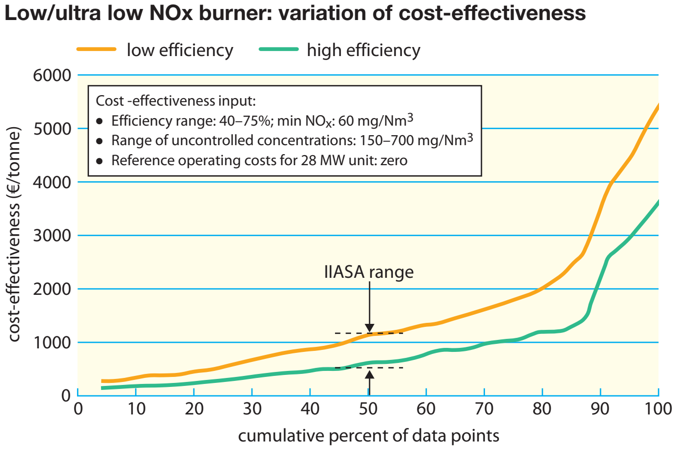
Costs of SCR versus other industries

Valid comparisons with cost data from other industrial sectors can only be made if detailed information is available to ensure appropriate adjustments to account for the differing situations (physical layout, fuels fired, unabated NO_x concentration and temperature, to name

2 *CONCAWE report 99/02 'Best Available Techniques to Reduce Emissions From Refineries'*
3 *IPPC Reference Document on Best Available Techniques for Mineral Oil and Gas Refineries, February 2003*
4 *Similar data was also generated for Selective Non-Catalytic NO_x Reduction (SNCR) for EGTEI but, given the limited applicability in refineries, this is not discussed further in this article.*
5 *Step-wise injection of air or fuel to avoid high flame temperatures*

The cost-effectiveness of NO_x abatement in European refineries

Checking the consistency of data



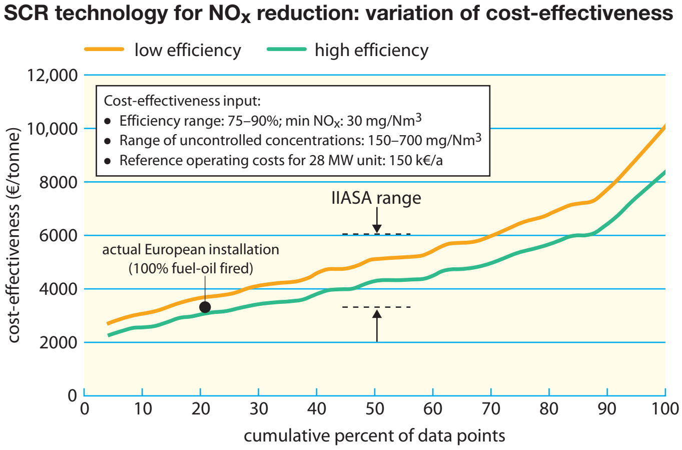


Figure 4 (above left)
The cost per tonne of NO_x abated varies significantly, depending on the particular situation, i.e. by a factor of approximately 8 for LNB.

Figure 5 (above right)
For SCR the variation in cost-effectiveness also varies notably, i.e. by a factor of approximately 4.

just a few). Simply using the firing rate as a surrogate for the size of an SCR may be reasonable for a single sector, but can be misleading when comparing different sectors. This can be demonstrated by comparing SCR costs derived from an actual application in the glass industry in France with the refinery installation in The Netherlands mentioned above. The two are very different, since glass furnaces produce much higher NO_x concentrations and the SCR operates at a higher temperature. Given the need to avoid contamination of the glass, the furnaces are gas fired. As a result the catalyst volume required per unit NO_x removed is significantly lower, which in turn makes the required SCR unit much smaller.

In this particular example, the catalyst volume is six times lower in the glass furnace than in the refinery furnace whereas the ratio of firing rates is only 2.3 (115 vs. 50 MW). Adjusting the cost of this glass furnace installation to account for the difference in SCR size at a given firing rate results in a cost that fits well within the range of the CONCAWE cost curves for refinery applications (Figure 3).

Cost-effectiveness and comparison with IIASA RAINS model

Figures 4 and 5 show the cost-effectiveness curves for LNB and SCR using the cost and effectiveness data discussed above. Again, the additional assumptions used to generate these curves are shown on the figures.

Both curves clearly indicate that the cost per tonne abated varies significantly depending on the particular situation: by a factor of approximately 8 for LNB and 4 for SCR. The variability in the unabated concentration (see Figure 1) plays a major role. This highlights the need to examine the cost-effectiveness of any given application on a site-by-site basis.

The purpose of the RAINS model, IIASA's Integrated Assessment Model, is to ensure a robust means of determining national burden sharing for a cost-effective delivery of the environmental targets for the EU. This requires the 'typical' situation to be well represented in the model. As indicated on Figures 4 and 5, the range of cost-effectiveness figures derived from IIASA's 'country cost curves' for NO_x abatement shows in both cases very good agreement with the median point of the CONCAWE cost curves.

IIASA's RAINS model is a key tool in providing input to the policy development process of the Commission's Clean Air For Europe (CAFE) programme. Stakeholder confidence in the underlying data used in RAINS is therefore vital. The close correspondence between RAINS and data developed independently in the EGTEI process provides concrete evidence of the quality of the information.

Monitoring and reporting of CO_2 emissions from oil refineries

Guidance for member companies

The 'Greenhouse gas emissions trading Directive' (2003/87/EC), due to take effect in 2005, will require oil refineries to obtain permits for emitting CO_2 and, more generally, greenhouse gases (GHG).

The scheme will be based on allocated or purchased emission permits that will need to match actual emissions. It will therefore rely on an accounting system for GHG emissions which must be based on a sound methodology for measuring actual emissions from industrial sites. Accordingly, in January 2004 the EU Commission issued a set of Guidelines for Member States and local authorities concerning monitoring and reporting of GHG emissions in installations covered by the emissions trading Directive[1]. The Guidelines contain a number of general provisions as well as a specific section for each of the trading sectors, oil refining being one of them.

Monitoring and measurement are potentially expensive activities; costs increase sharply as the required frequency, accuracy and number of measurement points increase. It is therefore essential that the objectives of the measurements be clearly defined to avoid unnecessary expense and, in this case, bureaucracy.

Although the oil industry was given the opportunity to comment on the draft Guidelines, not all its recommendations were taken on board. There remain serious concerns, particularly regarding the level of uncertainty that would be acceptable and the way this would be evaluated. The level of uncertainty proposed by the Guidelines is seen to be incompatible with general refinery practice and would either be unachievable or would lead to significant extra costs for little benefit. Not all implications of the specific circumstances of oil refineries were fully recognised in the Guidelines.

[1] *Commission decision of 29 January 2004 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council*

In addition, there are areas of the Guidelines which may lead to different interpretations by different authorities.

In order to assist CONCAWE member companies/ refineries in their discussions with Member States and their competent authorities, CONCAWE has prepared a short report (CONCAWE report 10/04), discussing realistic uncertainty expectations and the methodologies that are most appropriate to their particular circumstances. The main points dealt with in the report are summarised in this article.

What to measure?

In oil refineries, CO_2 is by far the dominant greenhouse gas. Emissions of other GHGs are site-dependent and the most appropriate estimation methodologies for these need to be defined locally. One of the features specific to oil refineries is the multiplicity of their CO_2 emission sources: most process plants have one or several furnaces plus utility plants (e.g. steam boilers) and flares. Chemical CO_2 from hydrogen manufacture must also be accounted for. The contribution of the various sources to the total emissions varies greatly, some sources such as flares accounting only for a few percent of the total. Clearly, the greater the CO_2 contribution of a particular source, the more effort should be devoted to measuring it. Another issue is that refinery streams in general are of variable composition, particularly fuel gas.

Direct measurement of CO_2 emissions (i.e. from the flue gases of combustion installations) is not practical and would be highly inaccurate. Establishing a complete carbon balance over the refinery, although possible in theory, would require accurate knowledge of the carbon content of all feed and product streams. Indirect measurement based on fuel consumption and carbon content is the most straightforward method, and also the one that will result in the least uncertainty. Evaluation of both the quantities (activity data) and the carbon content

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(emission factor) of all fuel sources still relies on a number of measurement devices and laboratory analyses.

How to measure?

Refinery fuel systems are generally complex, with many producers (especially of fuel gas) and many consumers. The material to be used as internal fuel is in some cases gathered at a central point, appropriately mixed and homogenised, and distributed to the consumers. For those cases a central point of measurement should be preferred, as a high quality instrument can be installed maintained and calibrated to a higher standard than multiple meters on each consumer. On fuel gas it can also be coupled with an on-line quality measuring instrument (usually a densimeter, occasionally a chromatograph). This grouping of sources by fuel type, with a single or a small number of central measurement points, is allowed for in the Commission Guidelines.

In order to estimate CO_2 emissions one needs to have access to the mass flow of the fuel as well as to its carbon content (the so-called 'oxidation factor' is of little relevance to refineries because, essentially, the whole of the fuel's carbon is turned into CO_2).

The uncertainty of a flow meter measurement depends on the medium being measured, the measurement method and also the maintenance and operating practices (e.g. calibration frequency). The actual 'in-the-field' precision of a metering device is, as a rule, lower than the figure indicated by the manufacturer. Measurements tend to be more accurate for liquid than for gas flows. Practical values vary from around 0.5% in the best circumstances, to several percent.

The determination of the carbon content of fuels is in many ways a new subject, inasmuch as it was hitherto of no great interest. For light gases it can generally be calculated from compositional data obtained by, e.g., a chromatograph. For liquids correlations based on other common properties, such as density and distillation, data are generally preferred to direct measurement, which lacks accuracy. Whatever the method, it has to be kept in mind that refinery streams are constantly changing in composition and this often has more impact on the overall accuracy than does the quality of the measurement method.

In refineries with a catalytic cracker (the vast majority in Europe) the coke, which is burned off the catalyst in the regenerator, acts as fuel for the process and is a significant contributor to the total emissions. The best method by far to estimate these emissions is to carry out a stoichiometric balance over the regenerator. Calculating the overall heat and material balance over the whole cracker, as suggested by the Guidelines, is impractical and would be very inaccurate.

Local versus global uncertainty

The Guidelines establish so-called 'tiers' or classes of measurement precision that should be applied to all sources within a site. The objective of the measurements, however, remains to estimate, with an acceptable level of accuracy and precision, the total emissions from a site.

In a typical refinery with 10 to 15 emission sources, only a small number of these account for the bulk of the emissions. A simple statistical analysis shows that, due to the combination of variances, the overall level of uncertainty is driven by that of the main sources and is usually significantly less than the uncertainty of each of the individual measurements, particularly with regard to the minor sources. In other words, while the Guideline's tier requirements may not be achieved for all sources, the uncertainty on the total emissions is within the allowable limits. Bringing the minor sources within the tier requirement would have an insignificant impact on the overall accuracy. In such a case, the installation of complex and expensive measuring devices on minor sources would be grossly cost-ineffective.

The Commission Guidelines require an analysis of the overall uncertainty for estimating CO_2 emissions from a refining site. The above approach can be used to identify the most important sources and to arrive, together with the permitting Authorities, at the most cost-effective solution to achieve the overall uncertainty objective.

Chemicals control legislation

What are the implications of the REACH proposal for the downstream oil industry?

The future of chemicals control in the EU (under which petroleum substances are regulated) has been under discussion for several years. Following the EU Commission's White Paper on a Strategy for a Future Chemicals Policy (February 2001), the Commission issued its formal legislative proposal for a Regulation on REACH (Registration, Evaluation and Authorisation of Chemicals) on 29 October 2003. REACH is intended to provide a new framework for the control of chemicals in the EU, replacing the Existing Substances Regulation, the Dangerous Substances Directive, the Dangerous Preparations Directive and the Limitations on Marketing and Use Directive. REACH will introduce a fundamental paradigm shift in the traditional roles that authorities and industry have assumed. In contrast to the existing EU chemicals regime in which responsibility lies with the authorities to demonstrate that a chemical poses a risk to human health or the environment, under REACH responsibility will be shifted from the authorities to industry to demonstrate that a chemical can be handled safely without endangering human health or the environment.

The aim of this article is to summarise the legislative status and key elements of the Commission's proposal, activities CONCAWE has undertaken on behalf of its members to prepare for REACH, and suggestions for how member companies can begin to prepare to meet their obligations under REACH.

Legislative status

The Commission's legislative proposal for a regulation on REACH is now with the EU Parliament and the EU Council. In the Parliament the Environment Committee will have the lead role, and in the Council the Competitiveness Council will assume the lead. An ad-hoc Council working group with representatives from both the Competitiveness and Environment Councils was formed in spring 2004 to assist the Competitiveness Council. Although discussions are under way, the Council has indicated that it is unlikely a common position will be agreed before the second half of 2005. The EU Parliament is expected to begin its first reading of the proposed Regulation during autumn 2004.

To assist industry and regulatory authorities in meeting their responsibilities under REACH, the Commission launched an Interim Strategy in February 2004 to develop guidance documents on the practical implementation of REACH. The Interim Strategy will run until Q1 2006. Based on the Commission's current timeline, REACH would come into force Q2 2006. However, based on the status of discussions in the Council and Parliament, it is unlikely that this deadline will be met.

At this point in time, neither the precise details of the REACH regulatory text that will emerge from the legislative process, nor the date at which it will come into force are known. Consequently, it is not currently possible to understand fully the impact that REACH will have on CONCAWE member companies. Although the detailed requirements may change, there are nevertheless three fundamental building blocks for REACH which are likely to remain and which will provide the overall framework for the future control of chemicals in the EU. These are *Registration*, *Evaluation* and *Authorisation*.

It is important to realise that REACH will impact not only upon manufacturers and importers of chemical substances (i.e. imports from outside the EU), but also on downstream suppliers and users, as well as producers and importers of preparations and articles. Member companies are likely to find themselves in more than one of these categories and will need to be aware of their obligations under REACH. It is also important to recognise that, once adopted, this Regulation will apply to the EU-25 and be implemented on one date rather than needing to be adopted into National legislation.

Chemicals control legislation

What are the implications of the REACH proposal for the downstream oil industry?

What will CONCAWE do on behalf of its member companies to meet the requirements under REACH?

There will be an obligation under REACH for manufacturers and importers to submit a registration dossier for all substances manufactured in the EU and/or imported in quantities above 1 tonne per annum (t/a). Based on the current Commission proposal, registration deadlines for existing substances will depend on the annual production/import quantity. For example, substances produced in amounts greater than 1000 t/a will need to be registered 3 years after REACH comes into force, whereas the deadline will be 11 years for substances produced in amounts of between 1 and 100 t/a.

The registration dossier will include a Chemical Safety Report (CSR) (based on a risk assessment), technical dossier, summaries of health and environmental studies, an enhanced Safety Data Sheet (SDS) and recommendations for classification.

To assist member companies in preparing for the submission of a Chemical Safety Report under REACH, it has been agreed that CONCAWE will undertake risk assessments on all existing petroleum substances represented by the following 13 groups:

- aromatic extracts
- base oils
- bitumen
- crude oil
- gas oils
- gasoline
- heavy fuel oils
- kerosenes
- petroleum coke
- petroleum gases
- sulphur
- waxes
- white mineral oils

As a first step, CONCAWE has developed a methodology for conducting the risk assessment of gasoline. This same methodology is being applied to the risk assessments on gas oils, kerosenes and petroleum gases which are all currently under way. For higher boiling point petroleum substances (i.e. base oils, heavy fuel oils, etc.) detailed compositional information cannot be obtained. An alternative generic environmental risk assessment methodology is therefore being developed and will be available in 2005.

Once the Commission has issued the technical guidance document for Chemical Safety Reports (CSRs), CONCAWE will convert the risk assessments into the specified CSR format. It is also proposed that CONCAWE will compile the non-confidential elements of the registration dossiers on behalf of its members.

What will individual companies need to do?

Submission of a registration dossier under REACH will be a legal obligation on the manufacturer and/or a lead company representing a consortium of manufacturers/importers. Under the Commission's proposal, it will not be possible for CONCAWE, as an association, to submit Registrations.

It is also important to note that the risk assessments undertaken by CONCAWE would cover only those uses which have been identified or agreed within CONCAWE. For unique uses not covered, member companies will need to supplement the risk assessment.

CONCAWE will not prepare risk assessments or Chemical Safety Reports for chemicals that are purchased and used on site (e.g. catalysts, water treatment chemicals, laboratory chemicals, etc.) or additives used to formulate finished products (e.g. fuels and lubricants). Where member companies are either importers or manufacturers of these chemicals, they will be responsible for the preparation and submission of the appropriate registration dossiers. Where member companies are users of chemicals, they should confirm with their suppliers that the chemicals will be registered for the intended use.

Companies should develop an inventory (including the CAS No[1] and annual volumes) of all chemicals they either manufacture or import, to determine whether and when a registration dossier would need to be

[1] *CAS Registry Numbers (often referred to as CAS RNs or CAS Numbers) are unique identifiers for chemical substances*

Activities companies could already undertake in preparation for REACH

Produce an inventory of chemical substances

- Establish annual volumes produced or imported into the EU (including substances in preparations) that will be subject to REACH
- Identify the CAS numbers of these substances
- Establish a list of customers and their uses
- Establish what information already exists:
  - (i) hazard property information (i.e. any available studies according to Annexes V through VIII of REACH or other types of hazard information such as human data or QSARs)
  - (ii) exposure information across the supply chain (i.e. exposures in the member companies workforce, customers' workplaces and by the consumer).

Table 1
It is by no means too soon for companies to start making preparations for REACH.

submitted. It should be recognised that import of a formulated product/preparation may require the importer to register ***all*** the chemicals present in the mixture. Companies should also begin to identify all downstream uses of the products they supply.

Though this is not included in the Commission's current legislative proposal, the Commission is giving consideration to the adoption of the United Nations Globally Harmonised System (GHS) for classification and labelling at the same time that REACH comes into force. This will introduce further work, as current classification and labelling advice will need to be updated to meet the revised criteria. In any event, once REACH comes into force, member companies will need to update their SDSs and labels based on the CSRs for substances they produce and/or import. Additionally, SDSs/labels for preparations marketed in the EU will need to be updated.

Evaluation of selected registration dossiers will be the responsibility of either a Member State or the Central Agency foreseen in the proposal. Companies submitting registration dossiers should be aware that submission is not necessarily the end of the road and that further information may be requested by the evaluating authority.

Certain substances meeting the criteria for classification for carcinogenicity, mutagenicity or reprotoxicity (CMR) or meeting the criteria for persistence, bioaccumulation and toxicity (e.g. PBT or vPvB) will fall under the scope of Authorisation and could be subject to a restriction or a ban under REACH. Member companies should identify these 'at risk' substances, particularly those used in business-critical applications or requiring lengthy product approvals, and seek assurance from their suppliers that they will take the necessary steps to obtain authorisation for the chemicals concerned. For substances covered by the 13 groups of petroleum substances, it is proposed that CONCAWE could prepare the relevant authorisation dossiers.

Though the precise details of what will need to be done are still unclear, it is likely that the future of EU chemicals control will bring with it many challenges and much work for the downstream oil industry. CONCAWE will do its part to assist member companies to meet their obligations under REACH, but it can't do it all. Individual companies will need to do their part. It's not too soon to begin preparing (Table 1).

Understanding gasoline volatility and ethanol effects

Joint programmes on driveability and evaporative emissions

Although well researched in the past, there has been little recent work on fuel effects on driveability performance or evaporative emissions from European gasoline vehicles. Recently, the Biofuels Directive has stimulated interest in blending ethanol into gasoline, with consequent questions on the effects on gasoline volatility, driveability and evaporative emissions.

In France, the GFC (Groupement Français de Coordination) has developed new test procedures for both hot and cold weather driveability, but had not previously used them for detailed fuel effect studies. CONCAWE therefore undertook a joint programme with the GFC to evaluate the impact of gasoline volatility and ethanol content on the driveability performance of modern European vehicles using these procedures.

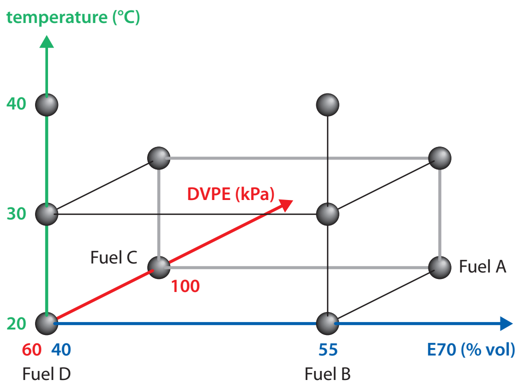
Eight vehicles, three with DISI fuel systems and five with MPI systems, were tested for driveability. Hot tests were carried out at 20, 30 and 40 °C, and cold tests at +5 and −10 °C. A matrix of four hydrocarbon test fuels at two levels of vapour pressure (DVPE) and E70 was blended for the hot weather testing, and three fuels with varying E100 but essentially parallel distillation curves for the cold weather tests. For each hydrocarbon fuel, two other fuels containing 10% ethanol were made, one 'splash' blend and one with matched volatility. Some tests were also carried out using 5% ethanol blends.

A recent CONCAWE report (3/04) has reported the hot and cold weather driveability results in detail. This article provides an overview of the main findings on driveability and briefly describes a further programme now under way to investigate evaporative emissions.

Hot weather testing

Eight cars were tested for hot driveability based on the test matrix shown in Figure 1. The GFC hot weather test procedure requires a trained driver to follow a specific set of driving sequences, comprising a motorway hot-soak test, a mountain climbing test and a 'canister loading' test designed to simulate stop and go driving in heavy traffic. Driveability malfunctions (stall, hesitation, loss of acceleration, stumble, surge, roughness) are recorded by the driver and given demerit ratings using pre-defined scales, described in the report.

Figure 1
Hot driveability test fuel/temperature matrix



An alternative rating approach was also used which considers each fault type separately and assigns it a colour-coded 'severity category', in addition to a demerit level, i.e.:

- None
- Trace
- Moderate
- Customer Unacceptable
- Safety Unacceptable

The total demerits and severity ratings for each test are given in the report. The main results are summarised below.

Vehicle effects

Three of the MPI vehicles showed good hot weather driveability on all fuels tested, with ≤24 demerits. Another showed <24 demerits in all tests, except for fuel A 10% ethanol splash blend at 30 °C (34 demerits). In view of these low demerit levels, three vehicles were also tested on the highest volatility hydrocarbon fuel (A) at 40 °C. Despite this extreme combination of temperature and volatility, all gave ≤20 demerits, confirming the excellent hot driveability of these modern MPI vehicles. Generally the highest demerits were seen on fuel A at 30 or 40 °C, showing a slight sensitivity to volatility.

Vehicle 4 had an MPI fuel system but no throttle; instead it relied on varying inlet valve lift to control engine power. This vehicle showed low demerits (<12) under all test conditions except for the highest volatility fuels at 30 °C, when demerit levels of 16–95 were seen.

One of the DISI vehicles showed good hot driveability performance in all test conditions, similar to the four MPI vehicles. The other two DISI vehicles showed much poorer driveability, with many tests giving 100–500 demerits. DISI vehicle 2 showed high demerits on high volatility fuels, with highest demerits of 471 in a test on fuel A at 30 °C. Vehicle 3 also gave high demerits (270–314) on high DVPE fuels A and C at 30 °C and on fuel B 10% ethanol splash blend at 40 °C. These high demerits were accompanied by an engine warning message that fuel pressure was out of range; indicating that classical vapour lock was taking place somewhere in the fuel system. For both of these vehicles, tests on D-series fuels gave low demerits (≤17) at all temperatures.

Volatility effects

For the five vehicles with low overall demerits, no analysis of volatility effects was possible. The other 3 vehicles showed clear effects of increasing volatility. For example, Figure 2 shows tests on vehicles 2 and 3 at 30 °C, plotted against volatility as 'bubbles', with the area of the bubble proportional to the number of demerits, and its colour indicating the severity rating. For vehicle 2, increasing DVPE at 30 °C (and E70 at 40 °C, not shown) gave a clear increase in demerits, while vehicle 3 at 30 °C only showed an increase on the most volatile fuel A.

Statistical modelling indicated that three critical vehicles, which showed substantial driveability problems and effects of variation with volatility, were more sensitive to fuel DVPE than to E70. The effect of DVPE over the range 60–100 kPa was more than double that of E70 over the range 40–55%v/v.

In all cases substantial increases in demerits were only seen at high temperatures on fuels with volatility beyond the summer limits of EN228.

Ethanol effects

As described earlier, several vehicles showed very low demerits on all fuels. Four vehicles generated enough demerits to perform a meaningful analysis of ethanol effects. Two examples of the effects of ethanol in the responsive vehicles are shown in Figure 3; generally the effects are only evident with high volatility fuels and at high temperatures. In these cases, ethanol splash blends increased demerits and in some cases overall severity rating. Matched volatility blends gave similar driveability to the equivalent hydrocarbon fuels. This suggests that the effects seen are not due to the presence of ethanol *per se* but are a consequence of the increase in volatility that is caused by the addition of ethanol.

Effect of DVPE and E70 of HC fuels on hot driveability of vehicles 2 and 3 (bubble area represents total demerits)

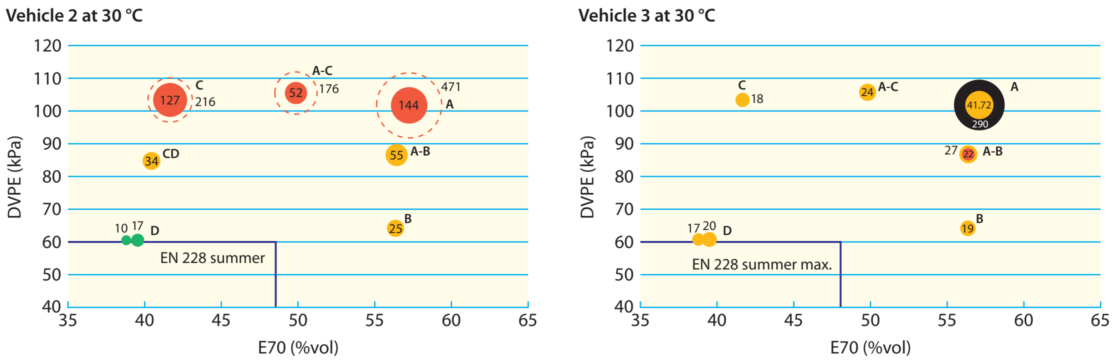


Figure 2
At 30 °C, increasing DVPE gave a clear increase in demerits for vehicle 2, while vehicle 3 only showed an increase on the most volatile fuel A.
Substantial increases in demerits were only seen at high temperatures on fuels with volatility beyond the summer limits of EN228.

Understanding gasoline volatility and ethanol effects

Joint programmes on driveability and evaporative emissions

Effect of ethanol on vehicles 3 and 4

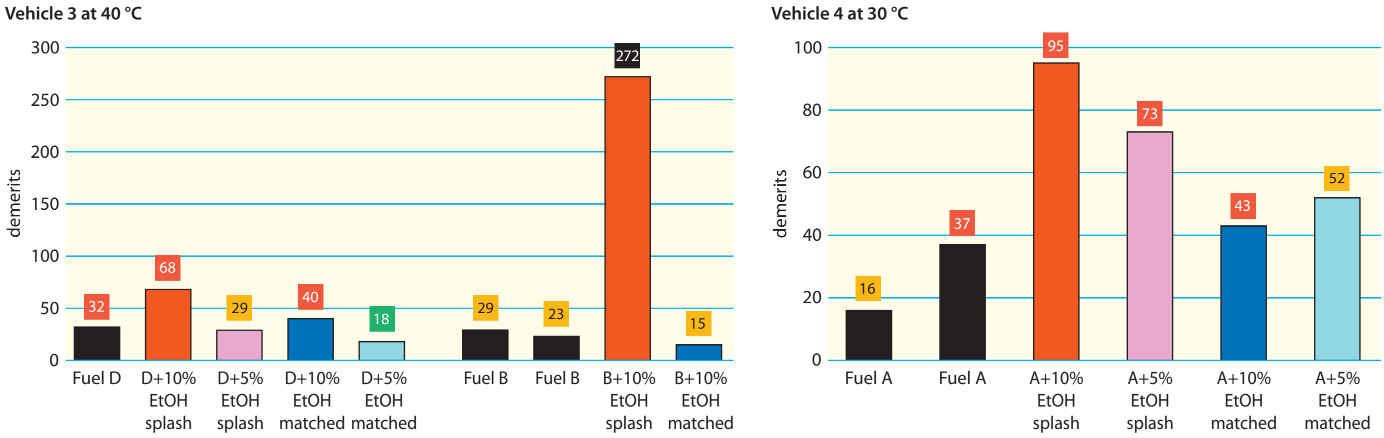


Figure 3

In general, the effects of ethanol on hot driveability are only evident with high volatility fuels and at high temperatures. The effects observed are likely to be a consequence of the increase in volatility caused by the addition of ethanol, rather than the presence of ethanol per se.

Cold weather testing

Tests were carried out at +5 °C and –10 °C, as representative of moderate European winter conditions. The same basic principles were followed as for hot weather testing, i.e. a trained driver followed a set drive cycle and reported driveability malfunctions which were converted to a demerit rating and an overall severity rating. The GFC drive cycle consists of five phases, carried out immediately after engine start and repeated six times. The detailed test cycle and definitions of demerit ratings can be found in the CONCAWE report.

Three hydrocarbon fuels were tested with approximately parallel distillation curves as high (A), medium (G) and low (E) volatility fuels. Two matching fuel matrices with 10% ethanol splash blended and with matched volatility were tested, and 5% ethanol fuels were tested in some cases. Only 4 cars (2 MPI, 2 DISI) were tested in depth at both temperatures on the full range of fuels. One other car (4) was tested only on the hydrocarbon fuels and the other 3 cars were only tested on fuels G and E at –10 °C.

Volatility effects

The majority of vehicles showed some increase in total demerits with reducing fuel volatility, most pronounced at –10 °C. In some vehicles the effect of fuel volatility was small, whereas other vehicles showed a clear increase in the level of demerits on the lowest volatility fuels at –10 °C. An example of this effect (vehicle 7) is given in Figure 4. Further work would be needed to accurately determine a critical E100 level below which the demerits begin to increase, however, from these results, this is estimated to be around 50% v/v.

Ethanol effects

Splash blending ethanol into a fuel increases its mid-range volatility (E70 and E100). However the higher latent heat of ethanol means that it may not vaporise as well in a cold engine where the availability of heat is limited. Matched volatility blends must have other light components removed, so might be expected to perform less well than hydrocarbon fuels.

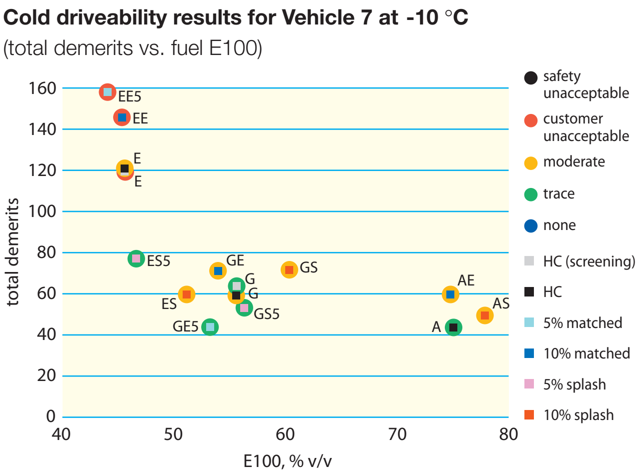
There was substantial variability in the data, and ethanol effects were not consistent across the whole data-set. However, on the lowest volatility fuel, splash blending ethanol generally improved driveability at –10 °C (though not at +5 °C). The matched volatility ethanol blends behaved similarly to the HC fuels (see example in Figure 5). It is likely that the effects seen are a consequence of the increase in volatility caused by the addition of ethanol rather than the presence of ethanol *per se*.

Conclusions

The new GFC test procedures appear to be more discriminating than the former CEC procedures for identifying fuel, vehicle and temperature effects on hot and cold weather driveability of modern vehicles.

Understanding gasoline volatility and ethanol effects

Joint programmes on driveability and evaporative emissions



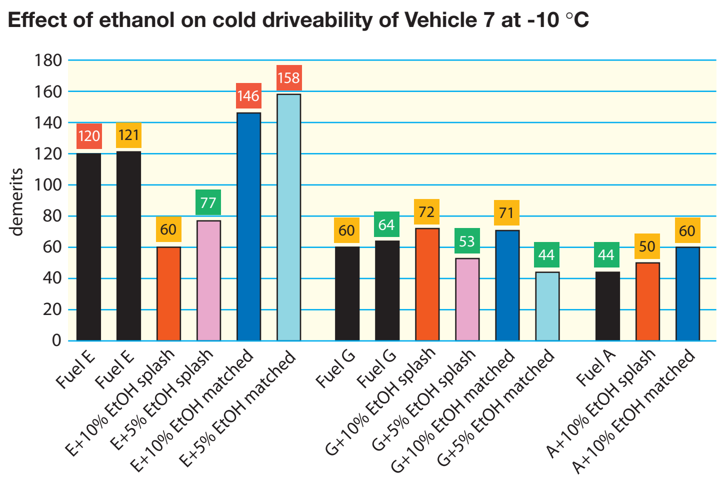


Figure 4 (above left)
Some vehicles showed a clear increase in the level of demerits on the lowest volatility fuels at –10 °C.

Figure 5 (above right)
Ethanol splash blends improved cold driveability on the lowest volatility fuels at –10 °C. It is likely that the effects observed are a consequence of the increase in volatility caused by the addition of ethanol rather than the presence of ethanol per se.

Hot driveability

Vehicles varied widely in their sensitivity to fuel changes. Four of the eight vehicles tested (three MPI and one DISI) exhibited good performance under all fuel/temperature conditions tested. Two MPI vehicles showed some demerits on high volatility fuels, one of them having substantial demerits. Two DISI vehicles showed poor driveability performance with very high demerits on high DVPE fuels at 30 °C, and on some less volatile fuels at 40 °C.

In general, ethanol splash blends without volatility matching increased demerits and, in some cases, overall severity rating. Matched volatility ethanol blends gave similar driveability to the equivalent hydrocarbon fuels. This suggests that the effects seen are due to the increase in volatility from the addition of ethanol rather than the presence of ethanol *per se*.

In all cases substantial increases in demerits were only seen at high temperatures on fuels with volatility beyond the summer limits of EN228.

Cold driveability

Most vehicles showed sensitivity to fuel volatility with higher demerits on less volatile fuels. Several vehicles showed a sharp increase in demerits on the least volatile fuels (E100<~50%v/v) at –10 °C, but not at +5 °C.

One DISI vehicle gave very high demerits on all fuels at both temperatures but showed no sensitivity to fuel volatility, ethanol content or temperature. The other two DISI vehicles gave demerits in the same range as most of the MPI vehicles.

The effects of ethanol were inconsistent, except on the lowest volatility fuel, where splash blending ethanol generally improved driveability at –10 °C (though not at +5 °C). The matched volatility ethanol blends gave similar driveability to the equivalent hydrocarbon fuels, suggesting that the effects seen are due to the increase in volatility caused by the addition of ethanol rather than the presence of ethanol *per se*.

Further work on evaporative emissions

The impact of ethanol and vapour pressure on evaporative emissions is another important aspect where new data is needed. A further project has recently been initiated jointly with EUCAR and JRC Ispra to study this issue. The objectives of this work are:

- to assess the effects of ethanol and vapour pressure on evaporative emissions from a range of latest generation gasoline cars; and
- to provide a technical basis for debates on gasoline vapour pressure limits in relation to ethanol blending for the Fuels Directive Review.

It is planned to test eight vehicles which will be provided by the ACEA. CONCAWE has supplied fuels with two volatility levels (DVPE = 60 and 70kPa) and two levels of ethanol content (5 and 10%), as both splash blends and matched blends. The tests will be carried out in JRC Ispra's test facilities.

Emissions regulations and fuel specifications

Maintaining awareness of worldwide developments

For many years, CONCAWE has produced a regular update to their report on 'motor vehicle emission regulations and fuel specifications'. Over the years, this has become a key compilation and ready reference manual for many readers. A comprehensive update to Part 1 of this report, covering the period to the end of 2003, has recently been published (CONCAWE report no. 9/04).

The report details the development of worldwide legislation and regulations governing motor vehicle emissions, fuel specifications and fuel consumption. It describes legislation on emissions limits and emissions testing, vehicle inspection and maintenance programmes, and legislation aimed at controlling in-service emissions performance, fuel consumption and carbon dioxide emissions. Automotive fuel specifications, including reference or certification fuels, are also documented.

Due to the increasing number and complexity of developments in motor vehicle emission regulations and fuel specifications, the two-part report format introduced in 1997 has been continued.

- Part 1 provides the latest summary and update on current and enacted future automotive emissions legislation and fuel quality regulations. The latest update includes details from 2000–03 and has been re-shaped into geographic format for easier reading. It replaces the previous Part 1 (CONCAWE report no. 3/02). For further details and historical information, the reader is directed to Part 2.
- The first edition of Part 2 was published as CONCAWE Report No 6/97 and covered the years 1970–96. The second edition of Part 2 (CONCAWE report no. 2/01) covered the period 1996–2000. The complete history of the development of automotive emissions regulations and fuel specifications is thus covered by the new Part 1 and the two editions of Part 2.

CONCAWE, as a European organisation, has focused on providing detailed information for Europe. Much attention has also been paid to the United States and Japan because their legislation also influences worldwide trends. Every effort has been made to document information from other countries, however the data obtained are not as detailed as for Europe and input from readers of this report is always welcomed. Readers with information which they feel could usefully be incorporated into the next revision of this report are encouraged to contact CONCAWE's Secretariat.

This report can be purchased via the CONCAWE website at a cost of €150 per copy (€200 for parts 1 & 2 together).

Downstream oil industry safety statistics

2003 report

The collection and analysis of accident data is an essential element of a modern safety management system, and its importance is recognised throughout the oil industry.

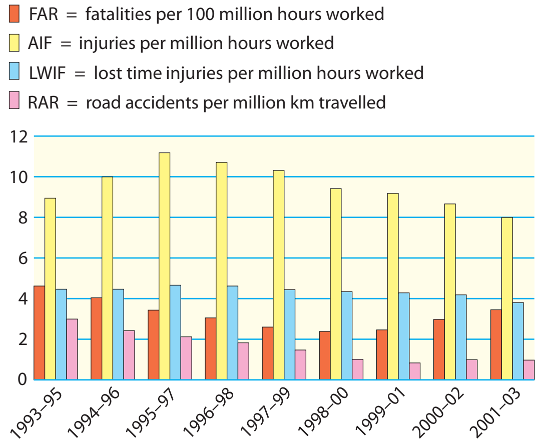
CONCAWE has been compiling statistical data for the European downstream oil industry for 11 years. The purpose of this activity is twofold:

- To provide member companies with a benchmark against which to compare their performance, so that they can determine the efficacy of their management systems, identify shortcomings and take corrective action.
- To demonstrate that the responsible management of safety in the downstream oil industry results in a low level of accidents, despite the hazards intrinsic to its operations.

The report for the year 2003 has recently been completed and will be published shortly (report no. 11/04). Beside the 2003 data, the report also includes a full historical perspective from 1993, as well as comparative figures from other industry sectors. Data for 2003 was submitted by 18 companies, together accounting for more than 80% of the refining capacity of EU-25. The area of coverage is primarily the former EU-15 plus Norway and Switzerland, and also includes Hungary and Slovakia. In addition some companies include in their data their operations in other new EU countries, such as Poland and the Czech Republic and, in some cases, Turkey.

In line with previous reports, the results are reported mainly in the form of key performance indicators that have been adopted by the majority of oil companies operating in Western Europe as well as by other branches of industry. These are: Lost Workday Injury Frequency (LWIF); All Injury Frequency (AIF); Road Accident Rate (RAR); and Fatal Accident Rate (FAR). The statistics include companies' own employees as well as contractors, and are split between 'manufacturing' (i.e. mostly refineries) and 'marketing' (i.e. distribution and retail).

Figure 1
Personal incident statistics relating to the European downstream oil industry



The results of such statistical analysis are mostly of interest in the form of historical trends, assisting the safety management efforts for continuous improvement. Figure 1 shows the evolution of the three-year rolling average for the four indicators over the past decade.

Following disappointing figures in the mid 1990s, the AIF has steadily improved ever since. Part of the early increase may have been due to a gradual improvement in reporting as, in many cases, this indicator has only been in use for a relatively short time. The more established LWIF shows a slow downward trend. It is already at a low level compared to other industries and further major reduction presents a challenge. Road accidents remain a concern and the RAR is now stationary after an initial period of steady decline.

The area of concern is the increasing number of fatalities reflected by the disappointing FAR figures in the past few years. Twenty-two fatalities were reported in 2003. Eight of those were due to road accidents, which remain the single main cause of death at work. There were, however, 14 fatalities due to activities directly related to our industry including fire and explosions, trips and falls, and workers being hit by equipment or flying debris.

Abbreviations and terms used in this CONCAWE *Review*

ACEA	Association des Constructeurs Européens d'Automobiles/European Automobile Manufacturers Association
AIF	All Injury Frequency
BAT REF	BAT Reference document—full title: 'Reference Document on Best Available Techniques for …' (A series of documents produced by the European Integration Pollution Prevention and Control Bureau (EIPPCB) to assist in the selection of BATs for each activity area listed in Annex 1 of Directive 96/61/EC.)
CAFE	Clean Air For Europe
CAS	Chemical Abstracts Service (The CAS Registry is a database of chemical substance information, each substance in the database being identified by a unique number, the CAS Registry Number.)
CBA	Cost Benefit Analysis
CEC	Co-ordinating European Council (for the development of performance tests for transportation fuels, lubricants and other fluids.)
CLRAP	Convention on Long-Range Transport of Air Pollutants
CMR	Carcinogenicity, mutagenicity or reprotoxicity
CSR	Chemical Safety Report
DISI	Direct Injection Spark Ignition
DVPE	Dry Vapour Pressure Equivalent (to RVP)
E70	%v/v of gasoline evaporated at 70 °C
E100	%v/v of gasoline evaporated at 100 °C
EGTEI	UN-ECE's Expert Group on Techno-Economic Issues
EPER	European Pollutant Emissions Register
EUCAR	European Council for Automotive Research
FAR	Fatal Accident Rate
GFC	Groupement Français de Coordination (French Co-ordinating Association for the development of performance tests for transportation fuels, lubricants and other fluids.)
GHG	Greenhouse gas
GHS	(United Nations) Globally Harmonised System (for classification and labelling)
IAM	Integrated Assessment Model
IIASA	International Institute for Applied Systems Analysis
IPPC	Integrated Pollution Prevention and Control (EU Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control)
JRC	European Commission's Joint Research Centre
LNB	Low NO_x Burners
LWIF	Lost Workday Injury Frequency
MPI	Multi-point Injection
PBT	Persistence, bioaccumulation and toxicity
QSARs	Quantitative Structure Activity Relationships
RAINS	Regional Air Pollution Information and Simulation model (A tool developed by the International Institute for Applied Systems Analysis (IIASA) for analysing alternative strategies to reduce acidification, eutrophication and ground-level ozone in Europe.)
RAR	Road Accident Rate
REACH	Registration, Evaluation and Authorisation of Chemicals
RVP	Reid Vapour Pressure
SCR	Selective Catalytic Reduction
SDS	Safety Data Sheet
SNCR	Selective Non-Catalytic Reduction
UN-ECE	The United Nations Economic Commission for Europe
VOC	Volatile Organic Compound
vPvB	Very persistent, very bioaccumulative
WTP	Willingness-to-pay

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We are pleased to welcome Lourens Post as our new Air Quality Technical Coordinator. Lourens joined CONCAWE in June this year and replaces Peter Goodsell who has returned to BP.

CONCAWE publications

Reports published by CONCAWE from 2003 to date

2003	
1/03	Performance of European cross-country oil pipelines—statistical summary of reported spillages—2001
2/03	European downstream oil industry safety performance—statistical summary of reported incidents—2001
3/03	European oil industry guideline for risk-based assessment of contaminated sites (revised)
4/03	The IPPC directive, refinery BREF, and European refineries—a guidance manual
5/03	Fuel effects on emissions from modern gasoline vehicles: Part 1—sulphur effects
6/03	A guide for reduction and disposal of waste from oil refineries and marketing installations

2004	
1/04	Chronic toxicity studies on white oils
2/04	Fuel effects on emissions from modern gasoline vehicles: Part 2—aromatics, olefins and volatility effects
3/04	Gasoline volatility end ethanol effects on hot and cold weather driveability of modern European vehicles
4/04	Trends in oil discharged with aqueous effluents from oil refineries in Europe—2000 survey
5/04	Occupational health auditing
6/04	European downstream oil industry safety performance—statistical summary of reported incidents—2002
7/04	Performance of European cross-country oil pipelines—statistical summary of reported spillages—2002
8/04	European epidemiology studies of asphalt workers—a review of the cohort study and its results
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