

EUROPEAN COMMISSION  
DIRECTORATE-GENERAL  
ENVIRONMENT  
Directorate C - Climate Change & Air  
ENV.C.3 - Clean Air & Transport

# Consultation on the mandatory introduction of Stage 2 Petrol Vapour Recovery Controls at Service Stations in the EU

## A consultation launched by DG Environment of the European Commission. Responses to be received by 25 April 2008

The aim of this of this consultation is to solicit views and information in respect of draft legislation that the European Commission may propose in respect of controlling emissions of petrol vapour during the refuelling of passenger cars at service stations. This is an integral part of the Commission's impact assessment process and the results of all consultations will be reported in an impact assessment report that would accompany any legislative proposal. Unless otherwise requested the Commission intends to make publicly available any responses received.

### 1. INTRODUCTION

Petrol vapour is displaced from a car's fuel tank when it is refuelled at service stations. This vapour is vented to the atmosphere unless otherwise controlled. This vapour contains benzene and other volatile organic compounds (VOCs) which contribute to local, regional and global air pollution problems.

Various Community instruments have been developed and implemented to limit VOC emissions. For example, national limits apply on Member States' total emissions of VOCs as embodied in directive 2001/81/EC on national emissions ceilings. There is also legislation to reduce the emissions of VOCs from the use of solvents in industrial installations and to reduce the use of solvents in paints and varnishes, to limit the benzene content of petrol (1% v/v) and to restrict the emissions of hydrocarbons from road vehicles.

Despite these measures, the impacts of air pollution, as assessed by the Thematic Strategy<sup>1</sup>, are still significant such that the long term objectives for health and the environment, as established in the 6<sup>th</sup> Environmental Action Programme and the National emissions ceilings directive, will not be attained on the basis of current policies alone even by 2020. The Strategy proposed a series of interim objectives to be attained by 2020 and several measures to help deliver further progress towards the long term objectives including additional controls on the refuelling of petrol cars

---

<sup>1</sup> Commission Communication COM(2005) 446 on a Thematic Strategy on air pollution

at service stations. In addition, the Commission has recognised that a greater uptake of biofuels (such as bioethanol in petrol) may lead to greater emissions of VOCs due an increased vapour pressure of the resulting blends. Stage II controls could help off-set part of these additional emissions.

The European Commission is currently considering therefore whether to propose draft legislation that would compel all Member States to introduce so-called "Stage 2 Petrol Vapour Recovery" controls at service stations throughout the EU. This consultation document invites answers and information to assist the Commission in its deliberations. Answers to the question in Section 0 (or other pertinent information) should be received by the European Commission **no later than 25 April 2008** and can be sent electronically or in paper form to the addresses at the end of this document.

## **2. PETROL VAPOUR & ADVERSE IMPACTS ON HEALTH AND THE ENVIRONMENT**

### **2.1. Benzene in ambient air**

Benzene is a VOC and a component of petrol. It is also a known human carcinogen and is associated with a heightened risk of illnesses such as leukaemia. A Community air quality standard exists for the protection of public health<sup>2</sup> but there is no known safe level of exposure. Human exposure comes mainly from tobacco smoke, petrol vapour and from vehicle exhaust emissions. The air quality limit value for benzene is expressed as an annual average concentration of 5µg/m<sup>3</sup> that must be met by 1 January 2010.

Given the restrictions on the benzene content of petrol and stricter exhaust limits for road vehicles, there has been an observed decrease in ambient levels of benzene. Moreover, it is likely that most places will comply with the air quality limit value by 2010. However, there may remain problems at heavily trafficked locations and residential areas in the immediate vicinity of petrol service stations. Also worthy of consideration is the fact that most non-smokers' accumulated exposure to benzene comes from commuting in cars and during car refuelling at service stations.

### **2.2. Ozone**

Once released into the atmosphere VOCs react in the presence of sunlight with nitrogen oxides emitted from combustion processes to form ground level ozone and other components of photochemical smog. Ozone is a transboundary pollutant so that precursors emitted in one country are dispersed and transported in the atmosphere and contribute to the observed ozone in other Member States. Short-term studies show that ozone has adverse effects on pulmonary function, lung inflammation, lung permeability, respiratory symptoms, increased medication usage, morbidity and mortality. There are Community air quality targets<sup>3</sup> to protect against

---

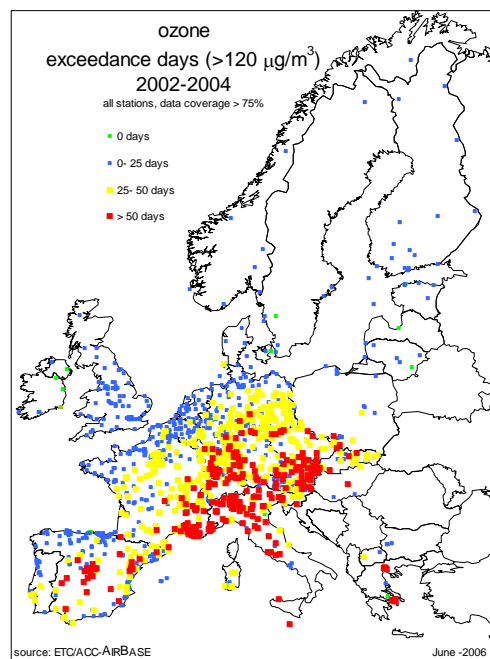
<sup>2</sup> Directive 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air: OJ L 313, 13.12.2000, p. 12.

<sup>3</sup> Directive 2002/3/EC relating to ozone in ambient air: OJ L 67, 9.3.2002, p. 14.

exposure to ozone which can result in a range of adverse impacts including premature mortality.

The World Health Organisation recommends a daily maximum 8-hour mean concentration as the principal benchmark for assessing the impact on mortality, with assessment over a full year. Current evidence is insufficient to derive a level for this 8-hour mean below which ozone has no effect on mortality. The ozone directive established a target value for the protection of human health of  $120 \mu\text{g}/\text{m}^3$  as a daily maximum concentration measured over an 8-hour period which is not to be exceeded more than 25 times per calendar year. Member States are obliged to comply as far as possible with this target.

The European Environment Agency undertakes periodic reviews of air quality based upon air quality monitoring data collected and reported to the Commission and the EEA<sup>4</sup>. Although reductions in emissions of ozone precursors appear to have led to lower peak concentrations of ozone in the troposphere, the current target level is frequently exceeded for a substantial part of the urban population of the EEA-32. In 2004, 94% of the urban population experienced exceedances of the  $120 \mu\text{g}/\text{m}^3$  level (the long-term objective for protection of human health), while about 20% of the urban population was exposed to concentrations above the  $120 \mu\text{g}/\text{m}^3$  level for more than 25 days. The target level was exceeded over a wide area and by a large margin.



**Figure 1: Days exceeding the target value as 3-year average 2002-4. In 2004 urban/suburban background areas provided 44% of stations, rural background areas 24%, traffic sites 18%, 9%,**

---

<sup>4</sup> Air Pollution in Europe 1990-2004, Steinar Larssen et al, European Environment Agency, Copenhagen 2007.

*industrial, and 5% not properly classified. [Reproduced by permission of the European Environment Agency]*

Several studies have shown that ozone peak values have tended to decrease during the first half of the nineties. However, available data available over the period 1996-2001 shows hardly any variation for the 26th highest maximum daily 8-hour mean. Ozone concentrations in 2004 were reported by 1886 stations across 32 countries and were lower than the extraordinarily high values seen in 2003 when concentrations across most of Europe exceeded permitted levels. Nevertheless, when, in accordance with the ozone directive, concentrations are averaged over 3 years it is clear that the target value was not met in large parts of continental Europe (see Fig 1).

The reductions in ozone precursor emissions that should result from enforcement of the national emissions ceilings directive 2001/81/EC and international agreements are unlikely to reduce ozone concentrations to below the current target value and long-term objective over the whole of the EEA area. In north-west Europe about 25 exceedance days of the 120  $\mu\text{g}/\text{m}^3$  level are still expected in 2010.

### **2.3. Ozone as a greenhouse gas**

The calculated global mean radiative forcing of ground level ozone since 1750 is  $+0.35 \text{ Wm}^{-2}$  is the third most important greenhouse gas after carbon dioxide ( $+1.66 \text{ Wm}^{-2}$ ) and methane ( $+0.48 \text{ Wm}^{-2}$ )<sup>5</sup>. Although ozone precursor emissions are not directly controlled under the UNFCCC and the Kyoto Protocol, Parties must report on their emissions of VOCs, NO<sub>x</sub> and carbon monoxide.

## **3. STAGE 2 PETROL VAPOUR RECOVERY**

Stage 2 petrol vapour recovery concerns the capture of petrol vapour during the refuelling of passenger cars. It complements Stage 1 PVR which addresses the emissions of petrol vapour during the storage and subsequent delivery of petrol from terminals to service stations.

### **3.1. Types of Stage 2 PVR equipment**

There are two distinct types of active Stage 2 vapour recovery. The first is the "traditional system". Here vapour displaced from the car's fuel tank is sucked back via the outer part of the fuel pump nozzle and transported to the underground fuel storage tanks of the service station. A newer system captures the displaced vapour in the same way but cools it and recycles directly back to the petrol dispenser where it is used to fill up the car's fuel tank. The advantage of the newer system is that it does not require any

---

<sup>5</sup> P. Forster, V. Ramaswamy, P. Artaxo, T. Bernsten, R. Betts, D.W. Fahey, J. Haywood, J. Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz and R. Van Dorland, 2007: Changes in Atmospheric Constituents and in Radiative Forcing. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom & New York.

reconstruction of the service station forecourt or the modification of underground pipe work.

Naturally, if Stage 2 PVR equipment is required to be fitted then it must complement and be compatible with existing regulations on Stage 1 vapour recovery. Currently all service stations with a volumetric throughput less than 100 cubic metres per annum of petrol are exempt from the Stage 1 directive 94/63/EC. Member States also have the option to exempt stations with a throughput less than 500 cubic metres where there are no adverse health and environmental impacts. However, all stations situated in or below residential dwellings must install Stage 1 PVR equipment.

### **3.2. Position in the Member States & need for consistent standards**

Stage 2 PVR is currently unregulated at the Community level although a significant number of Member States have mandated the use of Stage 2 control techniques. These regulations vary in scope in terms of the minimum size of petrol station captured, the required vapour collection efficiency and the post-installation compliance regime. Given the fundamental requirement for the free movement of goods in the EU, the definition of minimum technical requirements at Community level may enhance the functioning of the internal market in stage 2 equipment.

## **4. INFORMATION ON COSTS OF STAGE 2 PVR CONTROLS**

There are several important factors which influence the costs and cost-effectiveness of Stage 2 PVR equipment. These include: (1) the usual economic lifetime of the service station equipment particularly in relation to the regulatory timescale for installation of the Stage 2 equipment; (2) the size of station in terms of annual throughput of petrol; and (3) the required operational efficiency of the vapour recovery system.

### **4.1. New & existing service stations**

The costs for installation Stage 2 PVR equipment will be smaller if installed as part of the construction of a new station or as part of a major refurbishment of an existing station as the required works can be incorporated as part of the normal "economic cycle" of the station. The usual lifetime of below ground equipment is up to 15 years whilst that for above ground equipment is more variable and has been reported to be between 5 to 15 years.

Hence if Stage 2 PVR controls are applied to existing stations an important consideration will be the timescale over which the existing stations should be converted. A balance has to be struck between bringing short term benefits and assisting compliance with air quality standards for benzene and ozone and making progress towards longer term air pollution objectives (e.g. the 2020 objectives of the Thematic Strategy on air pollution). In addition, the cost-effectiveness will be better when retrofitting the larger service stations with greater petrol throughputs than for smaller stations.

## **4.2. Collection efficiency**

Similarly, the cost-effectiveness will be better if more vapour is collected i.e. if the system efficiency is greater. However, this has to be balanced against the ability and cost of maintaining a high efficiency in practical use. Whilst ENTEC assumed a recovery efficiency of 80% for petrol vapour captured, in California equipment must perform at 95% or better (similarly for Taiwan, Austria and China) whilst the recent legislation in the UK requires 85% recovery. Other countries have mandated efficiencies in the 80 to 90% range.

The reports prepared by ENTEC and COWI give extensive detail on the costs of installing Stage 2 PVR equipment. These reports are available from the Commissions web site<sup>6</sup>. In addition a summary of the different cost estimates are summarised in the attached annex.

## **4.3. In-service operation**

The overall cost-effectiveness of Stage 2 PVR equipment will be maximised if the equipment actually functions correctly once installed. However, it has been reported that in Germany some 50% of systems were non-compliant with the relevant requirements whilst in Denmark this was 25% and in the Rotterdam area of the Netherland close to 20% of operators did not undertake the necessary inspections to ensure correct functioning<sup>7</sup>.

Periodic checking of the performance on installed equipment can be carried out periodically where every one to two years seems to be common. Or alternatively, automatic "real-time" monitoring can be required which has the advantages of permitting self-calibration/fine tuning of the equipment whilst in operation and also lengthening the period between inspections and thereby reducing maintenance costs for the station operator. Since 2003 Germany has mandated automatic monitoring and doubled the period between inspections of Stage II equipped dispensers to two years.

## **4.4. Taxation and fuel price**

Whilst the benefits of any stage 2 regulation would usually be determined at the level of society as a whole, it is interesting to note that there are interesting distributional effects related to the economic value of the recovered petrol vapour.

For a conventional stage 2 system, the recovered petrol vapour is returned to the refinery and "resold" to service stations at a price excluding fuel duty and VAT. Whereas with the "at pump" system, vapour is captured, condensed and re-sold at a price including fuel duty and VAT. So in principle, the service station operator could gain additional product "free of charge" which he can sell for the full price without payment of VAT and

---

<sup>6</sup> <http://ec.europa.eu/environment/air/stationary.htm#petrol>

<sup>7</sup> ENTEC Report pages 22 – 25.

fuel duty as this has already been paid once already. This "additional benefit" could influence the investment decision and pay back time for the service station operator whilst it represents a potential loss of revenue for the tax authorities.

**5. QUESTIONS TO WHICH RESPONSES ARE INVITED**

- 5.1. Do you consider that the current lack of harmonisation of requirements for Stage 2 PVR controls across the EU has prevented the development of a single market for stage 2 PVR products and services?**
- 5.2. Would minimum/harmonised technical requirements at the EU level, improve the functioning of the single market for products and services related to stage 2 PVR equipment?**
- 5.3. Should Stage 2 PVR controls only be applied to new stations and those which are substantially refurbished?**
- 5.4. Should there be a minimum size/throughput of petrol below which there is no need to fit Stage 2 PVR controls to new and refurbished service stations?**
- 5.5. Should Stage 2 PVR controls also be applied to existing stations? If so, what is the minimum throughput/size of existing service station which should be covered by any new legislation?**
- 5.6. Should service stations be required to install automatic monitoring of stage 2 equipment to ensure that the equipment functions and the environmental benefits are delivered?**
- 5.7. As part of ensuring good air quality for benzene in ambient air, should Stage 2 PVR equipment be fitted to all service stations built underneath or as part of residential dwellings irrespective of how much petrol they sell?**

**6. ADDRESS FOR COMMUNICATION**

Responses should be sent to Duncan JOHNSTONE at the European Commission by no later than 25 April 2008:

<b>(email): ENV-Stage-2-VOC@ec.europa.eu</b>	<b>DG Environment (BU9 6/174) European Commission Rue de la Loi 200 B-1049 Brussels Belgium</b>
<b>(tel.): +32 (0)2 296 6702</b>	
<b>(fax): +32 (0)2 296 9554</b>	