EXPLANATORY MEMORANDUM TO

The Environmental Permitting (England and Wales) (Amendment) (No.2) Regulations 2011

2011 No. 2933

This explanatory memorandum has been prepared by the Department for Environment and Sustainable Development and is laid before the National Assembly for Wales in conjunction with the above subordinate legislation and in accordance with Standing Order 27.1.

Minister's Declaration

In my view, this Explanatory Memorandum gives a fair and reasonable view of the expected impact of the Environmental Permitting (England and Wales) (Amendment) (No.2) Regulations 2011. I am satisfied that the benefits outweigh any costs.

John Griffiths
Minister of Environment and Sustainable Development, one of the Welsh Ministers

3 December 2011

1. Description

1.1 This instrument amends the Environmental Permitting (England and Wales) Regulations 2010 so as to include transposition of Directive 2009/126/EC of the European Parliament and of the Council on Stage II petrol vapour recovery during refuelling of motor vehicles at service stations.

2. Matters of special interest to the Constitutional and Legislative Affairs Committee

2.1 These Regulations are made on a composite basis to ensure consistency of application in Wales and England.

3. Legislative Background

3.1 Directive 2009/126/EC of the European Parliament and of the Council on Stage II petrol vapour recovery during refuelling of motor vehicles at service stations requires transposition by 1 January 2012.

3.2 Directive 94/63/EC of the European Parliament and Council on the control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations has been transposed by means of the Environmental Permitting (England and Wales) Regulations 2010.

3.3 The amending Regulations which are this subject of this Memorandum amend the 2010 Regulations so as to include transposition of the 2009 Directive.

4. Purpose and intended effect of the legislation

4.1 This instrument extends to England and Wales.

4.2 Emissions to the atmosphere of volatile organic compounds (VOCs) are associated with a number of environmental and health problems, due to their effects upon local air quality; formation of ozone and photochemical smog; and atmospheric warming and climate change.

4.3 VOCs are emitted to the atmosphere at various stages during the storage and distribution of petrol. The petrol vapour recovery Stage I Directive (94/63/EC) contains measures to reduce VOC emissions from the unloading of petrol at petrol stations, and its subsequent storage on the premises.

4.4 Stage II petrol vapour recovery involves recovering the petrol vapour displaced from the fuel tank of a motor vehicle during refuelling at a service station and transferring that petrol vapour to an underground storage tank at the service station or back to the petrol dispenser for resale. Directive 2009/126/EC establishes a minimum level of petrol vapour recovery across Member States and introduces requirements for more extensive deployment of Stage II controls than currently exist in the UK.(Under previous amendments to the Environmental Permitting Regulations, a domestic equivalent to Stage II was brought in for some of the petrol stations affected by Directive 2009/126/EC. The Stage II equipment was required to be fitted by 1 January 2010.) The recovered vapour can be converted back into saleable petrol.

4.5 The Stage II Directive was developed by the European Commission to fulfil commitments under the Thematic Strategy on Air Pollution; a proposal to amend European legislation on petrol and diesel quality; and provisions in a new Directive on air quality.

5. Consultation

5.1 Defra, and the Welsh Government consulted key stakeholders on an emerging Impact Assessment during the Directive negotiations in the first quarter of 2010 and subsequently on the attached IA. There were no objections to the proposed Directive or the proposed means of transposition. Defra and the Welsh Government also consulted relevant trade associations and some local authorities on draft of the guidance on the meaning of "major refurbishment".

6. Guidance

6.1 Guidance is already published on the regulation of petrol stations under the Environmental Permitting Regulations. This will be supplemented to include an explanation of the new requirements. In particular, the Stage II Directive specifies that existing petrol stations of specified sizes must be fitted with the relevant equipment where they undergo a "major refurbishment". Guidance has been produced to help regulators decide whether site changes in any case should be regarded as amounting to a major refurbishment, and to minimise impacts on smaller petrol stations, and especially those in rural areas.

Title: **EU Directive to limit Petrol Vapour Emissions from Fuelling of Service Stations** **Lead department or agency:** Defra - Atmosphere and Local Environment **Other departments or agencies:** Welsh Government - Radioactivity and Pollution Prevention	**Impact Assessment (IA)** **IA No:** **Date:** 17/06/2011 **Stage:** Development/Options **Source of intervention:** EU **Type of measure:** Secondary legislation **Contact for enquiries:**

Summary: Intervention and Options

What is the problem under consideration? Why is government intervention necessary?

UK requirement to transpose a Directive on Stage II petrol vapour recovery during refuelling of motor vehicles at service stations. The UK has previously introduced legislation to require Stage II controls for certain service stations to control emissions of volatile organic compounds (VOCs) to atmosphere and was successful in ensuring that the Directive extends the same standards to relatively few additional service stations. This IA was originally produced during the negotiations to inform the UK position, and an assessment of a range of likely outcomes for the key issues and has been revised to reflect the current position.

What are the policy objectives and the intended effects?

To reduce petrol vapour emissions when refuelling motor vehicles. These emissions contribute to the formation of ground level ozone, contain benzene (a known carcinogen), and have a global warming potential. The Directive must be transposed into national legislation by 1 January 2012 and our aim is to do this in an effective, timely and proportionate manner to achieve the objectives of the Directive whilst minimising the burdens on business.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

0) Do nothing - this represents the status quo or business as usual situation and includes the Stage II legislation already introduced in the UK.

1) Amend the environmental permitting Regulations to extend domestic Stage II legislation to the extent necessary to comply with the requirements of the 2009 Directive. (preferred option)

The preferred option is option 1 because "do nothing" would represent a failure to comply with EU law and result in infraction proceedings and consequential fines by the European Court of Justice.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** n/a **What is the basis for this review?** Not applicable. **If applicable, set sunset clause date:** .n/a	
Are there arrangements in place that will allow a systematic collection of monitoring information for future policy review?	Yes

SELECT SIGNATORY Sign-off For consultation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible SELECT SIGNATORY: ..... Date: .....

Summary: Analysis and Evidence

Policy Option 1

Description:

EU Directive (extension over 3,000 million litres petrol throughput a year)

Price Base Year 2008	PV Base Year 2005	Time Period Years 14	Net Benefit (Present Value (PV)) (£m)		
			Low: -£43.8m	**High:** -£7.6m	**Best Estimate: -£43.8m**

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	£38m		£1m	**£53.8m**
High	£56m		£1.3m	**£78.2m**
Best Estimate	£47m		£1.15m	**£66m**

Description and scale of key monetised costs by 'main affected groups'

Main affected groups - Service station owners/operators: vapour recovery equipment, materials, labour, power, maintenance, compliance checking. Different lifetimes assumed for various equipment. Manufacturers of petrol vapour recovery equipment and monitoring equipment. All net benefits and monetised benefits taken from Entec's report (Annex 3, summarised in evidence base).

Other key non-monetised costs by 'main affected groups'

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	£0m		£3m	**£22.8m**
High	£0m		£6.3m	**£70.6m**
Best Estimate	£0m		£3m	**£22.8m**

Description and scale of key monetised benefits by 'main affected groups'

Avoided damage costs from reduced VOC emissions (interdepartmental group on costs and benefits); avoided greenhouse gas emissions (shadow price of carbon); value of recovered petrol vapours as re-sold fuel (see uncertainties on p9). Estimates of benefits are higher (£50-£75m) if considering CAFE estimates. Due to used model skewing upwards, low estimates are also best estimates, see Annex 3. Differences between the IGCB and CAFE are explained the evidence body under "Sensitivities", p9.

Other key non-monetised benefits by 'main affected groups'

Certain health effects. There is high uncertainty around the valuation of health impacts, UK valuation figures are at the low end of the range (see supporting report for both). Benefits for equipment suppliers. By transposing the Directive, the UK avoids failure to comply with EU law resulting in infraction proceedings and maintains it's credibility as a Member State.

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5%

Estimates for Benefits use IGCB values being HMG best practice. Estimates of benefits are higher (£50-£75m) if considering CAFE estimates (Differences between the IGCB and CAFE explained in evidence body under Sensitivities, page 9). Value of recovered fuel is included in benefits above but discussed in costs section of supporting report (evidence base). Supporting report provides PV and total annualised cost/benefits. Benefits are highly sensitive to reduction in damage costs from VOC emissions and data used may be subject to review at UK level. Net benfit would be positive with EU estimates of damage costs avoided.It must also be noted that during the modelling process the timing changed from 2020 to 2018 but this is not considered to significantly alter the analysis.

Direct impact on business (Equivalent Annual) £m):			In scope of OIOO?	Measure qualifies as
Costs: £10m	**Benefits:** £2m	**Net:** -£8m	No	NA

Enforcement, Implementation and Wider Impacts

What is the geographic coverage of the policy/option?			United Kingdom		
From what date will the policy be implemented?			01/01/2012		
Which organisation(s) will enforce the policy?			Local authorities/SEPA in Scotland		
What is the annual change in enforcement cost (£m)?			-£0.12 million		
Does enforcement comply with Hampton principles?			Yes		
Does implementation go beyond minimum EU requirements?			No		
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:**	**Non-traded:** 22k- 35k	
Does the proposal have an impact on competition?			No		
What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?			**Costs:** 100	**Benefits:** 100	
Annual cost (%) per organisation size (excl. Transition) (Constant Price)	**Micro**	**< 20**	**Small**	**Medium**	**Large**
Are any of these organisations exempt?	Yes/No	No	Yes/No	No	No

Specific Impact Tests: Checklist

Set out in the table below where information on any SITs undertaken as part of the analysis of the policy options can be found in the evidence base. For guidance on how to complete each test, double-click on the link for the guidance provided by the relevant department.

Please note this checklist is not intended to list each and every statutory consideration that departments should take into account when deciding which policy option to follow. It is the responsibility of departments to make sure that their duties are complied with.

Does your policy option/proposal have an impact on...?	Impact	Page ref within IA
Statutory equality duties[1] Statutory Equality Duties Impact Test guidance	No	12
Economic impacts		
Competition Competition Assessment Impact Test guidance	No	12
Small firms Small Firms Impact Test guidance	No	12
Environmental impacts		
Greenhouse gas assessment Greenhouse Gas Assessment Impact Test guidance	Yes	12
Wider environmental issues Wider Environmental Issues Impact Test guidance	Yes	12
Social impacts		
Health and well-being Health and Well-being Impact Test guidance	Yes	12
Human rights Human Rights Impact Test guidance	No	12
Justice system Justice Impact Test guidance	No	12
Rural proofing Rural Proofing Impact Test guidance	No	12
Sustainable development Sustainable Development Impact Test guidance	No	13

[1] Race, disability and gender Impact assessments are statutory requirements for relevant policies. Equality statutory requirements will be expanded 2011, once the Equality Bill comes into force. Statutory equality duties part of the Equality Bill apply to GB only. The Toolkit provides advice on statutory equality duties for public authorities with a remit in Northern Ireland.

Evidence Base (for summary sheets) – Notes

Use this space to set out the relevant references, evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Please fill in **References** section.

References

Include the links to relevant legislation and publications, such as public impact assessments of earlier stages (e.g. Consultation, Final, Enactment) and those of the matching IN or OUTs measures.

No.	Legislation or publication
1	
2	
3	
4	

+ Add another row

Evidence Base

Ensure that the information in this section provides clear evidence of the information provided in the summary pages of this form (recommended maximum of 30 pages). Complete the **Annual profile of monetised costs and benefits** (transition and recurring) below over the life of the preferred policy (use the spreadsheet attached if the period is longer than 10 years).

The spreadsheet also contains an emission changes table that you will need to fill in if your measure has an impact on greenhouse gas emissions.

Annual profile of monetised costs and benefits* - (£m) constant prices

	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9
Transition costs										
Annual recurring cost										
Total annual costs										
Transition benefits										
Annual recurring benefits										
Total annual benefits										

* For non-monetised benefits please see summary pages and main evidence base section

Microsoft Office
Excel Worksheet

Annual profile costs and benefits - (£m) constant prices

	2011	1212	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Transition costs	0	0	0	0	0	0	0	47	0	0	0	0
Annual recurring cost	0	0	0	0	0	0	0	1.2	1.2	1.2	1.2	1.2
Total Annual benefits	0	0	0	0	0	0	0	48.2	1.2	1.2	1.2	1.2
Transition benfits	0	0	0	0	0	0	0	0	0	0	0	0
Annual recuriing benefits	0	0	0	0	0	0	0	3	3	3	3	3
Total Annual benefits	0	0	0	0	0	0	0	3	3	3	3	3

Evidence Base (for summary sheets)

SUMMARY

Impact Assessment for European Commission Directive on Stage II petrol vapour recovery

Background

Petrol stations emit vapour when the petrol arrives in tankers and is unloaded, when it is stored at the petrol station, and when it is dispensed. The first two stages are already regulated under so-called Petrol Vapour Recovery Stage I Directive. The Stage II Directive deals with refuelling, generally at larger existing petrol stations and most new ones. The main obligation is to prevent most of the vapours displaced from vehicle tanks when they are being filled with petrol being emitted into the atmosphere.

The attached report **(Annex 3)** was prepared by Entec for the Department for Environment, Food and Rural Affairs (Defra), on behalf of all four UK administrations, in 2009 as an Impact Assessment of the different options during the negotiations for a new Directive on Stage II petrol vapour recovery. Since it covered what emerged in the adopted Directive, it has been appended to serve as the core of this transposition IA.

Estimates of the impact of this measure have been prepared on a UK basis from the available data. However the impact on petrol stations in Wales of the additional measures required by the Stage II Directive is expected to be minimal and is identified below.

The proposal was first tabled in December 2008. The emerging impact assessment work was used to inform the UK position during the period of rapid negotiations in February and March 2009. The proposal secured first reading agreement at the beginning of May 2009. The options considered relate primarily to the two main variables under consideration: the size of new and existing petrol station to be required to fit Stage II equipment (as measured by petrol throughput in cubic metres) and the date from or by which new and existing petrol stations of these sizes must fit the equipment. These were compared with the 'no change' option of current UK legislation which requires the introduction of Stage II for new petrol stations with a throughput of 500m^3 or more from 2010 or, in Scotland, 2012; and the upgrading of existing petrol stations with a throughput of 3,500m^3 by 1 January 2010 or 2012.

The summary page gives the range of costs and benefits applicable to the option of introducing Stage II for new petrol stations with a throughput of 500m^3 by 2012 (a nil figure because compliance is already required under UK legislation) and for existing installations above 3,000m^3 by no later than 2018. The range of costs and benefits takes account of variables for the lifetime of above-ground petrol dispensers and related equipment, and whether petrol station numbers and petrol sales will be constant or declining. The negotiations were finalised on the same figures, except for bringing forward the 2020 date by two years to 2018, which is not expected to significantly alter the costs or benefits.
While the assessment shows a negative cost-benefit balance, the other options under consideration by the EU Council of Ministers would have been even less favourable. The emerging IA analysis was valuable for UK negotiators in arguing for the proposal to reflect existing UK legislation and, subsequently, conceding only limited extension of petrol station regulation. Given all other considerations, this was the best outcome for the UK.

Evidence used

The report includes assessment of the possible costs and benefits of implementing the proposals. The results and data used in their preparations are based on various assumptions

and are subject to a number of uncertainties. These have been set out in the relevant sections of the report. The data and methods used are based on nationally or internationally agreed approaches (where such agreed approaches are available) and some key assumptions have been reviewed by relevant UK Government (together with the Welsh Government) and industry stakeholders.

Problem definition

Emissions to the atmosphere of volatile organic compounds (VOCs) are associated with a number of environmental and health problems, due to their effects upon local air quality; formation of ozone and photochemical smog; and atmospheric warming and climate change. VOCs are emitted to the atmosphere at various stages during the storage and distribution of petrol. The UK has already taken action to reduce these emissions by implementing a Directive on the control of VOC emissions from the storage of petrol and its distribution from terminals to service stations, so-called Stage I petrol vapour recovery.

Secondly, the UK has introduced legislation to control emissions of VOCs during the refuelling of vehicles from the majority of new service stations and the largest existing service stations (Stage II petrol recovery) as a contribution to achieving compliance with the Emissions Ceilings Directive and the UNECE Gothenburg Protocol. Stage II petrol vapour recovery involves recovering the petrol vapour displaced from the fuel tank of a motor vehicle during refuelling at a service station and transferring that petrol vapour to an underground storage tank at the service station or back to the petrol dispenser for resale.

The European Commission has produced a Directive on Stage II petrol vapour recovery in order to fulfil commitments under the Thematic Strategy on Air Pollution; a proposal to amend European legislation on petrol and diesel quality; and provisions in a new Directive on air quality. This Directive establishes a minimum level of petrol vapour recovery across Member States and introduces requirements for more extensive deployment of Stage II controls than currently exist in the UK. This Impact Assessment details the additional impacts of introducing the more extensive Stage II controls in the UK.

The main reason for implementing the Directive is that, apart from some benefit to the industry in terms of resale of recovered petrol and the opportunity for them to publicise their "green credentials", there is a cost to society in terms of greenhouse gases and air quality in general. Since this is a cost to society, industry are unlikely to act unless there is Government intervention.

The following summarises the key findings of the report:

Businesses affected

The main businesses affected are service stations and owners. They will be required to install, operate, maintain and check the operation of the Stage II petrol vapour recovery equipment.

Businesses producing, supplying and testing Stage II petrol vapour recovery equipment are also affected by the proposals.

The Directive affects the following size of petrol stations:

- existing petrol stations with an annual petrol throughput above 3,000m^3 per year from the end of 2018 (approximately 6% of petrol stations and 8% petrol sales), compared to existing controls for stations with a throughput above 3,500m^3 under current domestic legislation;

- all new petrol stations with a throughput above 500m^3 per year from 2012 (as per current domestic legislation) and all such petrol stations with a throughput above 100m^3 if situated under permanent living quarters or working areas; and

- all petrol stations that undergo major refurbishment from 2012, with the same threshold as for new petrol stations (new requirement - there is no equivalent in current domestic legislation).

It is estimated that 1,200 – 1,800 petrol stations will be required to fit equipment to comply with the Stage II Directive by the end of 2018, in addition to those already required to do so under domestic legislation. It has not been possible to classify service stations according to size by turnover/employees due to the structure of the industry and therefore not possible to ascertain annual cost as a percentage per organisation size.

In Wales it is estimated that this will require an additional 10 to 25 petrol stations to install equipment to comply with the Stage II Directive.

Transposition Options

Policy Options and effects on emissions

0) Do nothing – this represents the status quo or business as usual situation and includes the Stage II legislation already introduced in the UK.

1) Amend the Environmental permitting Regulations to extend domestic Stage II legislation to the extent necessary to comply with the following requirements of the 2009 Directive:

Consideration of options

In considering transposition of the new Directive we have taken full account of the principles set out in the *Transposition guide: how to implement European directives effectively* (http://www.berr.gov.uk/whatwedo/bre/policy/scrutinising-new-regulations/preparing-impact-assessments/toolkit/page44257.html).

The Guide states that it is a requirement of Community law that EU legislation should be implemented in an effective, timely and proportionate manner. Where directives are concerned, the UK Government's policy, shared with the Welsh Government, is to transpose so as to achieve the objectives of the European measure on time and in accordance with other UK policy goals, including minimising the burdens on business. In this Impact Assessment, unless separately indicated, Government refers to the Welsh Government and the UK Government.

Option 0

Option 0 (Do nothing) would represent a failure to comply with EU law and result in infraction proceedings and the consequential imposition of significant fines by the European Court of Justice (ECJ). However, the costs and benefits in this Impact Assessment (IA) are appraised relative to a "do-nothing" option in order to act as a reference point for the comparison of costs and benefits.

Option 1

This is our preferred option to secure basic compliance with the Directive (and no more) while not altering current domestic Stage II requirements. There are, however, some choices involved in these options:

a) we propose to transpose the Directive by means of the Environmental Permitting Regulations in England and Wales. We can find no merit in seeking an alternative legislative vehicle, given that the Stage I Directive and domestic Stage II requirements are already successfully delivered through these Regulations using a simplified permitting approach and risk-based regulation by local authorities. As with Schedule 18 of the Environmental Permitting Regulations, which transposes the Petrol Vapour Recovery Stage II Directive, transposition of the technical requirements of the Stage II Directive will be by reference to the relevant Articles in the Directive (i.e. effectively copy-out);

b) we propose that local authorities should continue as regulators, rather than the Environment Agency which regulates the larger, more complex installations under the Environmental Permitting Regulations; and

c) we propose to provide guidance to local authority regulators on the meaning of the term "major refurbishment", which is key to determining how many existing, smaller petrol stations will be required under the terms of the Regulations to be upgraded to fit Stage II equipment. Any existing petrol station with a throughput of >500m3 (or 100m3 if located under permanent living quarters or working areas) must fit Stage II if they undergo a major refurbishment. The guidance will be issued under regulation 64 of the Environmental Permitting Regulations and, as such, local authorities will be required to have regard to it. If a local authority in Wales were to impose condition in an environmental permit, or issue any form of enforcement notice, requiring upgrading and the petrol station operator considered that a major refurbishment was not being undertaken, the operator would be able to appeal to the Welsh Ministers. In practice, in our experience, local authorities in whose area small petrol stations continue to operate (especially in rural areas) are very well aware of the value to local communities of these stations and will be disinclined to conclude that any refurbishment is "major" without strong justification, because of the potential for such a decision to force closure of the station.

The latest draft of the guidance on "major refurbishment" is at Annex 2a. It is being drawn up with key industry stakeholders, and which has been agreed with the RMI Petroleum Retailers Association (who represent most of the smaller independent petrol stations). The Association has confirmed that the draft minimises the risk of these small stations having to upgrade to Stage II requirements within the scope allowed by the Directive.

NB the European Standards Body, CEN, has received a mandate from the European Commission to produce the harmonised methods and standards referred to in Article 8 of the Directive, and are expected to complete this work by the end of 2011. It is anticipated that the resulting standard will be closely modelled on current German standards which UK stakeholders have advised are acceptable.

Costs of implementing the Directive

Estimates have been made of the additional costs of implementing Stage II Legislation in the UK, both for 'typical' service stations of different sizes and for the UK as a whole.

The main costs that would be incurred relate to: materials, equipment and labour associated with making the service station "Stage II ready" (e.g. underground works); costs of vapour recovery equipment; costs associated with loss of fuel sales during installation; additional maintenance and power costs during operation of Stage II equipment; costs of regular checking for correct operation (compliance); and additional fees and charges under the relevant regulatory regime.

Costs for individual service stations

The typical capital costs of installing Stage II controls are estimated to be around £30,000 for a new service station (or an existing service station installing controls as part of a major

refurbishment) with annual throughput of 3,000 to 3,500m^3. Annualised costs for such service stations are estimated at around £4,000 per year. If existing service stations were to be required to install Stage II controls outside of scheduled refurbishment works (which is not proposed) the costs could be around £130,000 capital, and annualised costs of around £7,500.

Costs for the UK as a whole

It is estimated that 1,200 to 1,800 service stations will be affected by the implementation of the Directive. There will be a total cost for the UK of £50 to £80m, further detail of the calculations can be found in Annex 3, chapter 5.

Benefits of implementing the Directive

There would be health and environmental benefits associated with reductions in VOC emissions, including both:

- Reductions in impacts caused by VOCs, particularly those related to ozone exposure (these have been valued according to two different 'damage cost functions' applied in UK assessments and in European Commission CAFE assessments); and

- Reductions in climate change effects caused by the global warming potential of the VOCs released and also their subsequent degradation to CO2 in the atmosphere. These will be offset slightly by the increased use of electricity use associated with the power demands of the Stage II equipment. These have been valued according to Government guidance on the 'shadow price of carbon'.

In terms of the former, the best estimate of the value of the annualised damage costs avoided is estimated at £0.06 to £0.10 million per year using the UK damage cost functions. The present value estimates of these benefits are £0.7 to £1.07 million. The equivalent values using the EU CAFE damage cost functions are annualised costs avoided of £4.5 to £6.8 million with present value of £50 to £75 million. It is evident that the value of the damage costs avoided is subject to significant uncertainty and is dependent upon which data sources are used. The values using the UK damage cost functions are significantly lower. The annual value of the greenhouse gas emissions avoided is estimated to be £0.7 to £1.0 million (present value of £8 to £13 million). The 1,200 to 1,800 petrol stations subject to the new controls should benefit from the resale of recovered petrol (see table below). The various environmental and health benefits that are not included in the above estimates but are described further in section 6 of the Entec IA report.

Data taken from summary data sheet for all scenarios (Entec Report, Annex B);

Scenario	Low	High
Reduction in costs from value of recovered fuel (£m/yr)	1.74	1.74
Annual benefit from damage costs avoided (£m)	0.10	3.42
Annual benefit from reduced greenhouse gas emissions (£m/yr)	0.98	0.98
Total benefit	2.99	6.31

Sensitivities and uncertainties

The damage cost estimates are higher (£50-£75m) if considering CAFE estimates, in this IA, IGCB estimates are used as being HMG best practice. The price of fuel will likely go up or down which will subsequently affect the benefits estimates. The cost of equipment is likely to fall

as a result of technical advances and availability. Differences between the ICGB and CAFE estimates are due to a number of differences in the scientific modelling underpinning the "impact pathway" of the pollutants, as well as the valuation of health impacts.

The independent petrol station sector, as represented by the RMI Petrol Retailers Association (RMIP), say they do not currently benefit from the recovered petrol to any great extent. The sector is in discussion with HMRC and the National Measurement Office to address this. The typically smaller-scale independent petrol stations are not a growth area, and the guidance on 'major refurbishment' is likely to have the effect of triggering the installation of PVRII equipment on few, if any, sites. Low, medium and high estimates of the number of independent petrol stations affected are: 50, 200 and 400. Since these are generally smaller petrol stations, the potential saving is below the average. The following table assumes an average annual value of £805 per station (75% of the average).

estimated number of independent petrol stations affected	Reduction in costs from value of recovered fuel not secured (£m/yr)
High	322
Medium	161
Low	40

Assuming the medium number of independent petrol stations affected, the low figure for reduced costs from petrol recovery, which is contained in the summary sheet taken from the Entec report and set out in the table above, should be £1.74 instead of £1.91.

Comparison of quantified costs and benefits

Table 8.1 of the IA report provides a summary of the additional quantified costs and benefits in the report for Stage II implementation. Emission reductions and associated benefits comparisons are based on emissions in 2020 and relate to the difference between effects of the new legislation and the current legislation. A threshold of 3,000m^3 is assumed for applicability to all existing service stations and 500m^3 for new service stations and major refurbishment. The ranges given reflect uncertainties in factors including the expected lifetime of Stage II equipment and the expected decline (or not) in petrol station numbers and petrol sales.

Influence of applicable thresholds and implementation dates

The Directive offers no flexibility as to thresholds and implementation.

Annexes

Annex 1 should be used to set out the Post Implementation Review Plan as detailed below. Further annexes may be added where the Specific Impact Tests yield information relevant to an overall understanding of policy options.

Annex 1: Post Implementation Review (PIR) Plan

A PIR should be undertaken, usually three to five years after implementation of the policy, but exceptionally a longer period may be more appropriate. If the policy is subject to a sunset clause, the review should be carried out sufficiently early that any renewal or amendment to legislation can be enacted before the expiry date. A PIR should examine the extent to which the implemented regulations have achieved their objectives, assess their costs and benefits and identify whether they are having any unintended consequences. Please set out the PIR Plan as detailed below. If there is no plan to do a PIR please provide reasons below.

Basis of the review: [The basis of the review could be statutory (forming part of the legislation), i.e. a sunset clause or a duty to review , or there could be a political commitment to review (PIR)];

Duty to review. In addition to the regular oversight already undertaken on the environmental permitting regime under which petrol stations are currently regulated, a policy review will be undertaken in February 2014, which will inform the European Commission's own review scheduled by 31 December 2014.

Review objective: [Is it intended as a proportionate check that regulation is operating as expected to tackle the problem of concern?; or as a wider exploration of the policy approach taken?; or as a link from policy objective to outcome?]

The objective of the review would be to consider any technical or procedural issues arising from the implementation of the requirements, including interpretation of what is meant by a "major refurbishment".

Review approach and rationale: [e.g. describe here the review approach (in-depth evaluation, scope review of monitoring data, scan of stakeholder views, etc.) and the rationale that made choosing such an approach]

Feedback/monitoring data from regulators responsible for regulating/permitting petrol service stations and regular engagement with the main industry representative organisations including twice-yearly participation by the Petroleum Retailers Association at Defra's Industry Forum for pollution control.

Baseline: [The current (baseline) position against which the change introduced by the legislation can be measured]

Current UK legislation applies to service stations with an annual throughput over 3,500m3 of petrol (3,000m3 in the Directive). The Directive additionally applies to substantially-refurbished petrol stations with a throughput above 500 m3.

Success criteria: [Criteria showing achievement of the policy objectives as set out in the final impact assessment; criteria for modifying or replacing the policy if it does not achieve its objectives]

Full compliance by those petrol stations affected by the Directive deadlines. Minimum additional burden for service stations newly required to fit Stage II on top of their existing compliance with Stage I. Guidance provides a clear basis for consistent and proportionate regulation with at least 90% of petrol stations being rated "low risk".

Monitoring information arrangements: [Provide further details of the planned/existing arrangements in place that will allow a systematic collection systematic collection of monitoring information for future policy review]

The Government has established reporting and communication practices with regulators and with relevant trade associations.

Reasons for not planning a review: [If there is no plan to do a PIR please provide reasons here]

n/a

Statutory equality duties

The race equality impact of the proposals has been considered and it is not expected that the proposals will have any impact on race, disability or gender. (section 7.3.1 of the supporting report, page 31)

Economic impacts

From a consideration of the likely impacts of the Directive relative to the requirements already in place in the UK, it is not expected that the proposals will result in any significant competition issues. The impact assessment prepared for the UK domestic Stage II legislation reached a similar conclusion although it was noted that a minor impact on competition would be that new operators would have to install Stage II controls and incur associated costs whereas existing operators below the petrol threshold would not, thus placing them at a slight disadvantage.

Small Firms Impact

Stakeholders have raised concerns about impacts on small service stations and the possibility of some closures if required to install PVRII. Costs for a typical service station in that the annualised costs of installing Stage II controls for a small service station where not done as part of a scheduled major refurbishment are greater than the estimated annual profits from petrol sales. However, the continuing rationalisation of service stations is significantly reducing numbers, with smaller stations often particularly vulnerable. Inasmuch as PVRII slightly lowers the current threshold, transposition could increase pressures; on the other hand, smaller existing petrol stations ((>500m^3, or >100m^3 if located under permanent living quarters or working areas) are exempt from PVRII requirements unless they are subject to major refurbishment. Also any new petrol station with a petrol throughput greater than 500m^3 is covered. (section 7.2 of the supporting report, page 30). The RMIP (whose members include most of the smaller independent petrol stations) have confirmed that the proposed guidance on the meaning of 'major refurbishment' minimises the risk of small petrol stations having to upgrade to Stage II requirements within the scope allowed by the Directive.

Environmental Impacts and Wider Environmental Issues.

The impacts of the proposals on environmental outcomes are covered in this IA under "Benefits of implementing the Directive". In essence, the main impact associated with the proposal would be a reduction in emissions of VOCs to the atmosphere, with associated reductions in environmental and health damage which is the main reason for this policy as monetised in the evidence based. There are no wider impacts on health other than already indentified, more detail on the various environmental and health benefits can be found in section 6 of the Entec report.

Health and Wellbeing

The PVRII Directive will further reduce emission of VOCs with the benefits set out under "problem Definition". The benefits ought broadly to be spread amongst all groups in society, with particular advantage to young and elderly people with greater sensitivity of their lungs or reduced immune system.

Human Rights

The Directive is not expected to impact on any of the rights enshrined in any of the 14 articles of the European Convention on Human Rights, or the 3 articles of the first Protocol thereto. (section 7.3.3 of the supporting report, page 31)

Rural Proofing

It is recognised that most small service stations are located in rural areas and provide a valuable service to local communities. Closure of service stations in rural areas could result in a number of direct and indirect economic (e.g. increased fuel costs from having to drive further for fuel), social (e.g. reduced access to services) and environmental (e.g. increased emissions from travelling further for refuelling) impacts. These impacts could be of particular significance in remote parts of rural Wales. However, as mentioned in the section above "Small Firms Impact" few small petrol stations are likely to be affected and the proposed guidance on 'major refurbishment' which will be made available to local authorities in Wales should also minimise impacts.

Sustainable Development

The Directive represents a sustainable balance having regard to achieving VOC emission reductions from refuelling, and the need to maintain a viable network of service stations.

Legal Aid

The Directive mainly impacts on large operators of petrol stations, supermarket chains etc. It is very unlikely such operators would qualify for legal aid.

13 JUNE 2011 DRAFT GUIDANCE ON THE MEANING OF "MAJOR REFURBISHMENT"

The Directive does not contain a definition of what constitutes a "major refurbishment" which must trigger the installation of PVRII in existing petrol stations with a throughput above 500m^3, or above 100m^3 where petrol stations are located under permanent living quarters or working areas.

It is for regulators to decide, based on the facts of each individual case, whether particular works fall within this term. In doing so, they should have regard to the following:

a) in the Government's view, a major refurbishment will be one which, because of the scale of the works involved, will provide a cost-effective opportunity for installing PVRII equipment at the same time, such as when a forecourt is excavated in order to install replacement pipework and dispensers (typically necessitating temporary closure of the petrol station);

b) the Government can see no reason why rebuilding or refurbishment of a shop which is located on the petrol station site should constitute a major refurbishment if no works are being carried out on the petroleum pipework.or petrol dispensers;

c) subject to e), the following are unlikely to constitute a major refurbishment:

(i) repair of petroleum pipes, without replacing an entire pipe
(ii) replacement of one or more of the petrol dispensers without any other works
(iii) replacement of all the dispensers on a small petrol station with second-hand dispensers which do not have a PVRII capability
(iv) replacement of part of the petroleum pipework on a site without any other works;

d) the Government is not aware of any circumstances where changing all the petroleum pipework and replacing all the dispensers with new ones would not constitute a major refurbishment

e) consideration should be given to the cumulative effect of smaller-scale refurbishments. For example, where a petrol station has undertaken works which were judged not to constitute a major refurbishment and within the next three or so years carries out further significant works, the two (or more) sets of works should be considered together when deciding whether this is a major refurbishment. If the regulator decides that the combined works are, in effect, a staged major refurbishment, PVRII requirements should be installed as part of the second or subsequent set of works. But this should not be used to treat, for example, periodic small-scale repair of pipework or replacement of individual items of failing equipment as cumulatively amounting to major refurbishment;

f) in accordance with a), all decisions by regulators should be proportionate to the circumstances, having regard to what is said in recital 9 of the Directive. It is worth noting in relation to costs for small petrol stations that there can be a very substantial price differential between that of a second-hand dispenser and a new dispenser with PVR2 capability:

Recital 9. *Existing service stations may need to adapt existing infrastructure and it is preferable to install vapour recovery equipment when they undergo major refurbishment of the fuelling system (that is to say, significant alteration or renewal of the station infrastructure, particularly tanks and pipes), since this significantly reduces the cost of the necessary adaptations. However, larger existing stations are better able to adapt and*

should install petrol vapour recovery earlier, given that they make a greater contribution to emissions. New service stations can integrate petrol vapour recovery equipment during the design and construction of the service station and can therefore install such equipment immediately."

Annex 3 – Supporting Entec report

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Defra Stage II PV...

Defra

Impact assessment for European Commission proposal on Stage II petrol vapour recovery

Supporting Report

April 2009










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Creating the environment for business

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Entec

Creating the environment for business

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Defra

Impact assessment for European Commission proposal on Stage II petrol vapour recovery

Supporting Report

April 2009

Entec UK Limited

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Contents

1. Introduction

1.1 Purpose of this report

This supporting report has been prepared by Entec for the Department for Environment, Food and Rural Affairs (Defra) under a framework contract on preparation of evidence to inform consideration of policy and legislative proposals in relation to air quality, pollution control and industrial emissions[1]. It relates to provision of information in the form of an Impact Assessment to support Defra in understanding the likely implications of proposals for a new Directive on Stage II petrol vapour recovery.

We understand that Defra will use the information in this report to understand the implications of the proposals for the UK, including possible changes to the technical provisions of the proposals arising through negotiations during the Codecision process. The report will also be used, if applicable, in support of an Impact Assessment following the adoption of the proposed Directive. The report does not constitute advice to any third party.

The report includes assessment of the possible costs and benefits of implementing the proposals. The results and data used in their preparation are based on various assumptions and are subject to a number of uncertainties. These are set out in the relevant parts of this report. The data and methods used are based on nationally or internationally agreed approaches (where such agreed approaches are available) and some key assumptions[2] have been reviewed by relevant UK Government and industry stakeholders. However, given the relatively short time available – due to the speed at which EU negotiations have taken place – we have relied upon data from a range of existing sources in some cases.

1.2 Problem definition

Emissions to the atmosphere of volatile organic compounds (VOCs) are associated with a number of environmental and health problems, due to their effects upon local air quality; formation of ozone and photochemical smog; and atmospheric warming and climate change.

VOCs are emitted to the atmosphere at various stages during the storage and distribution of petrol. The UK has already taken actions to reduce these emissions. Firstly, the UK has implemented a Directive on the control of

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1 Contract number RMP 5161.

2 Assumptions regarding the UK petrol distribution market and costs of implementation.

VOC emissions resulting from the storage of petrol and its distribution from terminals to service stations[3], so-called "Stage I" petrol vapour recovery.

Secondly, the UK has introduced legislation to control emissions of VOCs during the refuelling of vehicles from the majority of new service stations and the largest existing service stations ("Stage II" petrol vapour recovery). This legislation[4] was implemented to fulfil an obligation arising under the 1991 Geneva Protocol[5].

Stage II petrol vapour recovery involves recovering the petrol vapour displaced from the fuel tank of a motor vehicle during refuelling at a service station and transferring that petrol vapour to an underground storage tank at the service station or back to the petrol dispenser for resale.

In order to fulfil commitments under the Thematic Strategy on Air Pollution[6]; a proposal to amend European legislation on petrol and diesel quality[7]; and provisions in a new Directive on air quality[8], the European Commission has produced a proposal[9] for a Directive on Stage II petrol vapour recovery. This would establish a minimum level of petrol vapour recovery across the Member States (several other Member States also have existing legislation in this area).

The Commission's proposal would introduce requirements for more extensive deployment of Stage II controls than currently exist in the UK. If adopted, the provisions of the Directive would need to be transposed into national legislation. This report therefore includes details of an assessment of the additional impacts of introducing more extensive Stage II controls in the UK.

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3 Directive 94/63/EC, OJ L 365, 31.12.1994.

4 The Pollution Prevention and Control (England and Wales) (Amendment) (England) Regulations 2006, SI 2006 No. 2311; The Pollution Prevention and Control (Scotland) Amendment Regulations 2008, SSI 2008 No. 410; The Pollution Prevention and Control (England and Wales) (Amendment) (Wales) Regulations 2006, SI 2006 No. 2802 (W.241); The Pollution Prevention and Control (Amendment) Regulations (Northern Ireland) 2007, SRNI 2007 No. 245.

5 UN Economic Committee for Europe Geneva Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes.

6 COM(2005) 446 final, 21.9.2005.

7 Directive 98/70/EC. The proposals would relax the vapour pressure requirements on petrol to allow use greater uptake of bioethanol, which could lead to greater emissions of VOCs.

8 Directive 2008/50/EC.

9 Proposal for a Directive of the European Parliament and of the Council on Stage II petrol vapour recovery during refuelling of passenger cars at service stations, COM(2008) 812 final, 4.12.2008.

At the time of writing (March 2009), negotiations are ongoing as part of the Co-decision process. A number of possible changes to the technical provisions of the proposed Directive are therefore included.

1.3 Policy objectives and intended effects

The current UK legislation on Stage II petrol vapour recovery applies to the following activities:

- Motor vehicle refuelling activities at an existing service station, if the petrol refuelling throughput at the existing service station in any period of 12 months is, or is likely to be 3500m^3 or more; and
- Motor vehicle refuelling activities at new service stations, if the petrol refuelling throughput at the service station in any period of 12 months is likely to be 500m^3 or more.

In England and Wales, these activities are regulated by local authorities under the Environmental Permitting Regulations 2007, with statutory guidance provided through Process Guidance Note PG1/14(06) (as well as General Guidance and additional guidance, such as through Air Quality Notes). Similar regimes exist in the other UK constituent countries. The requirements in the UK apply as of 1 January 2010 (2012 in Scotland).

The European Commission's proposal includes the following main elements:

- A requirement to apply Stage II petrol vapour recovery to:
  - New service stations (and those undergoing a major refurbishment) if actual or intended throughput is greater than 500m^3 per annum (from 1 July 2012, provisionally);
  - All new service stations regardless of throughput if situated under permanent living quarters or working areas (from 1 July 2012, provisionally); and
  - Existing service stations with a throughput in excess of 3,000m^3 (by 31 December 2020).
- A requirement to ensure a hydrocarbon capture efficiency[10] of at least 85% and, where the recovered petrol vapour is transferred to an underground storage tank at the service station, a vapour/petrol ratio[11] of 0.95 to 1.05;
- Testing of hydrocarbon capture efficiency at least once per year, unless an automatic monitoring system is installed (in which case, testing must be done at least every three years and the system is

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[10] This relates to the amount of petrol vapour captured by the Stage II petrol vapour recovery system compared to the amount of petrol vapour that would otherwise be emitted to the atmosphere in the absence of such a system.

[11] The ratio between the volume of petrol vapour passing through the Stage II petrol vapour recovery system and the volume of petrol dispensed.

required to indicate faults to the operator and automatically stop the flow of petrol within seven days if the fault is not rectified); and

- A requirement to lay down effective, proportionate and dissuasive penalties applicable to infringements (and to notify the provisions for these penalties and the main provisions of national law to the European Commission).

If adopted as currently drafted, legislation would need to be adopted to implement the provisions of the proposed Directive by 1 July 2012.

As part of the Co-decision negotiations, a number of possible amendments to the text of the proposed Directive have been produced. These include a draft report produced by the rapporteur of the European Parliament's Committee on the Environment, Public Health and Food Safety (26 January 2009) and modifications suggested by the Council Presidency (11 March 2009). These possible amendments have also been taken into account.

2. Policy Options

The following policy options have been considered for this impact assessment:

- Option 1: Do nothing – this represents the status quo or business as usual situation and includes the Stage II legislation already introduced in the UK;
- Option 2: Implement the proposed Directive based on current assumptions[12] regarding the likely provisions. This would require application of Stage II controls as follows:
  - New service stations: those with throughput above 100m^3 and all service stations below permanent living quarters or working areas from 2012.
  - Existing service stations undergoing a major refurbishment: those with throughput above 100m^3 from 2012.
  - All existing service stations: those with throughput above 3,000m^3 from 2020.
  - The potential to apply a derogation[13] for service stations with throughput 100-500m^3, as is the case in the existing Stage I Directive.

In addition, a number of possible sensitivities regarding the technical provisions of the proposed Directive have been explored, given that negotiations are currently (March 2009) ongoing. These include setting a different timescale for implementation of the requirements for all existing service stations (either 2015 or 2025 as an alternative to 2020 in Option 2) and applying the requirements for existing service stations to stations of different sizes (those with 1,000m^3 and 2,000m^3 annual petrol throughput compared to 3,000m^3 in Option 2). These sensitivities are described in Appendix B.

The table below provides a summary of the key provisions of the current UK legislation (Option 1) as compared to the proposed Directive considered under Option 2.

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[12] Personal communication, Defra, 19 March 2009. This is based on the Commission's proposal and subsequent amendments proposed by the Council Presidency.

[13] Where the service station is located in a geographical area or on a site where vapour emissions are unlikely to contribute significantly to environmental or health problems.

Table 2.1 Summary of key provisions of current UK Stage II controls and 'Option 2'

		Option 1 (current UK legislation)	Option 2 (proposed Directive)
Application to new service stations (Note 1)		>500m^3 from 2010	>100m^3 from 2012 (Notes 2,3)
Application to all existing service stations (Note 1)		>3500m^3 by 2010	>3,000m^3 by 2020
Application to existing service stations undergoing major refurbishment		Not applicable	>100m^3 from 2012 (Note 2)
Petrol vapour capture efficiency (Note 4)		85%	85%
Functionality tests: (Note 5)	V/L ratio with no automatic monitoring system	Every year	Every year
	V/L ratio with automatic monitoring system	Every 3 years	Every 3 years
	Checking vapour containment integrity	Every 3 years	Not specified

Notes:

1) New stations are those licensed after 2010 under UK legislation (2012 in Scotland) and assumed to be those licensed after July 2012 under Option 2. Existing stations are those licensed before these dates.

2) It is assumed that there is the potential to apply a derogation for service stations with throughput 100-500m^3, as is the case in the UK for the existing Stage I Directive, where the service station is located in a geographical area or on a site where vapour emissions are unlikely to contribute significantly to environmental or health problems. It is assumed that the UK would apply for such a derogation.

3) Under the proposed Directive, Stage II controls would also be required for all new service stations situated under permanent living quarters or working areas irrespective of their actual or intended throughput.

4) Requirements on petrol vapour capture efficiency and monitoring/testing are set out in statutory guidance under the UK's legislation and in the text of the proposed Directive under Option 2.

5) Under both scenarios it is assumed that there would be type approval requirements for the Stage II equipment with in-situ testing at service stations done by testing vapour/liquid (V/L) ratio – under both regimes this ratio should be in the range 0.95 to 1.05.

3. Sectors and groups affected

3.1 Geographic coverage

The proposed Directive would apply to the United Kingdom.

3.2 Businesses affected

The main businesses affected would be service station operators and owners. They would be required to install, operate, maintain and check the operation of the Stage II petrol vapour recovery equipment. The numbers and sizes of service stations affected will depend upon the level of throughput of those service stations.

Businesses producing, supplying and testing Stage II petrol vapour recovery equipment would also be affected by the proposals as there would be a need for additional Stage II equipment (their markets would therefore increase). The capacity of the equipment supply market may have an implication for whether the requirements of the legislation can be achieved, depending upon the timescales set for implementation.

It is expected that the requirements would be regulated under the same regimes that currently apply in the UK for Stage I and Stage II controls (see below). In particular, service stations covered by the proposed Directive and not currently required to apply Stage II controls according to UK legislation would be expected to be regulated so as to require Stage II controls. These service stations would all be expected to already apply Stage I controls (related to the unloading of petrol into storage at service stations).

Some of the main effects upon these businesses in terms of the practical changes that would need to be made include:

- Purchase of materials and equipment associated with preparing the service station site such as underground vapour recovery pipework, connections to underground storage tanks[14] and shear valves[15];
- Labour including excavation for ground excavation for pipework and installation of equipment;

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[14] Note that where the Stage II equipment involves transfer of the petrol vapour back to the dispenser for resale (rather than to the underground storage tank), these elements will not be required.

[15] A device fitted at the dispenser base that seals the vapour return pipe in the event of the dispenser being severely damaged (Code of Practice – Design, Installation, Commissioning, Operation and Maintenance of Stage II Vapour Recovery Systems, Forecourt Equipment Federation, Issue 1.2, March 2008).

- Purchase of new or replacement petrol dispensers (or retrofitting existing dispensers) suitable for vapour recovery, as well as vapour recovery equipment which may include some or all of: vapour recovery pumps, proportional valves, co-axial hoses and vapour recovery type dispensing nozzles;
- Part or full closure of the site in order to install the equipment, with the associated loss of revenue / sales (in the case of existing sites);
- Additional power (electricity) requirements to operate the Stage II equipment;
- Additional maintenance requirements for the Stage II equipment;
- Checks on operational compliance of the Stage II system;
- Additional requirements related to the regulatory system (see below).

3.3 Enforcement

The existing Stage I and Stage II petrol vapour recovery legislation in the UK is enforced by local authorities in England, Wales and Northern Ireland and by SEPA in Scotland.

All new service stations with an annual throughput above 500m^3 would be required to apply for a permit to cover Stage II controls. This is already the case under UK legislation so there would be expected to be no change for these installations.

All existing service stations above the defined annual throughput threshold (3,000m^3 according to the Commission's proposal) but below the current UK threshold (3,500m^3) would be regulated for Stage II controls; they are currently regulated only for Stage I controls. They would be expected to apply for a variation to their permit to cover this, with an associated cost, as well as paying an increased subsistence charge to reflect the level of regulatory effort associated with enforcement of the legislation[16].

In addition, all existing service stations with an annual throughput above 500m^3 would, when undergoing a major refurbishment, be required to apply for a variation to their permit to cover Stage II controls (if these are not already covered), as well as the existing requirement for Stage I controls. They would also pay an increased annual subsistence charge.

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[16] The operator of an installation must apply for a permit (or variation thereto) and must pay a fee for doing so, which is to cover the local authority's costs. They must also pay an annual subsistence charge to cover local authorities' continuing regulatory costs once a permit has been issued. The subsistence charge is greater for those service stations covered by both Stages I and II than for those covered by Stage I only.

4. Baseline definition and review of new provisions

4.1 Overview

This section provides a brief review of key factors related to UK service stations, petrol sales and current emissions controls, as well as reviewing some of the key provisions of the proposed Directive that have the potential to create impacts for the UK.

In particular, consideration is given to: numbers of service stations in the UK and sales of petrol; potential additional coverage of these by Stage II controls under the proposed Directive; provisions on petrol vapour capture efficiency and monitoring/testing; and to levels of VOC emissions from service stations.

4.2 Service station numbers and petrol sales

Data have been provided for this assessment by Experian Catalist on the numbers of petrol stations and estimated petrol sales associated with those petrol stations. These data are set out in detail in Appendix A to this report and suggest that there were around 9,250 service stations in the UK, with annual petrol sales of around 21.7 million m^3, in 2008[17]. There has been a recent decline in the number of service stations in the UK; the number in 1967 was around 40,000 and the number in 2000 around 13,000 (there has been a trend towards fewer but larger service stations). In 2007, around 77% of petrol outlets were located in England, 10% in Scotland, 6% in Wales and 5% in Northern Ireland[18].

A large service station – one selling around 5,000m^3 fuel per year – is currently understood to cost around £2 million to build (UKPIA, 2009a)[19]. Petrol margins are relatively small, assumed herein to be around 5-6p per litre gross margin and around 2p per litre profit.

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17 The latest Government figures suggest that *retail* petrol sales were 16.8 million tonnes or around 22.9 million m^3 in 2007 and 15.9 million tonnes or around 21.6 million m^3 in 2008 (plus 0.8 million m^3 commercial sales), (DECC Digest of UK Energy Statistics, demand for key petroleum products, 23 December 2008 and 26 March 2009). These figures are in sufficient agreement for the purposes of the current analysis, which is based on retail petrol sales.

18 Energy Institute (2008). Around 1% were located in the Channel Islands, Isle of Man and Isle of Wight. Figures have been rounded.

19 UKPIA (2009a): Industry information – Marketing & retailing, UK Petroleum Industry Association website, accessed 4 March 2009.

4.3 Applicability of current and possible future Stage II controls

The current UK Stage II legislation applies to existing service stations with an annual petrol throughput above 3,500m^3 from 2010[20]. Based on the Catalist data, this covers around 1,750 service stations or just under 20% of the total number. However, these service stations were responsible for around 10.5 million m^3 throughput, just under 50% of the UK total, and hence an equivalent proportion of potential VOC emissions from vehicle refuelling.

In addition, the current UK legislation applies to new service stations with an annual throughput above 500m^3 from 2010. Therefore, as older stations are replaced with new ones (at a different location), there will be a progressive uptake of additional Stage II controls. The number of service stations within the range 500-3500m^3 is around 5,850 or 63% of the total number. These service stations were responsible for a further 10.7 million m^3 throughput, again just under 50% of the UK total throughput and hence potential VOC emissions from vehicle refuelling.

Service stations in the range 0-500m^3 accounted for a further 0.4 million m^3 throughput, giving a total of 21.7 million m^3 in 2008[21].

The proposed Directive would require more existing service stations to introduce Stage II controls. In particular, all existing service stations with an annual throughput above 500m^3 would, *when undergoing a major refurbishment*, be required to introduce Stage II controls from 2012 and all existing service stations with throughput above 3,000m^3, regardless of whether refurbished, would be required to install such controls. Note that there would not be any additional implications for new service stations, as these are already required to introduce Stage II controls under current UK legislation[22].

The table below provides an indication of the potential numbers of service stations and petrol sales that could be affected by the proposed legislation. These are total numbers and no distinction is made between new, existing and refurbished stations.

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[20] Specifically, if the annual throughput exceeds the relevant threshold in any of the three years preceding the relevant date.

[21] This figure is slightly lower than the most recent data for 2008 (since provisional data for petrol and diesel sales were used), as described above.

[22] The analysis included assumptions regarding (a) replacement of existing service stations with new ones e.g. in a different location as some are closed and new ones opened; (b) major refurbishments. Only the former has been assumed to be relevant for the current UK Stage II legislation (i.e. major refurbishments are not assumed to require Stage II under current UK legislation).

Table 4.1 Potential numbers of service stations and petrol sales affected in different size ranges

Petrol throughput range (m^3)	Number of service stations	Petrol throughput (million m^3)
3,000-3,500	532 (6%)	1.7 (8%)
2,000-3,500	2280 (25%)	6.1 (28%)
1,000-3,500	4789 (52%)	10.0 (46%)

Figures in parentheses indicate the percentage of the UK total. Based on data from Experian Catalist.

The above sets out the likely size of the markets that would be affected by the proposed legislation depending upon the threshold set for applicability above certain annual throughputs. There are also other provisions in the proposed Directive that would mean additional service stations would be required to implement Stage II controls, these are as follows:

- Under the current UK legislation, all new service stations with a throughput above $500m^3$ are required to be equipped with Stage II controls from 2010. The Commission's proposal would additionally require all new stations, irrespective of throughput, to install Stage II controls where they are situated under permanent living quarters or working areas[23]. The Council Presidency's suggested amendments would apply to new service stations above $100m^3$ throughput;
- The current UK legislation does not require the installation of Stage II controls at existing service stations with a throughput below $3500m^3$. The Commission's proposal would imply installation Stage II controls at any service station with a throughput above $500m^3$ when undergoing a major refurbishment. The Council Presidency's suggested amendments would apply this at a threshold of $100m^3$ and to all such service stations situated under permanent living quarters or working areas.

In relation to the Council Presidency suggestions that certain provisions be applied to service stations with throughput between 100 and $500m^3$, it is of note that the UK has a derogation from the requirements of the Directive on Stage I petrol vapour recovery for service stations which unload into stationary storage tanks $100m^3$ to $500m^3$ of petrol in any 12-month period[24]. Assuming that this derogation will be continued, it may be appropriate for the UK to also apply a similar derogation for Stage II controls, since the benefits of Stage II controls are typically foregone if no Stage I controls exist[25].

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23 The number of such service stations in the UK is not known, though it is believed to be relatively small.

24 As allowed for under Article 6(4) of Directive 94/63/EC.

25 Since petrol vapours returned to the underground storage tank by Stage II controls would not be recovered during unloading of petrol into storage tanks. However, if an "at-pump" system were to be used, with petrol vapours recovered above ground and returned direct to the dispenser for refuelling of vehicles, these VOC benefits would not be foregone.

4.4 Petrol vapour capture efficiency

In the UK, requirements for the petrol vapour capture efficiency of Stage II systems (amount of petrol vapour captured compared to the amount that would otherwise be emitted to the atmosphere in the absence of a Stage II system) are set out in statutory guidance, namely PG1/14(06). This guidance states that the Stage II system should be designed to ensure recovery of at least 85% of the displaced petrol vapours. In order to achieve this, the equipment used should be approved for use under the regulatory regime of at least one EU or EFTA country and certified to achieve at least this efficiency level ("type approval").

The Commission's proposed Directive specifies a capture efficiency of 85% of more, which is in line with the current position in the UK[26,27].

4.5 Monitoring and testing

Testing of petrol vapour capture efficiency post-commissioning is not generally practicable. Therefore, once a Stage II system has been "type approved", in-situ testing generally relates to ensuring that the ratio of the volume of petrol vapour recovered (this will include air as well as petrol vapour) to the volume of petrol dispensed is at least 0.95 and no more than 1.05 – this is described in PG1/14/(06)[28]. The lower end of this range effectively ensures that an appropriate volume of vapour is being drawn back through the Stage II system to achieve a high level of vapour recovery; the upper end ensures that this volume is not so high as to cause excessive over-pressurisation in the underground storage tank, which could lead to release of vapours through the service stations pressure-relief valve. This test is usually performed as a "dry" test, with petrol dispensing simulated rather than actually dispensing petrol.

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26 The Council Presidency's proposed amendments suggest further clarification that the efficiency should be certified by the manufacture in accordance with relevant national or European technical standards or type approval procedures. The European Parliament rapporteur's draft report suggested a minimum efficiency of 95%, citing application of such levels in legislation in other countries. In California, efficiency is required to be 95% (Vapor Recovery Certification Procedure CP - 201, Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities, California Air Resources Board). However, it is understood that there are requirements for standardised filling necks in cars in the US (which there is not in the EU) which will tend to make achieving such high efficiencies difficult for the EU.

27 The Council Presidency's proposed amendments would also allow the non-essential elements of the Directive to be adapted to technical progress (by the Commission, with scrutiny of the European Parliament and Council), in particular to ensure consistency with any relevant CEN standards that may be drawn up in relation to the provisions on vapour capture efficiency and checks/monitoring.

28 This is an indirect way of checking that the Stage II equipment is functioning correctly and hence that the "type approved" vapour capture efficiency is being achieved.

As set out in PG1/14(06), such testing should be undertaken every year, unless a system is in place for automatic monitoring of vapour recovery effectiveness, in which case the frequency should be once every three years[29]. In addition, a check on vapour containment integrity should be tested at least once every three years (in all cases).

The Commission's proposal essentially places comparable requirements upon monitoring and testing to those in place in the UK. Therefore, it is not expected that any additional monitoring and testing requirements would be associated with the proposed Directive for service stations already required to implement Stage II controls in the UK. Additional service stations required to implement State II under the proposed Directive[30] would thus need to apply the same monitoring and testing as is already expected of UK service stations with Stage II.

4.6 VOC emissions from service stations

As Stage II controls are progressively taken up in the UK – for existing service stations with throughput above 3500m^3 per year and new service stations above 500m^3 per year – there will be a reduction in VOC emissions over time.

Based on the approach set out in Appendix A, VOC emissions in 2008 from refuelling at service stations were estimated to be around 24,000 tonnes. With the expected additional uptake of Stage II controls, these are predicted to decline to between 7,000 and 12,000 tonnes in 2020[31]. The table 4.2 provides details of estimated emissions of VOCs under current UK legislation from the various sources at service stations including a comparison with 'uncontrolled' emissions, those that would occur with no controls (either Stage I or Stage II) in place.

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29 Such a system should automatically shut off the system if any fault is not rectified within one week.

30 See Section 4 for details of the numbers of service stations expected to be affected.

31 The range represents uncertainty regarding whether there will be a decline in UK petrol sales. These figures are lower than data included in the UK national atmospheric emissions inventory and associated emissions projections (AEA Energy & Environment, National atmospheric emissions inventory – historical emissions and projections, data provided by AEA Energy & Environment, 17 March 2009), which project emissions from refuelling of around 13,500 tonnes in 2020 (and around 27,000t in 2007). The differences are expected to be due to use of different data sets on the numbers of service stations and the distribution of total petrol sales between service stations of different sizes (with associated implications for the predicted uptake of Stage II controls). Other differences may arise as a result of assumptions regarding the vapour pressure of petrol and average temperature, which both affect the emissions estimation model.

Table 4.2 Projected VOC emissions in 2020 under UK legislation compared to uncontrolled emissions (tonnes)

Emission source	2020 Uncontrolled	2020 UK legislation
Filling underground storage tanks	10,200 – 16,200	600 – 1,000
Storage tank breathing losses	1,400 – 2,200	1,400 – 2,200
Dispensing to automobiles	15,400 – 24,300	7,200 – 11,400
Drips and spillage	900 – 1,500	900 – 1,500
Total emissions	27,900 – 44,100	10,100 – 16,000

Notes: "Uncontrolled" emissions refers to a hypothetical situation with no Stage I or Stage II controls in place. Stage I vapour recovery applies to filling underground storage tanks; Stage II vapour recovery applies to dispensing to automobiles.

If the Commission's proposed Directive were to be adopted, it is estimated that emissions from dispensing to automobiles could be reduced to between 5,000-7,900 tonnes by 2020, an additional reduction of between 2,200-3,500 tonnes per year[32].

If the requirements to apply Stage II controls were also to apply to service stations (new stations and those undergoing a major refurbishment) with a throughput of 100-500m^3, the additional reduction in emissions from refuelling could be between 100-200 tonnes per year in 2020[33]. Note, however, that these service stations are currently subject to a derogation for Stage I controls so installation of Stage II controls could be questionable[34].

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32 The range reflects different assumptions on whether and how petrol sales will decline in the future. The higher values assumes constant petrol sales from 2008-2020 while the lower values assume that petrol sales continue to decline according to the historical trend.

33 These data have been calculated assuming application to all service stations with a throughput below 500m^3, not excluding those below 100m^3 due to data availability. However, the number of service stations and associated throughput of those below 100m^3 is relatively small: around 20% of the number of stations below 500m^3 and 2% of total numbers and around 3% of petrol sales for stations below 500m^3 and 0.05% based on previous projections for 2010 (Defra 2005 Impact Assessment).

34 There would only be a benefit in terms of reduced VOC emissions if vapours were to be recovered at the pump. If vapours were to be returned to the underground storage tank and no Stage I controls are in place, the emissions would not be captured during unloading from vehicles into the underground storage tank.

5. Costs

5.1 Compliance costs

5.1.1 Approach

The approach taken to estimation of costs of compliance is set out in Appendix A. In broad terms, the following approach has been adopted.

A baseline has been developed, including estimated uptake of Stage II controls from 2010 according to UK legislation. This assumes uptake at existing and new service stations with throughput above the relevant thresholds. The baseline calculations also include replacement of existing service stations with new stations and major refurbishments (only new stations are subject to Stage II requirements under current UK legislation). It includes estimates of the numbers of service stations and associated petrol sales within a range of sizes (throughput intervals of 500m^3).

The implications of the proposed Directive for *additional* uptake of Stage II controls have been estimated, including the differing requirements for new service stations, existing refurbished service stations and non-refurbished service stations.

In general, no additional cost implications have been assumed for new service stations, as these are already covered under existing UK legislation[35].

For existing service stations above the relevant throughput threshold (3,000m^3 under Option 2), the costs of installing Stage II controls have been estimated, assuming implementation by the relevant deadline (2020 for Option 2). There are various one-off and ongoing costs associated with implementing Stage II controls and costs have been assumed to be higher for those service stations that are not predicted to have undergone a (scheduled) major refurbishment by the relevant deadline – such costs are associated with, for example, additional work in underground works and installation of underground pipework.

For other existing service stations (those below 3,000m^3 throughput but above 100m^3 for option 2), it has been assumed that the costs of installing Stage II controls will be incurred if the service station undergoes a major refurbishment.

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35 With the exception of those with annual throughput less than 500m^3.

Sensitivities regarding the expected future changes in service station numbers and total petrol sales have been included (either assuming constant values from 2008 or a continuation of historical declines in service station numbers and projected changes in future petrol sales based on data from DfT).

The cost elements included are: materials, equipment and labour associated with making the service station "Stage II ready" (e.g. underground works); costs of vapour recovery equipment; costs associated with loss of fuel sales during installation; additional maintenance and power costs during operation of the Stage II equipment; costs of regular checking for correct operation (compliance); and additional fees and charges under the relevant regulatory regime.

The costs are those that are additional to those that would otherwise be incurred, either through existing UK legislation on Stage II controls or through continued operation without Stage II controls (the latter for service stations that are currently exempt).

All costs are quoted in 2008 prices. The reference year for presentation of emissions (and comparison with costs incurred) is 2020. The assessment period for calculation of present value and annualised costs is 14 years[36].

5.1.2 Costs for a 'typical' service station

The estimated costs of installing Stage II controls for a typical service station are set out in the table below, with typical service stations taken in each of the 500m^3 petrol throughput ranges considered (these stations will also sell diesel which is not considered here). These figures compare reasonably well with estimates from industry that typical costs being incurred for service stations currently installing Stage II controls in the UK are around £25-30,000 for service stations with throughput between 3,000 and 3,500m^3.

The recovered fuel may be re-sold. If the petrol vapour is recovered at the pump, the retailer will accrue the benefits associated with sale of this petrol. If it is returned to the underground storage tank, the petrol vapours may be returned to the petrol terminal/refinery, in which case the additional benefits would occur for the petrol suppliers[37]. The value of the recovered fuel has been taken into account based on the average petrol value excluding VAT and duty in 2008, as described in Appendix A.

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[36] The amortisation period assumed for certain cost elements varies and the results are presented in ranges where sensitivity analysis has been undertaken. For example, an assumed lifetime of 5 years has been assumed for vapour recovery nozzles, with sensitivity analysis undertaken assuming 14 years.

[37] In practice, the extent to which any additional vapour (over and above that otherwise collected through Stage I controls) will be returned to the terminal as a result of displacement and collection during unloading of petrol into storage tanks will depend upon the extent of vapour/liquid equilibration in the storage tank (amongst other factors).

It can be seen from the data below that the costs of installing Stage II controls represent a significantly greater proportion of profit and gross margin associated with petrol sales for smaller service stations. This has implications for the extent to which service stations will be able to bear the additional costs of implementing Stage II controls. Whilst the annualised costs are a relatively small percentage (around 6%) of profits from petrol for a service station with petrol throughput between 3,000m^3 and 3,500m^3 where controls can be introduced as part of a planned refurbishment, the costs for a service station with 2,000-2,500m^3 throughput if required to introduce Stage II controls where it would not otherwise be refurbished by the implementation deadline could be significantly higher (perhaps 17% of annual profits from petrol).

There are thus implications for the viability of petrol stations depending upon the timescales for introduction of Stage II controls (affecting whether installation can take place as part of planned refurbishments) as well as for the throughput threshold that applies. It is possible that some service stations would close rather than incur the costs of implementing Stage II controls, as highlighted by UK industry stakeholders.

Table 5.1 Summary of estimated costs for a typical service station

Service station throughput (m^3)	0-500	501-1000	1001-1500	1501-2000	2001-2500	2501-3000	3001-3500
Emissions reductions (t/yr)	0.2	0.7	1.2	1.7	2.1	2.6	3.1
Retail value of recovered fuel (excluding taxes) (£/year)	130	400	660	930	1190	1460	1720
New/refurbished stations							
Capital costs (£)	18,000	19,000	26,000	27,000	28,000	29,000	30,000
PV costs (£)	29,000	30,000	38,000	39,000	40,000	41,000	42,000
Total annualised costs average (£/year)	2,900	2,900	3,700	3,800	3,900	3,900	4,000
£/t abated	12,000	4,100	3,100	2,300	1,800	1,500	1,300
£/t abated inc value of recovered petrol	11,400	3,500	2,600	1,700	1,200	900	700
Non-refurbished stations							
Capital costs (£)	56,000	65,000	90,000	100,000	109,000	119,000	129,000
PV costs (£)	63,000	64,000	81,000	82,000	83,000	84,000	85,000
Total annualised costs average (£/year)	5,600	5,700	7,300	7,400	7,500	7,500	7,600
£/t abated	23,500	7,900	6,100	4,400	3,500	2,900	2,400
£/t abated inc value of recovered petrol	22,900	7,300	5,600	3,900	2,900	2,300	1,900
Estimated petrol margins and profit for comparison							
Estimated profit from petrol sales (£/year)	5,000	15,000	25,000	35,000	45,000	55,000	65,000
Estimated gross margin from petrol sales (£/year)	15,000	45,000	75,000	105,000	135,000	165,000	195,000

All average cost values are averages of the high and low costs for the conventional system (not at-pump system). Emissions reductions and associated value of recovered fuel based on throughput at the mid-point of the range. Annualised and PV costs calculated using a discount rate of 3.5% and an assessment period of 14 years. Annual profit and gross margin from petrol sales based on an assumed 2p per litre profit and 6p per litre gross margin. All data have been rounded. Service stations with throughput >3500m^3 are not included as these are required to install Stage II controls by 2010 under existing UK legislation.

5.1.3 UK costs (Option 2)

Based on the approach to estimation of costs set out above and in Appendix A, estimates have been made for the costs for all UK service stations of implementing Stage II legislation as set out in Section 2 of this report.

The table below provides a summary of the estimated costs, both including and excluding the value of the recovered fuel. The latter provides an indication of the costs faced by service stations (assuming use of a conventional Stage II system) whereas the former represents the net costs for the petrol distribution and retail sector.

The ranges of values presented reflect uncertainties regarding the assumed lifetimes of the various Stage II equipment and whether or not the historical declines in service station numbers and petrol sales will continue in the future. Further details of these sensitivities are provided in Appendices A and B of this report.

The values in Table 5.2 will tend to somewhat overestimate the costs because, for existing service stations that have not undergone a major refurbishment by the compliance deadline (2020), the costs have not been weighted according to the number of years before a planned refurbishment for each of the service stations. The differential in costs between fitting Stage II controls during a planned major refurbishment and when not planned will tend to be lower the closer a service station is in time to a planned major refurbishment. For Option 2, taking this into account would reduce the overall costs by around 7%[38].

Table 5.2 Summary of estimated costs for Option 2

Cost element	Details
Numbers of service stations affected and reductions in emissions	
Number of additional service stations applying Stage II controls	1,260 – 1,770
Total reduction in emissions from refuelling under this option (tonnes VOC per year)	2,200 – 3,500
Costs excluding the value of recovered petrol	
Total annualised costs, including one-off and ongoing costs (£m per year)	4.0 – 7.4
Present value costs (£m)	54 – 78

[38] The *additional* costs for existing service stations not having already undergone a major refurbishment would be reduced significantly, by around 75% for a 2020 deadline (compared to the costs for installing Stage II during a major refurbishment). However, as these only represent just over 20% of the total costs – the remainder related to costs for installation of Stage II during planned major refurbishments for service stations 500-3,000m^3 – the effect on the overall costs is relatively small. This effect will tend to further reduce the costs for later deadlines and increase the costs if a lower throughput threshold for existing service stations is applied.

Cost element	Details
Cost effectiveness (£/t VOC abated)	1,600 – 2,300
Costs including the value of recovered petrol	
Retail value of recovered petrol, excluding taxes (£m per year)	1.2 – 1.9
Total annualised costs, including one-off and ongoing costs (£m per year)	2.7 – 5.5
Present value costs (£m)	40 – 58
Cost effectiveness (£/t VOC abated)	1,100 – 1,700

Emissions reductions and associated costs comparisons are based on emissions in 2020 and relate to the difference between effects of the proposed legislation and the current UK legislation. The ranges given reflect uncertainties in factors including: the expected lifetimes of Stage II equipment; and the expected decline (or not) in petrol station numbers and petrol sales. Costs represent an average of Stage II equipment costs for the conventional system (see Appendix A). Costs are expressed in 2008 prices. Figures have been rounded.

5.1.4 Costs under different possible implementation scenarios

In order to explore the implications of potential changes to the current proposals, the costs associated with setting certain key parameters differently in the proposed legislation have been estimated. In particular, the following scenarios have been considered:

- Timescale for implementation at existing service stations: 2015 and 2025 as well as 2020;
- Throughput threshold for existing service stations: 1,000m^3 and 2,000m^3 as well as 3,000m^3; and
- The various combinations of the above.

These have been assessed using a single set of assumptions regarding expected changes in the petrol retail market and assumed lifetime of Stage II equipment. The table below provides a summary of the results.

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As can be seen from the data in this table, the throughput threshold at which the Stage II legislation is set for existing service stations makes a difference to the overall level of costs, particularly when the timescale for compliance is relatively short (e.g. 2015).

The overall costs decrease and cost-effectiveness increases with longer timescales allowed, as more service stations would be able to install Stage II controls as part of planned maintenance activities.

There is a relatively small difference in overall costs between assumed implementation by 2015 and implementation by 2020 at all existing service stations. The *total* number of service stations applying Stage II controls by 2020 is the same in 2020 as that for implementation in 2015. However, there is a lower proportion of service stations that will have undergone a scheduled major refurbishment (and will hence incur greater costs) if the timescale is 2015. The costs per service station for these stations will be substantially higher, while not necessarily affecting the overall costs or cost-effectiveness to a great extent.

If the timescale for implementation for existing service stations is set to 2025, there is no variation in costs – in the model used for this assessment – if the throughput threshold is set at different levels. This is because it is assumed that all service stations will have undergone a major refurbishment or been replaced with a new service station[39]. Therefore, the costs presented represent the additional costs, compared to the situation under current UK legislation, associated with the installation of Stage II controls at existing service stations when they are refurbished.

5.2 Administrative costs

There would be additional administrative costs associated with bringing additional service stations under Stage II controls, both for service station operators and for the regulators.

For the purposes of this assessment, it has been assumed that the additional permit application fee and ongoing additional subsistence charge payable by service stations to the regulators reflect the additional regulatory burden upon the **authorities**.

Under the main proposal (Option 2), an additional 1,770 service stations would be brought under Stage II control (by 2020). Assuming an additional £97 fee for variation to the site's permit and an increase in the annual subsistence charge from £149 to £214, the total additional one-off costs would be around £170,000. The additional ongoing (annual) costs would be around £115,000. The total present value costs would be around £1.4 million[40].

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[39] In practice, it is likely/possible that there will be some service stations that have not been refurbished by 2025, though it is assumed that the number is likely to be relatively small.

[40] Including ongoing costs plus capital costs annualised over a period of 14 years with a discount rate of 3.5%.

If the throughput threshold were changed, there would be differences in the additional administrative costs. Based on the same assumptions as above:

- At a threshold of 1,000m^3 for existing service stations, an additional 3,700 service stations would be affected compared to the current UK legislation. Additional one-off costs would be around £360,000 with additional annual costs of around £240,000 and total present value costs of around £3.0 million;
- At a threshold of 2,000m^3 for existing service stations, an additional 2,560 service stations would be affected compared to the current UK legislation. Additional one-off costs would be around £250,000 with additional annual costs of around £165,000 and total present value costs of around £2.1 million.

Additional administrative costs for the service station **operators** have been estimated assuming that ten hours is required to produce and submit an application for variation of the permit and that five hours is required each year for ongoing reporting. The associated costs for the UK would be as follows[41]:

- At a threshold of 1,000m^3 for existing service stations, additional one-off costs of around £580,000, with additional annual costs of around £290,000 and total present value costs of around £3.7 million;
- At a threshold of 2,000m^3 for existing service stations, additional one-off costs of around £400,000, with additional annual costs of around £200,000 and total present value costs of around £2.6 million; and
- At a threshold of 3,000m^3 for existing service stations (Option 2), additional one-off costs of around £280,000, with additional annual costs of around £140,000 and total present value costs of around £1.8 million.

[41] Estimated assuming data from the Standard Cost Model for "managers and proprietors - garage managers", with hourly pay costs of £10.72 plus 30% overhead (converted from 2005 to 2008 prices using a factor of 1.118 based on the Retail Price Index).

6. Benefits

6.1 Approach

Emissions of VOCs at service stations and the reductions associated with the application of Stage II controls have been estimated using an approach set out in a report by the Institute of Petroleum (2000)[42]. This is described in greater detail in Appendix A and the results summarised in Sections 5.1.3 and 5.1.4.

Due to the tight timescales involved for the preparation of this impact assessment it has not been possible to undertake detailed environmental and health impacts modelling. Therefore the potential benefits (damage costs avoided) that may be realised if the estimated VOC emission reductions are achieved have been estimated through the application of the damage cost functions developed by the Interdepartmental Group on Costs and Benefits (IGCB)[43,44].

For comparison with the European Commission's EU-wide impact assessment, potential benefits have also been estimated using the cost-benefit analysis developed under the Clean Air for Europe (CAFE) programme[45]. A range of values have been calculated under the CAFE programme to take account of variation in the methodologies used to value mortality; this reflects the use of the median and mean estimates for the value of a life year (VOLY) and statistical life (VSL).

The IGCB and CAFE damage cost functions vary quite significantly for many pollutants. The main differences relate to:

- The use of different pollution metrics (IGCB use $PM_{2.5}$ and CAFE uses PM_{10});
- A 6.5% higher UK population estimate is used in CAFE compared to IGCB;
- IGCB only uses YOLL (years of life lost) whereas CAFE uses YLL (years life lost) and VSL (value of a statistical life);

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42 Protocol for the estimation of VOC emissions from petroleum refineries and gasoline marketing operations, Institute of Petroleum, 2000.

43 AEAT (2006): Damage costs for air pollution. Final report to Defra, March 2006. Available from: http://www.defra.gov.uk/environment/airquality/publications/stratreview-analysis/damagecosts.pdf.

44 IGCB (2007): Economic analysis to inform the Air Quality Strategy. Final report, July 2007. Available from: http://www.defra.gov.uk/environment/airquality/publications/stratreview-analysis/index.htm.

45 Available from: http://www.cafe-cba.org/assets/marginal_damage_03-05.pdf.

- The impact matrix used;
- CAFE places much higher values on health endpoints, with the high value 2.75 times higher than the IGCB value;
- The IGCB figures discount (at 3.5% p.a) and uplift (at 2% p.a.) values in accordance with the Green Book whereas CAFE does not; and
- CAFE includes a much wider range of morbidity effects equating to approximately 10% of the total impact value.

The damage cost functions applied to calculate the indicative benefits are presented in Table 6.1. The IGCB damage cost estimates are the UK's currently preferred measure. It is evident that there is a significant difference between the two approaches.

Table 6.1 Damage cost functions for VOCs (£ per tonne of pollutant reduced) (Note 1)

	£/tonne abated		
UK IGCB	**Low**	**Best**	**High**
	28	28 (Note 2)	995
EC CAFE (Note 3)	**Low**	**Best**	**High**
	876	1,991 (Note 4)	2,548

Notes:

1) IGCB figures were provided by Defra (18 February 2008), presented in 2008 prices. VOC damage cost functions have been estimated based on the original Final RIA on the implementation of the Paints Directive (2004/42/CE), presented in 2008 prices.

2) Best estimate assumed to be at the lower end of the range based on discussion with Defra (2 April 2009). This is subject to significant uncertainty.

3) Exchange rate of €1=£0.8.

4) Best estimate is €2,500.

The IGCB VOC damage cost functions have been estimated based on the transfer of values from the original Final RIA on the implementation of the Paints Directive (2004/42/CE)[46]. The low end of the range has been taken as the current best estimate following discussion with Defra. Monetised estimates of the benefit of a reduction in VOC emissions were originally estimated in the Paints Directive RIA for the following:

[46] See Annex C - http://www.opsi.gov.uk/si/em2005/uksiem_20052773_en.pdf

- Acute health effects to population due to ozone exposure – deaths brought forward and respiratory hospital admissions (additional or brought forward);
- Effects on materials due to ozone exposure;
- Effects on crop production due to ozone exposure;

However, the following effects were not quantified in the original RIA:

- Physical injury to crops from ozone exposure (affecting value) – this effect was thought to be small relative to the effect on crop yield above;
- Change in exposure to odour "likely to cause annoyance" – this effect was thought to be small;
- Effects upon forest and natural ecosystems due to ozone exposure – quantification was not possible but the effects are potentially important;
- Chronic health effects to population due to ozone exposure – quantification was not possible but the effects are potentially important; and
- Direct effects of VOCs.

Therefore, the benefits estimated through the application of damage cost functions may be underestimated[47].

In addition, the benefits presented based on the IGCB damage cost functions only relate to those that may be realised in the UK if the UK were to implement these measures. They do not take into account the additional benefits that may be achieved in the EU from the UK implementing these measures (i.e. transboundary impacts)[48].

As the damage cost functions address the health and environmental impacts of VOC emissions and do not take into account benefits due to reductions in greenhouse gas emissions, these have been estimated separately taking into account the following factors:

- Increases in CO_2 emissions occurring as a result of increased electricity consumption required to power the Stage II petrol vapour recovery equipment;

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[47] For the CAFE damage cost functions a number of effects are also excluded from quantification, including impacts on ecosystems and cultural heritage.

[48] Furthermore, recent work funded by the US Health Effects Institute suggests that longer term exposure to ozone air pollution may be associated with premature respiratory mortality and this is not taken into account in the IGCB data. This work would need to be reviewed by relevant expert groups (such as COMEAP) before any changes are made to the damage cost functions.

- Reductions in climate change impacts associated with the reduction in VOC emissions, due both to the chemical effect of the VOC on the atmosphere and due to the CO_2 arising from the degradation of the VOC in the atmosphere. It is noted that these emissions do not form part of the 'basket of six' greenhouse gases covered by the Kyoto Protocol.

The value of the decrease in greenhouse gas emissions has been estimated using Government guidance on the shadow price of carbon (SPC). This is described further in Appendix A.

6.2 Results

6.2.1 UK benefits (Option 2)

Based on the approach to estimation of emission reductions and associated damage costs avoided set out above and in Appendix A, estimates have been made for the additional benefits associated with the Commission's proposals relative to current UK legislation. Further details are provided in Appendix B of this report.

Table 6.2 Summary of estimated benefits for Option 2

Element	Details
Emission reductions	
Total reduction in VOC emissions from refuelling under this option (tonnes VOC per year)	2,200 – 3,500
Net CO_2 emissions reductions (tCO_2e per year)	22,000 – 35,000
Damage costs avoided	
Damage costs avoided (£m per year)	IGCB: 0.06 – 0.10 (0.06 – 3.4) CAFE: 4.5 – 6.8 (2.0 – 8.8)
Present value of damage costs avoided (£m)	IGCB: 0.7 – 1.0 (0.7 – 37) CAFE: 50 – 75 (22 – 96)
CO_2 emission reductions	
Value of greenhouse gas emissions avoided (£m per year)	0.7 – 1.0
Net present value of greenhouse gas emissions avoided (£m)	8 – 13
Total environmental and health benefits (quantifiable)	
Annual benefits (£m per year)	IGCB: 0.7 – 1.1 (0.7 – 4.4) CAFE: 5.1 – 7.8 (2.6 – 9.7)
Net present value (£m)	IGCB: 9 – 13 (9 – 50) CAFE: 58 – 87 (30 – 108)

Emissions reductions and associated benefits comparisons are based on emissions in 2020 and relate to the difference between effects of the proposed legislation and the current UK legislation. The ranges given reflect uncertainties in factors including the expected decline (or not) in petrol station numbers and petrol sales, plus the range in the damage cost functions used (the latter figures are in brackets in the above). Benefits are expressed in 2008 prices. Figures have been rounded.

6.2.2 Benefits under different possible implementation scenarios

As discussed in previous sections, in order to explore the implications of potential changes to the current proposals, a number of variations around certain key parameters have been investigated. In particular, the following scenarios have been considered:

- Timescale for implementation at existing service stations: 2015 and 2025 as well as 2020;
- Throughput threshold for existing service stations: 1,000m^3 and 2,000m^3 as well as 3,000m^3; and
- The various combinations of the above.

These have been assessed using a single set of assumptions regarding expected changes in the petrol retail market and assumed lifetime of Stage II equipment. The table on the following page provides a summary of the results.

6.2.3 Benefits to the UK of EU-wide implementation

In addition to the benefits expected to be realised as a result of the implementation of the Commission's proposals in the UK, there may also be some benefits to the UK arising from a consistent implementation of Stage II controls across the EU. As highlighted in the Commission's impact assessment supporting the legislative proposal, at least seventeen of the EU's twenty-seven Member States have national legislation requiring Stage II controls to be fitted at service stations. Therefore, a consistent EU-wide application should bring about fairly significant reductions in VOC emissions from refuelling (estimated to be approximately 12-18kt reduction per year for the EU as a whole). Application of Stage II controls in those Member States which do not have any national requirements should result in health and environmental benefits for neighbouring countries. Although the majority of the UK's closest neighbours (including Belgium, France, Germany and the Netherlands) already have national legislation in place, some are yet to require the installation of Stage II controls (including Ireland and Spain). However, these benefits are expected to be minimal and have therefore not been quantified and included in the analysis.

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7. Specific impact tests

7.1 Competition assessment

The competition guidelines (August 2007)[49] set out four main questions. These require considering whether the proposed Stage II PVR Directive would affect the market by:

1. Directly limiting the number or range of suppliers.
2. Indirectly limiting the number or range of suppliers.
3. Limiting the ability of suppliers to compete.
4. Reducing suppliers' incentives to compete vigorously.

From a consideration of the likely impacts of the proposed Directive relative to the requirements already in place in the UK, it appears that the proposals are unlikely to result in any significant competition issues.

The impact assessment prepared for the UK national Stage II legislation[50] reached a similar conclusion although it was noted that a minor impact on competition would be that new operators (with a throughput >500m^3) would have to install Stage II controls and incur associated costs whereas existing operators (between 500-3,500m^3) would not, thus placing them at a slight advantage (although it was also noted that costs for new build are lower and most new service stations have throughputs >3,500m^3). The Commission's proposals would require all existing service stations with a throughput >100m^3 (with a possible derogation for 100-500m^3 sites) to install Stage II controls when they undergo a major refurbishment. This would therefore place them on a more level standing with new service stations which have to install Stage II controls when they are constructed.

As detailed in Section 5.1.2 of this report, the costs of implementation for individual service stations may, in some cases, be sufficient to make continued operation not viable. This is particularly true if the throughput threshold for existing service stations, irrespective of throughput threshold, is set at a low level (since the costs will be a greater proportion of petrol profits/margins for smaller service stations) or if the timescale for implementation are relatively short (meaning that service stations above the threshold would be less likely to undergo a planned major refurbishment before the deadline and would hence incur greater costs). In addition, some service stations (in particular, independent operators) may have limited access to finance in order to cover the up front capital costs of installation.

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[49] Completing competition assessments in Impact Assessments – guideline for policy makers, Office of Fair Trading, August 2007, http://www.oft.gov.uk/shared_oft/reports/comp_policy/oft876.pdf.

[50] Defra (2005): Final regulatory impact assessment on petrol vapour recovery stage II controls (PVR II).

Therefore, there exists some potential for the legislation to indirectly limit the number of suppliers by forcing closure of some service stations due to the costs of compliance. It has not been practicable to estimate the additional number of service stations that might close as a result of this proposed legislation and it should be noted there is already a trend towards reducing numbers of service stations in the UK.

7.2 Distributional effects on different size firms

Section 5.1.2 presents the approximate costs of installing Stage II controls for a 'typical' service station broken down by annual petrol throughput. This demonstrated that the costs of installing Stage II controls represent a significantly greater proportion of profit and gross margin associated with petrol sales for smaller service stations. This has implications for the extent to which service stations will be able to bear the additional costs of implementing Stage II controls. Whilst the annualised costs are a relatively small percentage (around 6%) of profits from petrol for a service station with petrol throughput between 3,000m^3 and 3,500m^3 where controls can be introduced as part of a planned refurbishment, the costs for a service station with 2,000-2,500m^3 throughput if required to introduce Stage II controls where it would not otherwise be refurbished by the implementation deadline could be significantly higher (perhaps 17% of annual profits from petrol)[51]. This is even higher for smaller service stations. It is unlikely that some or all of the costs of compliance could be offset by higher petrol prices; this will be primarily dependent upon the location of the service station and its proximity to other competitors.

Concerns have been raised by some stakeholders during consultation in relation to possible impacts on small service stations. As outlined above, the costs associated with the installation of Stage II controls could have an effect on the viability of smaller service stations. Although this is particularly relevant for those with the lowest throughputs (<500m^3), it may also apply to those with higher throughput (e.g. 2,000-3,000m^3). However, it is worth noting that the UK has a derogation from the requirements of the Directive on Stage I petrol vapour recovery for service stations which unload into stationary storage tanks 100m^3 to 500m^3 of petrol in any 12-month period[52]. Assuming that this derogation will be continued, it may be appropriate for the UK to also apply a similar derogation for Stage II controls, since the benefits of Stage II controls are typically foregone if no Stage I controls exist[53].

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51 UKPIA has highlighted (April 2009) that margins from petrol sales are lower in the UK than in some other Member States.

52 As allowed for under Article 6(4) of Directive 94/63/EC.

53 Since petrol vapours returned to the underground storage tank by Stage II controls would not be recovered during unloading of petrol into storage tanks. However, if an "at-pump" system were to be used, with petrol vapours recovered above ground and returned direct to the dispenser for refuelling of vehicles, these VOC benefits would not be foregone.

7.3 Social Impact Assessments

7.3.1 Race equality

The race equality impact of the proposals has been considered and it is not expected that the proposals will have any impact on race equality.

7.3.2 Rural communities

As discussed in Section 7.2, stakeholders have raised concerns about possible impacts on small service stations, most of which are located in rural areas and provide a valuable service to local communities. Stakeholders expect some of these to close if required to install Stage II controls. Section 5.1.2 presents the costs for a 'typical' service station which appear to confirm these concerns in that the annualised costs of installing Stage II controls for a small service station (100-500m^3) where not done as part of a scheduled major refurbishment are greater than the estimated annual profits from petrol sales, thus making it uneconomical to stay open. However, the UK already has a derogation from the requirements of the Directive on Stage I petrol vapour recovery for these sized service stations and it is expected that the UK would be able to apply a similar derogation for Stage II controls.

If a higher throughput threshold for existing service stations (say 1,000m^3 or 2,000m^3 compared to 3,000m^3 under Option 2) were applied, it is again possible that some service stations could close as a result of the requirement to implement Stage II controls (see also Section 7.1).

Closure of service stations in rural areas could result in a number of direct and indirect economic (e.g. increased fuel costs from having to drive further for fuel), social (e.g. reduced access to services) and environmental (e.g. increased emissions from travelling further for refuelling) impacts.

7.3.3 Human rights

The Commission's proposals are not expected to impact on any of the rights enshrined in any of the 14 articles of the European Convention on Human Rights, or of the 3 articles of the first Protocol thereto.

7.3.4 Ethnic minorities

The Commission's proposals are not expected to have a particular impact on ethnic minorities.

7.3.5 Gender equality

The Commission's proposals are not expected to impact on one gender more heavily than the other.

7.3.6 Disabled people

Air pollution will impact more significantly on those with certain disabilities than other healthy adults and the impact on disabled children will be greater than for non-disabled children. However, the Commission's proposals will lead to an improvement in air quality.

7.3.7 Children and young people

There is greater susceptibility of children and young people to air pollution due to greater sensitivity of their lungs as their lungs are growing and developing. However, the Commission's proposals will lead to an improvement in air quality.

7.3.8 Older people

There is greater susceptibility of older people to air pollution due to greater sensitivity of their lungs and reduced immune system. However, the Commission's proposals will lead to an improvement in air quality.

7.3.9 Income groups

The Commission's proposals are not expected to impact on any particular income groups more than any others.

7.3.10 Devolved countries

A key driver for the UK's application of the derogation for Stage I controls for service stations with a throughput of 100-500m^3 was the location and value to local communities of a number of these sized stations in rural areas in Scotland (see Section 7.3.2). Application of a similar derogation for Stage II controls would prevent the possible closure of these sites due to the costs associated with installing Stage II controls.

7.3.11 Particular regions of the UK

See Sections 7.3.2 and 7.3.10 of this report.

8. Summary

8.1 Policy options and effects on emissions

This report has considered the impacts for the UK of implementing a proposed Directive to require more widespread implementation of Stage II petrol vapour recovery controls. The key changes that would be required under the proposal (Option 2) as compared to the continued uptake under existing UK legislation (Option 1) are:

- Extension of controls to all existing service stations with an annual throughput above 3,000m^3 from 2020 (compared to 3,500m^3 by 2010 at present);
- Extension to all new and refurbished service stations with a throughput above 100m^3 from 2012 (with a potential derogation for those above 500m^3); and
- Extension to new service stations irrespective of throughput where these are situated below permanent living quarters or working areas from 2012.

Given that negotiations on the text of the proposed Directive are ongoing, a number of sensitivities have been explored regarding the timescales for implementation and the throughput thresholds to which the legislation will apply.

These proposals would affect operators of service stations who would be required to install and operate Stage II controls, as well as the relevant regulatory authorities and businesses involved in providing, installing and maintaining the petrol vapour recovery equipment.

The main benefit associated with the proposals would be a reduction in emissions of VOCs to the atmosphere, with associated reductions in environmental and health damage. If the proposed Directive were to be adopted, it is estimated that emissions from dispensing of petrol to automobiles could be reduced to around 5,000-7,900 tonnes by 2020, an additional reduction of around 2,200-3,500 tonnes per year. This reduction represents around 0.3% to 0.5% of the total projected VOC emissions in 2020[54].

8.2 Costs of implementing the proposed Directive

Estimates have been made of the additional costs of implementing Stage II legislation in the UK, both for 'typical' service stations of different sizes and for the UK as a whole.

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[54] Total UK VOC emissions in 2020 are projected to be just over 700,000 tonnes (AEA, 2009).

The main costs that would be incurred relate to: materials, equipment and labour associated with making the service station "Stage II ready" (e.g. underground works); costs of vapour recovery equipment; costs associated with loss of fuel sales during installation; additional maintenance and power costs during operation of the Stage II equipment; costs of regular checking for correct operation (compliance); and additional fees and charges under the relevant regulatory regime.

In terms of costs for **individual service stations**, the typical capital costs of installing Stage II controls are estimated to be around £30,000 for a new service station (or an existing station installing Stage II controls as part of a major refurbishment) with annual throughput of 3,000 to 3,500m^3. Annualised costs for such service stations are estimated at around £4,000 per year, giving a cost per tonne of VOC emissions abated of £700 to £1,300 per tonne (depending upon whether the value of the recovered fuel is included). Costs for existing service stations required to install Stage II controls outside of scheduled refurbishment works could be much higher (capital costs of around £130,000; annualised costs of around £7,500; and cost per tonne of VOC abated of £1,900 to £2,400 per tonne), though in practice the differential in costs is dependent upon how long before a planned major refurbishment a service station is required to install Stage II controls. The costs for smaller service stations would be lower.

Whilst annualised costs are a *relatively* small percentage (around 6%) of profits from petrol for a service station with petrol throughput between 3,000m^3 and 3,500m^3 where controls can be introduced as part of a planned refurbishment, the costs for a service station with 2,000-2,500m3 throughput if required to introduce Stage II controls where it would not otherwise be refurbished by the implementation deadline could be significantly higher (perhaps 17% of annual profits from petrol). Costs as a percentage of profit would be higher still for smaller service stations.

In terms of costs for the **UK as a whole**, it is estimated that the additional number of service stations affected would be around 1,200 to 1,800. Annualised costs are estimated at £4.0 to £7.4 million (£2.7 to £5.5 million if the value of the recovered fuel is deducted). Present value costs are estimated to be around £50 to £80 million (£40 to £60 million) and costs per tonne of VOC emissions reduced around £1,600 to £2,300 per tonne (£1,100 to £1,700 per tonne).

In terms of possible changes to the proposed Directive, the overall costs would be significantly higher if the annual throughput for the requirement to install Stage II controls at all existing stations is reduced: the estimates set out in Section 5 of this report suggest that annualised and present value costs would approximately double if the throughput threshold were 2,000m^3 instead of 3,000m^3 and would approximately treble if the threshold were 1,000m^3 (assuming the deadline of 2020 is retained and not including the value of the recovered petrol).

The timescale for implementation for all existing service stations also has implications for the overall costs, with higher costs expected to be incurred if the timescale is brought forward (say to 2015). Whilst the overall cost effect of this is expected to be moderate, the costs per service station for those that cannot install Stage II controls as part of a scheduled major refurbishment (due to the shorter timescales allowed) would be significantly higher.

If the timescales for introduction of additional Stage II controls is relatively short or the throughput thresholds relatively low, industry has highlighted there could be implications for the ability of equipment suppliers to meet the increased demand for Stage II controls. It was not feasible to quantitatively estimate the potential implications of this for the current study.

There would also be administrative costs for both operators and regulators associated with implementation of Stage II controls at additional service stations. Under the main option considered (Option 2), the additional one-off costs (to both operators and regulators combined) are estimated to be around £450,000, with ongoing (annual) costs of around £250,000 and present value costs of around £3.2 million.

8.3 Benefits of implementing the proposed Directive

There would be health and environmental benefits associated with reductions in VOC emissions, including both:

- Reductions in impacts caused by VOCs, particularly those related to ozone exposure (these have been valued according to two different 'damage cost functions' applied in UK assessments and in European Commission CAFE assessments); and
- Reductions in climate change effects caused by the global warming potential of the VOCs released and also their subsequent degradation to CO_2 in the atmosphere. These will be offset slightly by the increased electricity use associated with the power demands of the Stage II equipment These have been valued according to Government guidance on the 'shadow price of carbon'.

In terms of the former, the best estimate of the value of the annualised damage costs avoided is estimated at £0.06 to £0.10 million per year using the UK damage cost functions (with a range of £0.06 to £3.4 million taking into account the upper and lower range of these damage cost functions). The present value estimates of these benefits are £0.7 to £1.1 million (£0.7 to £37 million). The equivalent values using the EU CAFE damage cost functions are annualised costs avoided of £4.5 to £6.8 million (£2.0 to £8.8 million) with present value of £50 to £75 million (£22 to £96 million). It is evident that the value of the damage costs avoided is subject to significant uncertainty and is dependent upon which data sources are used: the values using the UK damage cost functions are significantly lower.

With respect to the latter, the annual value of the greenhouse gas emissions avoided is estimated to be £0.7 to £1.0 million (present value of £8 to £13 million).

There are various environmental and health benefits that are not included in the quantified estimates, as described in Section 6 of this report.

8.4 Comparison of quantified costs and benefits

The table below provides a summary of the additional quantified costs and benefits presented in this report for Option 2 as compared to Option 1. Costs and benefits are presented in 2008 prices with a reference year for

emissions reductions of 2020. There are various sensitivities and uncertainties regarding these estimates, as highlighted elsewhere within this report.

Table 8.1 Summary of monetised costs and benefits associated with implementation of Option 2

Element	Details
Emission reductions	
Number of additional service stations applying Stage II controls	1,260 – 1,770
Total reduction in VOC emissions from refuelling under this option (tonnes VOC per year)	2,200 – 3,500
Net CO_2 emissions reductions (tCO_2e per year)	22,000 – 35,000
Costs excluding the value of recovered petrol	
Total annualised costs, including one-off and ongoing costs (£m per year)	4.0 – 7.4
Present value costs (£m)	54 – 78
Cost effectiveness (£/t VOC abated)	1,600 – 2,300
Costs including the value of recovered petrol	
Retail value of recovered petrol, excluding taxes (£m per year)	1.2 – 1.9
Total annualised costs, including one-off and ongoing costs (£m per year)	2.7 – 5.5
Present value costs (£m)	40 – 58
Cost effectiveness (£/t VOC abated)	1,100 – 1,700
Damage costs avoided	
Damage costs avoided (£m per year)	IGCB: 0.06 – 0.10 (0.06 – 3.4) CAFE: 4.5 – 6.8 (2.0 – 8.8)
Present value of damage costs avoided (£m)	IGCB: 0.7 – 1.0 (0.7 – 37) CAFE: 50 – 75 (22 – 96)
CO_2 emission reductions	
Value of greenhouse gas emissions avoided (£m per year)	0.7 – 1.0
Net present value of greenhouse gas emissions avoided (£m)	8 – 13
Total environmental and health benefits	
Annual benefits (£m per year)	IGCB: 0.7 – 1.1 (0.7 – 4.4) CAFE: 5.1 – 7.8 (2.6 – 9.7)
Net present value (£m)	IGCB: 9 – 13 (9 – 50) CAFE: 58 – 87 (30 – 108)

Emissions reductions and associated benefits comparisons are based on emissions in 2020 and relate to the difference between effects of the proposed legislation and the current UK legislation. A threshold of 3,000m^3 is assumed for applicability to all existing service stations and 500m^3 for new service stations and major refurbishments. The ranges given reflect uncertainties in factors including: the expected lifetimes of Stage II equipment; and the expected decline (or not) in petrol station numbers and petrol sales (for the benefits, the ranges in brackets reflect the range in damage cost functions). Costs and benefits are expressed in 2008 prices. A discount rate of 3.5% has been applied. Costs represent an average of Stage II equipment costs for the conventional system (see Appendix A). Figures have been rounded.

8.5 Influence of applicable thresholds and implementation dates

The figure below provides a summary of the annualised costs and benefits associated with implementation of additional Stage II controls, with the requirements for existing service stations applying from 2020. It can be seen that the scale of the quantified costs as compared to quantified benefits varies significantly depending upon the throughput threshold applied.

Figure 8.1 Comparison of compliance costs with health and environmental benefits at different throughput thresholds

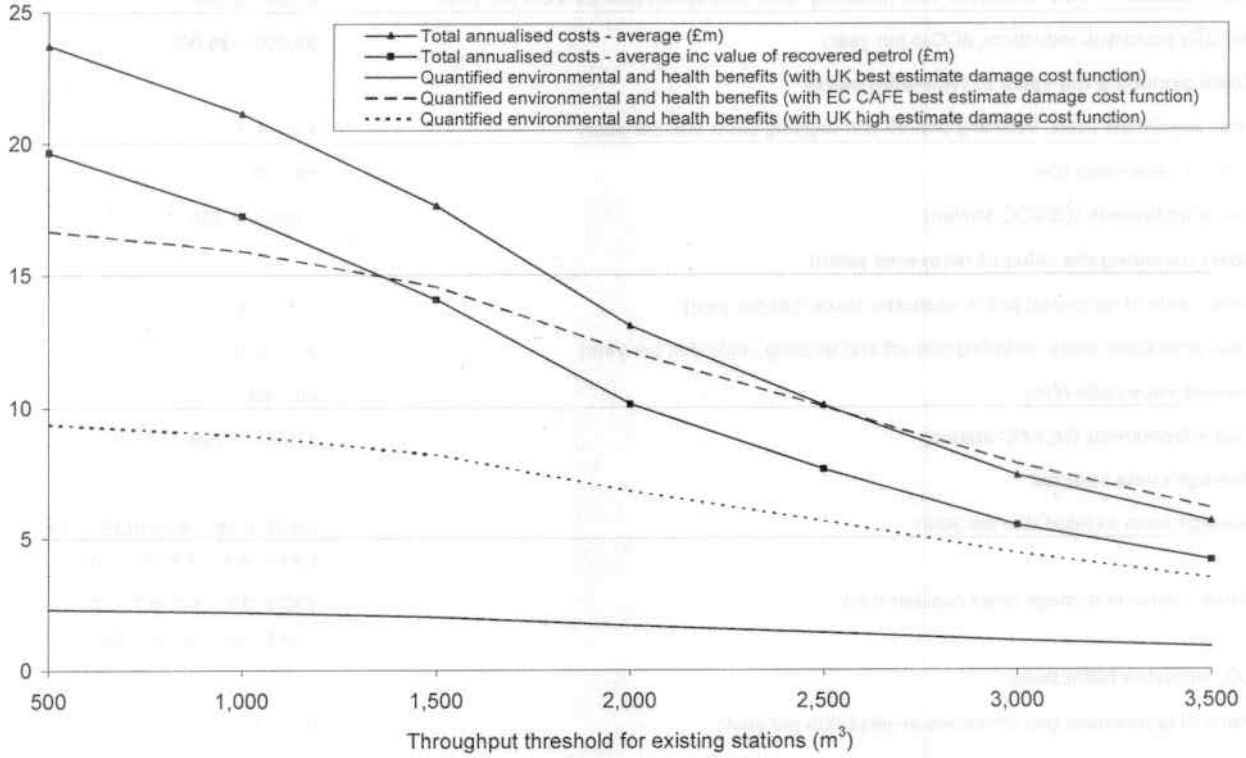


Figure notes: Assumes controls apply to existing stations from 2020 and to new/refurbished stations at >500m^3 throughput from 2012; constant petrol station numbers and petrol sales from 2008; and lifetime of VR nozzles 5 years (14 years other equipment). Quantified environmental and health benefits include benefits associated with reduced VOC emissions (using UK best and high estimate and CAFÉ best estimate damage cost functions) plus annualised benefits through reduced CO_2 emissions. There are various uncertainties and sensitivities in the underlying data that would affect the absolute values presented here, as well as the relative magnitude of costs and benefits.

Appendix A
Details of data sources and calculations

Service station numbers and petrol throughput

Current service stations and petrol sales

Data were provided on numbers of service stations and annual fuel throughput by Experian Catalist. The following data were provided:

- Total motor fuel sales, including a breakdown of numbers of service stations and total fuel sales within 11 throughput categories (at 500m^3 intervals), as well as average numbers of pumps and filling positions;
- Total retail petrol sales, including similar breakdowns to those above[55].

These data are provided in the tables below.

Experian Catalist data on UK motor fuel sales by throughput band

Motorfuel volume range (m^3/year)	Number of sites	Total MF volume (m^3/year)	Average number of pumps
0-500	1,152	337,667	2.5
501-1000	802	637,191	3.0
1001-1500	565	752,516	3.3
1501-2000	637	1,180,820	3.5
2001-2500	583	1,370,838	3.7
2501-3000	841	2,432,796	4.0
3001-3500	646	2,193,695	4.1
3501-4000	689	2,677,680	4.3
4001-4500	533	2,333,264	4.3
4501-5000	482	2,363,900	4.5

[55] Total retail petrol sales were estimated by applying a national-level factor for the split between petrol and diesel sales to the throughput at each service station (approximately 57% sales were petrol in 2008 according to data from DUKES). It is recognised that this estimation method is subject to uncertainty.

Motorfuel volume range (m^3/year)	Number of sites	Total MF volume (m^3/year)	Average number of pumps
5000+	2,322	21,717,689	5.3
Total UK	**9,252**	**37,998,056**	**4.0**

Motorfuel includes both petrol and diesel retail sales. Excludes 12 sites with null volume.

Experian Catalist data on UK petrol sales by throughput band

Petrol volume range (m^3/year)	Number of sites	Total petrol volume (m^3/year)	Average number of pumps
0-500	1,664	395,528	2.6
501-1000	1,053	776,851	3.2
1001-1500	1,097	1,377,677	3.7
1501-2000	1,412	2,526,092	4.1
2001-2500	925	2,095,459	4.3
2501-3000	823	2,239,245	4.4
3001-3500	532	1,739,083	4.4
3501-4000	283	1,083,198	4.6
4001-4500	86	366,267	4.6
4501-5000	193	896,514	4.8
5000+	1,184	8,162,979	6.1
Total UK	**9,252**	**21,658,892**	**4.0**

Petrol volumes calculated (at the site level) assuming petrol is 57% of motorfuel volume. Excludes 12 sites with null volume.

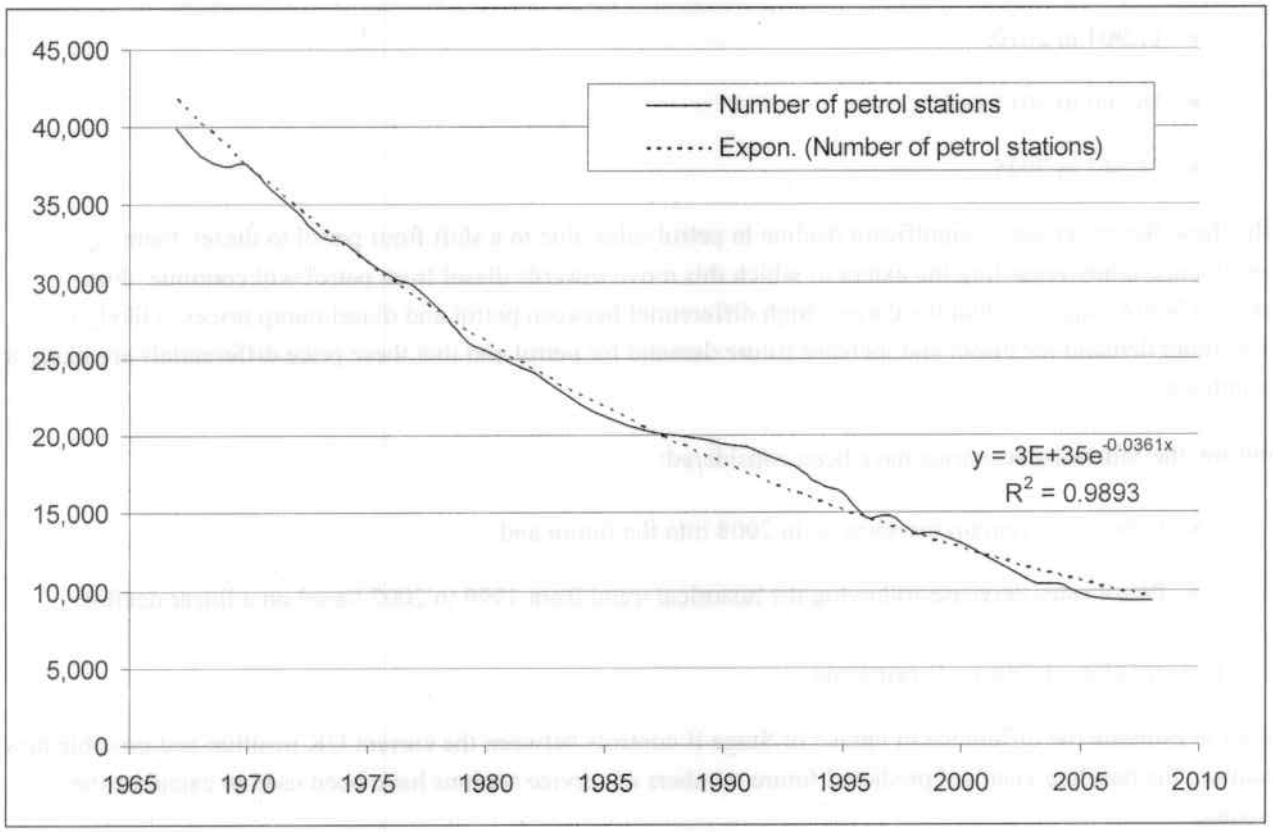
Predicted future service station numbers and petrol sales

Service station numbers

There has been a significant decline in the number of service stations in the UK over recent years. However, it is unclear whether and how numbers will decline in the future. According to data from Experian Catalist, there were 9,252 service stations in 2008.

The chart below provides details of the numbers of service stations, illustrating the historical decline in numbers based on data from the Energy Institute[56].

Historical data on numbers of service stations (based on Energy Institute, 2008)



The following scenarios have been considered:

- Service station numbers remain the same as in 2008 into the future.
- Numbers decline following the historical trend between 1997 and 2008 based on an exponential decline, fitted to the historical curve[57].

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[56] Energy Institute (2008): Retail marketing survey 2008, April 2008.

[57] An exponential curve gives the best fit for the whole dataset (from 1967). Depending upon the start year for the historical trend, a linear decline in petrol station numbers may give a better fit than an exponential decline. However, a linear decline has not been used as this would imply a reduction in service station numbers to zero by just after 2020.

Petrol sales/throughput

Department for Transport[58] has provided forecasts of petrol sales in Great Britain based on the National Traffic Model. The values for petrol use are as follows (in million litres):

- 26,533 in 2003;
- 17,904 in 2010;
- 16,160 in 2015 and
- 11,347 in 2025.

Whilst these figures project a significant decline in petrol sales, due to a shift from petrol to diesel, there is currently uncertainty regarding the extent to which this move towards diesel from petrol will continue. For example, UKPIA suggest[59] that the current high differential between petrol and diesel pump prices is likely to reduce future demand for diesel and increase future demand for petrol and that these price differentials are likely to be maintained.

Therefore, the following scenarios have been considered:

- Petrol sales remain the same as in 2008 into the future and
- Petrol sales decrease following the historical trend from 1999 to 2007 based on a linear decline.

Predicted uptake of Stage II controls

In order to estimate the difference in uptake of Stage II controls between the current UK position and possible new legislation, the baseline year and predicted future numbers of service stations have been used to calculate the following:

- Replacement of existing service stations with new stations at an assumed rate of 1/35 per year. This applies to both the UK legislation scenario and the proposals for a new Directive;
- The numbers of new service stations required to introduce Stage II controls have been calculated for each scenario, noting that the definition of what constitutes a "new" service station may differ from the UK legislation scenario to the proposals (due to different definitions). In practice, there is little if any difference between the two scenarios because new service stations are already required to implement Stage II controls in the UK;

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[58] Personal communication, 5 March 2009.

[59] Personal communication, 4 March 2009.

- The numbers of existing service stations having installed Stage II controls have been calculated for the year for which emissions, costs and benefits have been calculated;
- In the case of the proposed Directive, the numbers of refurbished and non-refurbished service stations has been calculated, assuming a rate for major refurbishment of 1/25 years for smaller stations (<3,500m^3) and 1/14 years for larger stations (>3,500m^3). This allows the number of existing service stations required to implement Stage II to be calculated, differentiated according to whether they will be able to install the required below ground equipment (e.g. pipework) during planned major refurbishments, significantly reducing the costs of compliance;
- Based on the above, the additional numbers of service stations with Stage II controls under the proposed Directive scenario(s) has been calculated broken down as follows:
  - Total additional numbers of service stations in each throughput range with Stage II controls in place under the proposed Directive scenario(s). This has been used in calculation of emission reductions and associated benefits that would be achieved.
  - Additional numbers of new, existing refurbished and existing non-refurbished stations in each throughput range with Stage II controls in place. These data have been used in calculation of the compliance costs for businesses. These numbers obviously vary according to the throughput thresholds and timescales for implementation under the different scenarios.

Estimation of emissions

Overview of approach

Emissions at service have been estimated for a number of different sources in the petrol distribution chain, including: filling of underground storage tanks; tank breathing; dispensing to automobiles; and drips and spillage. The main source that is of interest in relation to Stage II controls is dispensing to automobiles.

Emissions have been estimated using an approach set out in a report by the Institute of Petroleum (2000)[60]. The relationships used are set out below[61].

Filling of tanks without vapour balancing in operation: $E \quad 2.44 \quad V \quad TVP$

Filling of tanks with vapour balancing in operation: $E \quad 0.11 \quad V \quad TVP$

Tank breathing: $E \quad 0.33 \quad V \quad TVP$

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[60] Protocol for the estimation of VOC emissions from petroleum refineries and gasoline marketing operations, Institute of Petroleum, 2000.

[61] These are also now incorporated into the 2007 EMEP/CORINAIR Emission Inventory Guidebook, European Environment Agency Technical report No 16/2007.

Dispensing to automobiles without Stage II PVR in place: $E \quad 3.67 \quad V \quad TVP$

Drips and spillage during dispensing: $E \quad 0.22 \quad V \quad TVP$

Where:

E = emissions (t/yr)

V = volume dispensed per year ('000m^3)

TVP = true vapour pressure of petrol (bar)

$$TVP \quad 0.01 \quad RVP \quad 10^{\,0.000007047 \; RVP \quad 0.01392 \; T \quad 0.0002311 \; RVP \quad 0.5236}$$

T = product temperature in °C

RVP = Reid vapour pressure of petrol (kPa)

Note that the above equations imply an abatement efficiency of around 95% for Stage IB controls when filling of storage tanks at service stations. An abatement efficiency of 85% has been used as a default assumption for the effects of introducing Stage II controls.

Data used in estimation of emissions

The table below summarises the data that have been used as inputs to the above in estimating emissions.

Summary of data used in estimating emissions

Parameter	Data used
V – volume of petrol dispensed per year	Based on total throughput within each throughput band for UK figures and mid-point of throughput range for typical individual service station emissions.
T – product temperature	Average ambient temperatures have been assumed to be 12.3°C during summer months and 5.4°C in non-summer months (see also below). It has been assumed that the product temperature is the same as the ambient temperature.
RVP – Reid vapour pressure of petrol	Maximum RVP during summer period (1 June to 31 August) of 70kPa; minimum of 45 kPa. Maximum RVP during winter (16 October to 15 April) of 100kPa; minimum of 70 kPa. Wider ranges apply during transitions between summer/winter. Mid-points of the ranges have been applied (Note 1).

Notes:

1) Mid-point of RVP ranges has been applied as it is understood that refineries will tend to blend towards the middle of the specification range in order to avoid exceeding the minimum or maximum values.

Annual emissions have been calculated by adding together the emissions during the summer and non-summer periods (based on temperature, RVP and length of the relevant periods).

In estimating total emissions for the UK, the following have been calculated:

- "Uncontrolled" emissions predicted for the year of interest with no Stage IB or Stage II controls in place;
- Status quo or business as usual emissions predicted for the year of interest based on the percentage uptake of Stage IB and Stage II controls within each throughput size band (based on existing UK legislation) and
- Emissions predicted for the scenario (proposed Directive) under consideration for the year of interest with additional uptake of Stage II controls.

The above allows the reduction in emissions from implementation of the proposed Directive to be calculated as compared to the business as usual emissions in the year of interest (emissions reductions and costs/benefits are presented for the year 2020).

Costs of introducing Stage II controls

Overview

The capital costs of implementing Stage II controls vary significantly according to whether installation is undertaken during part of a "major refurbishment" (in this case taken to be essentially a knock-down and rebuild of the service station) or as part of a non-scheduled upgrade in order to meet the requirements of new legislation. Costs for new service stations are assumed to be essentially the same for "new" stations as for existing service stations undergoing a planned major refurbishment.

Some of the data used are relatively old (the timescales for undertaking this work were relatively short, precluding collection of significant amounts of new information) and may thus not fully reflect the current costs.

Details of the cost estimates applied in this assessment are provided in the sections below for the following key elements:

- Materials, equipment and labour. This includes:
  - Materials and equipment including: installation of underground pipework; surround to pipework; tank-connection and shear valves;
  - Labour including trench excavation for vapour recovery pipework; removal of pumps for connections and replacement; and installation equipment.

- Costs of vapour recovery equipment, including: vapour recovery equipment (pumps, proportional valves, etc.); vapour recovery nozzles; and additional costs for dispensers (the latter if dispensers need to be replaced earlier than usual to comply with legislation);
- Costs associated with loss of fuel sales during installation of equipment (both petrol and diesel sales will be foregone);
- Additional costs of maintenance and power for the Stage II vapour recovery equipment;
- Costs of compliance checking (assumed to be a "dry test" of vapour / liquid ratio) and
- Additional UK fees and charges under the Environmental Permitting Regulations.

There may also be costs associated with undertaking any type approval tests for the Stage II equipment to be used. However, these have not been included in the assessment as suitable type approval is already understood to be achieved for those installations having already installed Stage II in the UK; no additional type approval testing is therefore assumed to be required.

Costs of developing and implementing legislation have not been included in the assessment.

The data presented below have been taken from a variety of sources. All cost data have been converted into Sterling using ECB reference exchange rates[62] (where applicable) and uplifted to Sterling prices for 2008 based on the Retail Price Index[63].

Various stakeholders in the UK (Government and industry) have been given the opportunity to comment on the cost data used in the assessment.

Materials, equipment and labour

The table below provides details of the costs of materials, equipment and labour for installation of Stage II pipework and equipment. They are based on data from Entec's 1998 report on Stage II PVR[64]. These data have

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62 http://sdw.ecb.europa.eu/browseSelection.do?DATASET=0&FREQ=M&CURRENCY=GBP&node=2018794 (accessed 13 February 2009).

63 RPIX, CHAW from www.statistics.gov.uk (accessed 13 February 2009).

64 Design of a scheme to control evaporative emissions for petrol vehicle refuelling. Report for the Department of Environment Transport & Regions. Entec UK Limited, Pieda and Catalist. 27 March 1998.

also been used in the Commission's Impact Assessment[65] and were used in the 2005 UK Impact Assessment for the existing Stage II legislation.

[65] Commission staff working document – Accompanying document to the Proposal from the Commission to the European Parliament and Council for a directive proposal for stage II petrol vapour recovery during the refuelling of petrol cars at service stations – Impact Assessment, SEC(2008) 2937, 4.12.2008.

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Costs of Stage II PVR equipment

The costs of additional vapour recovery equipment have been based on data from the 2005 Impact Assessment supporting the UK's Stage II legislation. These are consistent with the data used in the Commission's Impact Assessment and with other data supporting the Commission's Impact Assessment[66].

The following sets of figures are presented in the table below: high and low end costs for 'conventional' Stage II systems (involving passing recovered petrol vapours back to the underground storage tank; and costs for the "at-pump" system. In practice, the overall figures presented in this Impact Assessment are based on an average of the high and low values for the conventional system as it appears that uptake of the "at pump" system has so far been minimal, at least amongst the major oil company retailers (though uptake may have been greater amongst supermarkets and independent retailers).

B) Costs of Stage II equipment (per dispenser)

1) Conventional - high estimate

	Retrofit	New (unscheduled)	New (scheduled)
Additional cost for dispenser	£0	£7,930	£0
VR equipment excluding nozzle	£3,420	£2,520	£2,520
VR nozzle	£1,770	£1,760	£1,760

2) Conventional - low estimate

	Retrofit	New (unscheduled)	New (scheduled)
Additional cost for dispenser	£0	£7,930	£0
VR equipment excluding nozzle	£2,740	£2,010	£2,010
VR nozzle	£1,770	£1,760	£1,760

3) At-pump system

	Retrofit	New (unscheduled)	New (scheduled)
Additional cost for dispenser	£0	£7,930	£0
VR equipment excluding nozzle	£3,360	£2,240	£2,240
VR nozzle	£1,770	£1,760	£1,760

It has been assumed that there is an average of four petrol vapour recovery nozzles per dispenser.

Costs of loss of fuel sales

It has been assumed that there will be a cost to the service station operator associated with a loss of sales of fuel during installation of Stage II equipment. It has been assumed that a service station will need to close for one week

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66 Data used in Entec's 2005 report for the European Commission have not been used in this case as these were based on representative values for the EU as a whole. The data used herein are considered to be representative for the UK.

for installation and that, during this period, the income foregone would be approximately £2 per m^3 of annual throughput[67].

Maintenance and power costs

It has been assumed that the incremental (additional) costs for maintenance and power of Stage II equipment, per dispenser, are as follows:

- Incremental maintenance cost per dispenser: £80
- Incremental power cost per dispenser: £7

These values are based on Entec's 1998 report (see above) and were also used in the Commission's Impact Assessment and Defra's 2005 Impact Assessment.

Note that there will be additional power costs associated with use of the "at pump" system. These have not been considered directly in the Impact Assessment as they are not expected to be much higher than the power costs for conventional Stage II systems and relatively small in the context of overall costs[68].

Compliance checks

The cost of undertaking a routine check on vapour / liquid ratio to confirm correct operation of the Stage II equipment has been estimated as £360 per site. This is based on Defra's 2005 Impact Assessment for the UK's Stage II legislation.

Under the current UK legislation, it is assumed that such a check is required each year, except where an automatic monitoring system is in place. The Commission's proposal includes requirements similar to those in the UK.

Fees and charges

Under the local authority pollution prevention and control (LAPPC) regime, service stations are subject to one-off fees related to permit applications/variations and an annual subsistence charge. Under the proposals, certain service stations would have to install Stage II as well as the existing Stage I controls. It is assumed that there

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[67] This is calculated assuming a gross retail margin on petrol sales of 6p per litre; that the site needs to close for one week to install Stage II equipment; and that sales of both petrol and diesel are foregone (with petrol assumed to account for 57% of total retail fuel sales).

[68] Power costs for the "at pump" system are understood to be around 2p per 1000l of petrol sales. Assuming petrol sales per unit (dispenser) of, say, 300 to 600 thousand litres per dispenser, this equates to additional power costs of £6 to £12 per dispenser per year, compared to an estimated average of £7 for conventional Stage II equipment.

would be a fee for a variation to the permit (£97 for reduced fee activities based on the 2009/10 scheme) as well as an increase in the annual subsistence charge (assumed to be from £149 to £214)[69].

Assumed lifetimes of equipment

In calculating annualised costs and present value costs, the following assumptions have been used regarding equipment lifetimes (in addition to the figures given earlier in this section on assumed refurbishment rates):

- Average lifetime of above-ground internal equipment = 14 years;
- Average lifetime of above-ground external equipment = 5 years (e.g. vapour recovery nozzles). An assumed lifetime of 14 years has also been used for sensitivity purposes.

Estimated value of recovered fuel

Implementation of Stage II controls allows for recovery of a proportion (i.e. 85%) of the fuel that would otherwise be lost during refuelling. This is likely to be the more volatile than the average petrol sold as it will include mainly butane.

Depending on the type of system used, the recovered petrol vapour can be resold by the petrol supplier[70] (conventional system) or the service station retailer ("at pump" system).

The volume of recovered petrol has been calculated from the level of emission reduction in tonnes converted assuming a petrol density of 0.735t/m^3. The value of this recovered petrol has been assumed to be £0.41 per litre[71].

Summary of costs and emission reductions for 'typical' service stations

The table below provides estimates of costs and reductions in emissions for a "typical" service station within each throughput category for the implementation of Stage II controls. It includes expected capital costs; present value costs; total annualised costs; and cost-effectiveness in £/t VOC abated. Data are also presented on the cost-

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69 These values are based on the 'local authority permits for part B installations and mobile plant (fees and charges) (England) scheme 2009". It has been assumed that service stations will be medium risk for the first year following extension of the risk-based approach to charging which has been introduced for reduced fee activities such as service stations as of April 2009.

70 Simplistically, when the vapours returned to the underground storage tank are collected by the road tanker during petrol delivery and returned to the terminal vapour recovery unit.

71 Based on an average retail price of 107.09p per litre in 2008 using DECC's quarterly energy prices data (National Statistics, December 2008); a VAT rate applicable for the majority of 2008 of 17.5%; and a duty rate of 50.35p per litre.

effectiveness taking into account the value of the recovered petrol. Separate values are given for installation of Stage II controls at non-refurbished service stations and refurbished/new service stations.

The capital costs presented below are comparable to "actual" costs reported by UKPIA (personal communication, 9 March 2009) of £25,000 to £30,000 per site for sites with a throughput of around 3 million litres per annum.

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0.24	0.72	1.19	1.67	2.15	2.62	3.10	3.58	4.05	4.53	5.25
18,200	19,195	25,626	26,622	27,617	28,613	29,608	36,339	37,335	38,330	45,259
55,670	65,285	90,255	99,871	109,486	119,102	128,717	154,287	163,903	173,518	203,596
29,506	30,502	38,366	39,362	40,357	41,353	42,349	45,731	46,726	47,722	55,600
62,666	63,662	81,446	82,442	83,437	84,433	85,429	99,031	100,026	101,022	119,120
2854	2914	3746	3807	3867	3927	3988	5337	5428	5520	6471
5,596	5,657	7,334	7,394	7,455	7,515	7,575	10,212	10,303	10,394	12,280
11,968	4,074	3,142	2,280	1,802	1,497	1,286	1,492	1,339	1,218	1,233
23,467	7,907	6,151	4,429	3,473	2,865	2,444	2,855	2,541	2,294	2,341
132	397	662	927	1,192	1,456	1,721	1,986	2,251	2,515	2,913
11,413	3,519	2,587	1,725	1,247	942	731	937	784	663	678
22,912	7,352	5,595	3,874	2,918	2,310	1,888	2,300	1,986	1,739	1,785

Benefits

Greenhouse gas emission reductions

There are benefits in terms of reduced impacts on climate change associated with reductions in VOC emissions. These benefits have been estimated based on the reductions in VOC emissions under each of the scenarios considered.

Firstly, there will be an increase in CO_2 emissions associated with the increased electricity consumption needed for Stage II petrol vapour recovery equipment. As highlighted in the above section on costs, the additional cost of power associated with Stage II equipment is estimated to be £7 per dispenser. Electricity consumption will vary amongst Stage II techniques/equipment and so this figure has been used to back-calculate an assumed electricity consumption per dispenser of 100kWh per year[72]. A fuel factor of 0.523 tonnes CO_2 per MWh has been applied[73], giving an assumed 0.052 tonnes CO_2 per dispenser per year. This has been scaled up to a UK level using the assumed number of additional service stations and associated dispensers required to implement Stage II controls.

Secondly, there will be a reduction in climate change impacts associated with the reduction in VOC emissions. There are two relevant elements: those due to the chemical effect of the VOC on the atmosphere (primary emissions) and those due to the CO_2 arising from the degradation of the VOC in the atmosphere (secondary emissions).

Primary emissions are the climate change impacts arising as a result of the global warming potential of the VOCs themselves. These have been estimated by multiplying the mass of VOC emitted under each scenario by the global warming potential of butane[74]. This gives an estimate of the emissions in CO_2 equivalent.

Secondary CO_2 emissions have been estimated by calculating the carbon content of the mass of VOC released, assuming that it is all comprised of butane. The carbon content has then been used to estimate the equivalent value of CO_2 released per tonne of VOC released[75], allowing the UK total CO_2 equivalent emissions to be calculated.

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72 Using an assumed electricity price of £0.07 per kWh, taken as broadly representative of values in DECC's quarterly energy prices data (National Statistics, December 2008).

73 Based on AEA (2007): Climate change consequences of VOC emission controls, Report to The Department for Environment, Food and Rural Affairs, Welsh Assembly Government, the Scottish Executive and the Department of the Environment for Northern Ireland, Issue 3, AEA Energy & Environment, September 2007.

74 The 100 year GWP of butane is taken to be 7.0. Much of the VOC captured by Stage II vapour recovery systems is assumed to be butane.

75 One tonne of butane comprises 0.828t carbon, equating to 3.03t CO_2e.

The value of the reductions in greenhouse gas emissions has been calculated using Defra guidance[76] on the 'shadow price of carbon' (SPC). Values have been calculated assuming that the policy takes effect in 2012 and the SPC has been assumed to increase by 2% per year to account for rising damage costs for higher greenhouse gas concentrations. All values are expressed in 2008 prices and a discount rate of 3.5% has been used in calculating the present value of the greenhouse gas emissions avoided over a period of 14 years.

[76] How to use the Shadow Price of Carbon in policy appraisal, Defra website (http://www.defra.gov.uk/environment/climatechange/research/carboncost/index.htm), accessed 16 March 2009.

Appendix B
Detailed information on costs and benefits

This appendix provides information on the estimates of costs and benefits for the various scenarios and sensitivities considered (as described in the main report). The table below provides details of the scenarios and sensitivities considered and the table overleaf includes details of the calculated cost and benefit estimates.

Summary of scenarios and sensitivities considered

Scenario description		Scenario variants		Sensitivities	
		Implementation year for existing stations (Note 1)	Throughput thresholds for existing (m^3) (Note 2)	Lifetime of above-ground equipment	Station numbers and petrol sales (Note 3)
1. Status quo		2010 (2012 for Scotland)	3500	N/A	N/A
2. Implement according to Commission proposal (Note 4)		2020	3000	5 years 14 years	Constant Declining
3. Possible sensitivities in implementation – negotiations	3a	2015	3000	5 years	Constant
	3b	2025	3000	5 years	Constant
	3c	2020	2000	5 years	Constant
	3d	2015	2000	5 years	Constant
	3e	2025	2000	5 years	Constant
	3f	2020	1000	5 years	Constant
	3g	2015	1000	5 years	Constant
	3h	2025	1000	5 years	Constant
	3i	2020	500	5 years	Constant
	3j	2020	1500	5 years	Constant
	3k	2020	2500	5 years	Constant
	3l	2020	3500	5 years	Constant

Notes:

1) Implementation year for new stations assumed to be 2012.

2) Throughput thresholds for new/refurbished stations assumed to be 100m3 (or 500m3 with derogation – which UK would be expected to take up).

3) Service station numbers either assumed to remain constant over time.

4) Results produced are 2i (5 years, constant); 2ii (5 years, declining); 2iii (14 years, constant); 2iv (14 years, declining).