
Dover District Council

**Air Quality Action Plan
for Sulphur Dioxide**

**February 2005 -
Final Version**

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Glossary

AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
CO ₂	Carbon Dioxide
DEFRA	Department of the Environment, Food and Rural Affairs
EU	European Union
FGD	Flue Gas Desulphurisation
HFO	Heavy Fuel Oil
LAQM	Local Air Quality Management
MGO	Marine Gas Oil
R&A	Review and Assessment
SO ₂	Sulphur Dioxide
USA	Updating and Screening Assessment

Summary

Mott MacDonald has been appointed by Dover District Council (Dover DC) to prepare this Air Quality Action Plan (the Report) which aims to address issues related to air quality in the Port of Dover.

In accordance with the Environment Act 1995, Dover DC, as with all Local Authorities, is required to review and assess air quality in its district. The assessment is a staged process. Dover's most recent review identified that one of the UK air quality objectives for sulphur dioxide (the 15-minute mean) is likely to be breached within the Port of Dover. The 15-minute mean objective exists for the protection of human health and local authorities are obliged to instigate best efforts in complying with the objective. Air quality modelling, undertaken as part of Dover's latest (Stage 4) review, identified that emissions from ferry exhausts within the Port of Dover are the prime source of the sulphur dioxide.

Subsequent to the identification of the geographical extent of the likely breach within the Port, Dover DC was obliged to designate the area of breach an Air Quality Management Area and to formulate this Air Quality Action Plan to address the problem. Action Plans provide a comparison of all possible mitigatory measures in terms of costs and benefits, appropriateness to the problem and likelihood of success.

In Dover, the only option for remediation of the sulphur dioxide problem is to reduce emissions from ferries using the Port. This can either be achieved by burning fuel with low sulphur content, or fitting desulphurisation equipment to the ferries to remove sulphur dioxide from the exhaust stack.

Both these options represent significant financial cost which will be borne by the ferry companies. In terms of the extent to which each of the two measures must be applied in order that the 15 minute sulphur dioxide objective be met, use of low-sulphur fuel represents a significantly greater cost in the longer term. With regard to secondary environmental impacts associated with each option, discharges to the sea as a result of desulphurisation may be of concern; however, desulphurisation will also reduce particulate emissions, providing environmental benefit. Secondary effects of the use of low-sulphur fuel include increased emissions of both sulphur dioxide and carbon dioxide at the refinery from which the fuel is sourced.

Given that adoption of measures to combat Dover's sulphur dioxide problem is dependent upon the cooperation and financing from the ferry operating companies, this Report concludes that adoption of desulphurisation is the best option to tackle the sulphur dioxide problem. Dover DC has no statutory authority over Dover Harbour Authority or the ferry operating companies and hence is unable to enforce the measures identified in this Report upon either party. The Council does, however, arrange regular Stakeholder Group meetings (together with the Dover Harbour Authority and the ferry operators) to discuss progress regarding emissions reduction strategies and ferry company progress with both parties. P&O Ferries is currently trialling the use of desulphurisation technology on one of its ferries and following successful trialling one other ship will be fitted with the same system.

All interested stakeholders and the general public have been consulted at each stage throughout the review and assessment process and Dover DC welcomes queries or comments relating to the content of this Report.

1 Introduction

1.1 Background

Mott MacDonald has been appointed by Dover District Council (Dover DC) to prepare this Report which aims to address issues related to air quality in the Port of Dover.

Since 1997, Dover DC has been reviewing and assessing air quality in the Dover district, in accordance with Part IV of the Environment Act 1995. The Council published its latest Review and Assessment (R&A) Report, its Stage 4, in October 2003. The Stage 4 Report confirmed results of the earlier Stage 3 R&A, reaffirming that one of the UK objectives for sulphur dioxide (SO₂), the 15-minute mean objective, as prescribed in the Air Quality (England) Regulations 2002, is likely to be breached in the Eastern Docks area of Dover. Elevated levels of SO₂ are attributable to shipping in the Port.

Results of the assessments undertaken to date have deemed it necessary for the designation of an Air Quality Management Area (AQMA) in the Port of Dover on the basis of SO₂. The AQMA came into force on 20th June 2002. The aim of this Air Quality Action Plan (AQAP) is to:

- assess the various options available to Dover DC to improve local air quality
- evaluate the likely costs and benefits of possible options, enabling recommendation of the most effective solution
- provide a timescale for the implementation of mitigatory measures.

1.2 Scope of the Air Quality Action Plan

The majority of local authorities in the UK who have designated AQMAs have done so on the basis of predicted breach of nitrogen dioxide or particulate objectives, usually attributable to road traffic emissions. Dover's air quality problem is unusual in that air quality issues relate to SO₂ emissions from shipping activity within the Port. As Dover's AQMA has been declared on the basis of SO₂, and as this Action Plan aims to provide a mitigation strategy for alleviating this problem, it will concentrate only on SO₂.

Section 2 of this AQAP provides an overview of air quality legislation and the Local Air Quality Management (LAQM) process in the UK. Section 3 details R&A undertaken in Dover to date, actions which arose following this assessment, and the cause of the SO₂ issue. Section 4 provides the crux of the Report, detailing and evaluating proposed management measures, and Section 5 outlines consultation and reporting (both that undertaken to date and that proposed for the future) and the role of the Stakeholder Group.

Environmental Consultants *Casella Stanger* provides a helpdesk service for Local Authorities preparing AQAPs via the 'Air Quality' link on its company website (www.casellastanger.com).

Table 1-1 below summarises Casella's Action Plan Appraisal general checklist of information and methodology to be included in AQAP Reports.

Table 1-1: Casella's AQAP Checklist

AQAP Checklist Sections	Sub-sections	Included in this AQAP Report?
Local Authority Information	To include contact details of the relevant point of contact at the Local Authority	✓
Adherence to Guidelines and Consideration of Policies	Evidence of consultation with Statutory Consultees, other Local Authority departments and other relevant consultees.	✓
	Clear statement of pollutant causing AQMA and identification of sources.	✓
	Consideration of other Local Authority plans evident.	✓
	Timescales, costs and impacts of options identified.	✓
Checklist of Measures	For each source and proposed option, demonstrate full assessment of impacts and cost.	✓
	Identify which options chosen.	✓
Appropriateness and Proportionality	Assess options in terms of appropriateness to problem; appraise assessment methodology and costings.	✓
	Evaluate likelihood of meeting objectives; measurement of success; wider implications of options.	✓
	Compliance of options with wider Government policies.	✓
Implementation	Appraise likelihood of meeting goals in terms of timescales; outline responsibility and financial arrangements.	✓

1.3 Contact Information

If you wish to comment on the findings in this Report or require clarification regarding any of the issues raised, please contact:

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1.4 Acknowledgements

Mott MacDonald would like to thank members of the Stakeholder Group and, in particular, Dover District Council's Pollution Team for their co-operation in the production of this Report.

2 UK Air Quality Management

2.1 Legislative Framework

Part IV of the Environment Act 1995 sets out requirements for central government to publish and implement an Air Quality Strategy (AQS) to improve local air quality with reference to a number of air quality limits and objectives for the protection of human health and vegetation. The air quality limits originate from EU legislation.

The Air Quality Limit Values Regulations 2003 implements Council Directive 96/62/EC on ambient air quality assessment and management and Council Directive 99/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air. The obligation for complying with these limit values rests with central government.

The Air Quality (England) Regulations 2000 and Air Quality (England) (Amendment) Regulations 2002 include air quality objectives which, in most cases, are numerically synonymous with the limit values. However, the air quality objectives are for specific use by local authorities in undertaking their local air quality management duties in pursuit of Part IV of the Environment Act 1995. Where air quality objectives are not expected to be achieved, local authorities are required to designate AQMA and implement AQAPs to improve air quality. The statutory status of air quality objectives is that local authorities are required to demonstrate best efforts rather than strict compliance.

Table 2-1 summarises the SO₂ criteria relevant to this assessment. The 1-hour and 24-hour criteria are included in the Air Quality Limit Values Regulations 2003, the Air Quality (England) Regulations 2000 and Air Quality (England) (Amendment) Regulations 2002. Importantly, the 15-minute criterion is only included in the Air Quality (England) Regulations 2000 and Air Quality (England) (Amendment) Regulations 2002. Central government is, therefore, obliged to ensure compliance with the 1-hour and 24-hour criteria but local authorities are only obliged to instigate best efforts in complying with the 15-minute criterion.

Table 2-1: Air Quality Assessment Criteria Relating to SO₂

Concentration	Measured as	Date to be achieved by
266 µg/m ³ not to be exceeded more than 35 times a year	15 minute mean	31 st December 2005
350 µg/m ³ not to be exceeded more than 24 times a year	1 hour mean	31 st December 2004
125 µg/m ³ not to be exceeded more than 3 times a year	24 hour mean	31 st December 2004

2.2 Review and Assessment

R&A is a staged process. At each stage, the first step of the process is to undertake an Updating and Screening Assessment (USA) to identify any issues that have changed since completion of the previous stage assessment. Where the USA identifies a risk that an air quality objective will be breached at a location with relevant public exposure, a detailed assessment must be undertaken. The

Detailed Assessment should determine both the magnitude and geographical extent of the breach, following which an AQMA must be declared to encompass this area.

Figure 2-1 is a flow diagram representing the cyclic R&A process, including deadlines for submissions to DEFRA at each stage. Upon completion of each current round of R&A the whole process begins again. Dover is currently coming to the end of the first round of R&A as Dover DC has been granted an extension to its AQAP submission date, however, for illustrative purposes Figure 2-1 provides dates for round 2, the next phase to be undertaken for Dover.

Prompted by the Environment Act 1995, the R&A of local air quality commenced in 1997. The first round of R&A, comprising three stages, for Dover, culminated in the designation of an AQMA. As of 2003, the second round of the R&A process has been revised, adopting the USA approach as detailed in Figure 2-1. The third round of R&A should follow the same approach as for the second.

2.3 Air Quality Management Areas

Following identification of an area or areas where breaches of air quality objectives have been predicted using dispersion modelling, AQMAs must be designated by taking into account public exposure. The Air Quality Regulations 2000 and (Amendment) Regulations 2002 for LAQM emphasise that likely exceedences of the objectives should be assessed in relation to *'the quality of air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present'*. AQMAs should, therefore, encompass only areas where the public is regularly present and likely to be exposed over the averaging period of the objective.

AQMAs may be amended or revoked if results of subsequent R&As indicate confidently that the air quality objective that was previously a concern will be met.

2.4 Air Quality Action Plans

Section 84 of Part IV of the Environment Act requires local authorities that have declared an AQMA to prepare a written action plan in pursuit of the achievement of air quality standards and objectives of concern within the designated area. Action Plans should state the problem causing the AQMA as defined by previous assessment; clearly identify the sources of the pollutant/s of concern; provide details of consultation with all relevant Statutory Consultees; show consideration of the Council's other plans and policies; outline the possible mitigatory options being considered and provide a timescale and costings for these options; assess the impacts of the proposed strategy.

2.5 Public Consultation

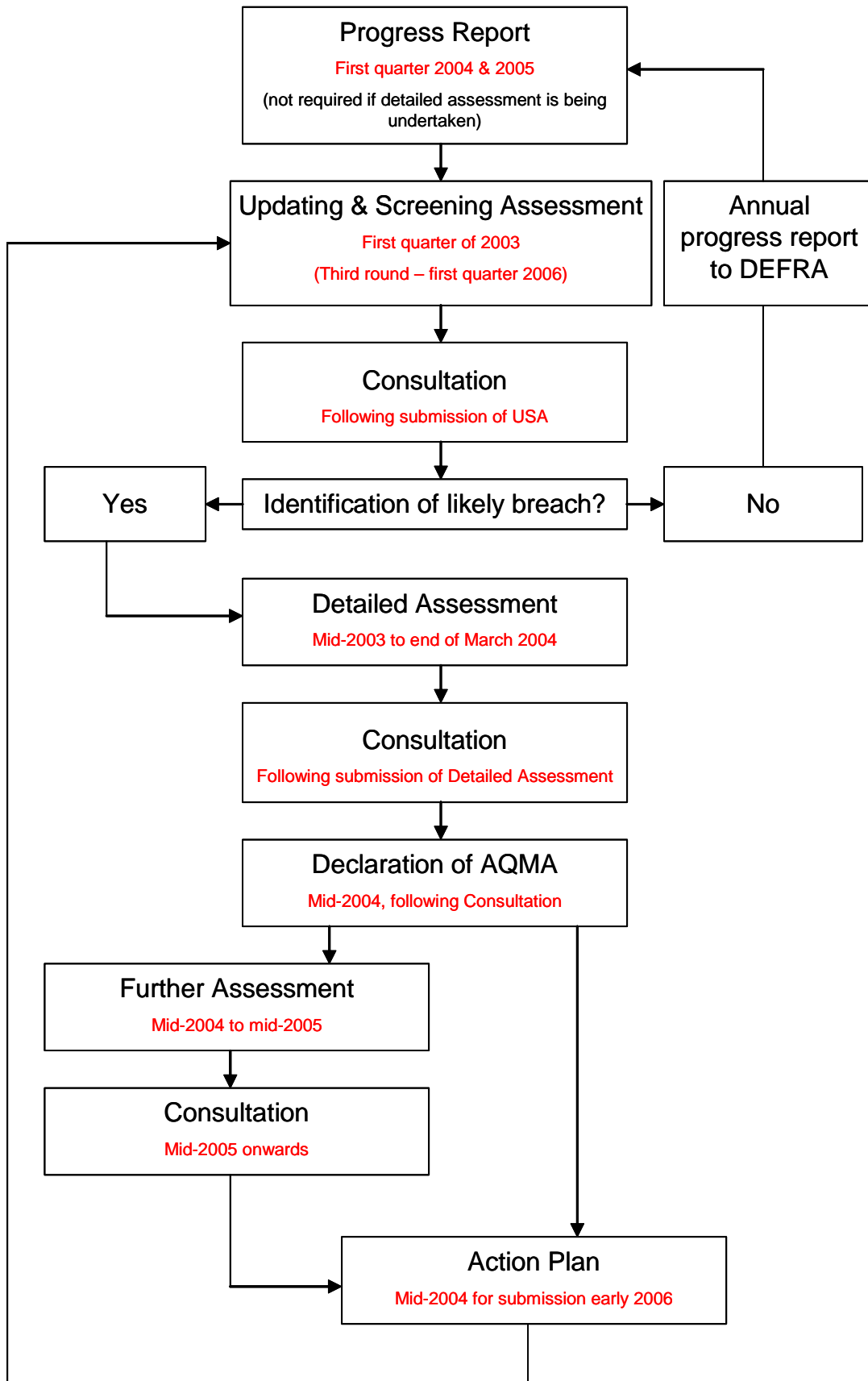
R&A, USA and AQAP Reports, produced throughout each round of review and assessment, should be made publicly available to anyone who wishes to read and comment on the issues raised therein. Local authorities must then respond to comments / queries as applicable.

2.6 Further Rounds of R&A

As illustrated in Figure 2-1, publication of the AQAP is the end-stage of the cyclical R&A process. Dover DC is currently undertaking the second round of R&A, following which assessment in Dover

will return to the USA stage to begin the third round of R&A which will culminate in the production of a second, or revised, AQAP.

Figure 2-1: Flow Diagram Representing the Local Air Quality Management (LAQM) Process



3 Sulphur Dioxide (SO₂) in Dover

3.1 Review and Assessment Findings

Dover DC's Stage 2 R&A indicated the likelihood of breaching the Air Quality (England) Regulations 15-minute mean objective for SO₂ only, in an area close to the Port where there is relevant public exposure. Consequently a continuous automatic air quality monitor was installed on Langdon Cliff for dispersion model validation purposes (Dover DC, 2003).

The more detailed Stage 3 Report predicted the scale and magnitude of the area in which the breach would occur. SO₂ data captured by the monitor at Langdon Cliff over a six month period indicated that monitored concentrations were substantially elevated and exceeded the 15 minute objective on 20 occasions. Dispersion modelling results supported the monitoring results hence the Stage 3 Report recommended designation of an AQMA in, and close to, the Port of Dover.

Dover's Stage 4 Assessment: further confirmed previous findings; provided modelled calculations of the necessary reductions in emissions required to meet the SO₂ objective within the AQMA; by means of source apportionment identified the prime cause of the emissions in order that this AQAP could be effectively targeted; and presented results of further continuous monitoring undertaken at a second site. The Stage 4 Report concluded that following consultation the AQMA could be amended slightly but that it must remain and that, following identification of relevant public exposure, an AQAP shall be implemented. Emissions from ferries using the Port of Dover were identified as being the prime and major source of the SO₂.

Since the completion of the Stage 4 report, monitoring of SO₂ levels at the two sites has continued. The following table shows historical and recent monitoring results including the number of exceedences of the 15 min SO₂ objective. Whilst up to date figures (Oct 2004) indicate a reduction in the number of exceedences (e.g. 12 at ZD3) this is a rolling year which can be seasonally sensitive.

allows for comparison of modelled 99.9th percentile 15 minute mean SO₂ concentrations for each scenario reported in Dover's Stage 4 R&A. Results indicated that, of the scenarios modelled, only that in which all ferries used fuel with less than 1.5 % sulphur content resulted in modelled concentrations indicating full compliance with the 15 minute SO₂ objective of 266 µg/m³. Use of fuel with 2 % sulphur content by all ferries would, however, provide a significant reduction in resultant concentrations compared to the baseline case.

Table 3.1

	ZD3 – Langdon Cliff				ZD4 – East Cliff			
	2001	2002	2003	2004*	2001	2002	2003	2004*
Data % Capture	76	97	95	739	65	35	97	72
Periods > 266mg/m ³	25	48	43	12	27	5	23	9
99.9%ile	260	277	276	232	275	224	250	207

*Monitoring still in progress readings to October 2004

Table 3-2: Summary of Stage 4 R&A Modelling Results for Eastern Docks (for 2005 assessment year)

Modelled Scenario	Maximum modelled 99.9 th percentile 15-minute mean SO ₂ concentration (µg/m ³)
Baseline	375
10 % growth in ferries	412
20 % growth in ferries	450
use of 2 % S in HFO ^(a) and 0.2 % gas oil by all ferries	273
use of 1.5 % S in HFO ^(a) and 0.2 % gas oil by all ferries	205
One ship only fitted with FGD ^(b) scrubber	344
Two ships only fitted with FGD ^(b) scrubbers	309

Note: It is P&O Ferries' opinion that growth in ferry movements by 2005 is unlikely to be 20 % or even 10 %

^(a) heavy fuel oil

^(b) flue gas desulphurisation

3.2 The Air Quality Management Area

Figure 3-1 indicates the extent of Dover's AQMA as designated following the Stage 3 R&A consultation and encompasses all areas in which it is anticipated that the SO₂ objective will not be achieved by 31st December 2005. As confirmed by the Stage 4 modelling, the highest 99.9th Percentile¹ concentrations occur at the Eastern Docks, then Langdon Cliff followed by East Cliff. As highlighted by the Stage 4 R&A, modelled contours indicating areas of breach are variable and are particularly dependent on the meteorological data used in the model.

3.3 Source Apportionment

Sulphur dioxide (SO₂) is a colourless, non-flammable gas, the most common sources of which include fossil fuel combustion by industrial and technological processes, power and heating plant and domestic coal / oil use. In the case of ferries, SO₂ arises through the combustion of sulphur-containing fuels whilst the ferries are either berthed in Port for loading and unloading or manoeuvring into and out of the Port.

Further air dispersion modelling undertaken as part of Dover's Stage 4 Assessment included ferry emissions and movements within the Port area. Results were analysed to determine predicted concentrations at several locations. Results indicated that the highest modelled SO₂ concentrations are close to where the ferries are emitting and confirmed that ferries are the principal source. Modelled concentrations showed good correlation with both the level and type of ferry activity occurring in the same areas, throughout the area of breach. Predicted modelled concentrations at the two monitoring locations showed good correlation, further supporting this conclusion.

¹ If an objective to be complied with at the 99.8th percentile, then 99.8 % of modelled concentrations at each receptor point in the relevant period (usually 1 year) must be at or below the level specified. This approach accounts for the possibility of occasions when it would not be appropriate to try to prevent breach of the objective level e.g. when 100 % compliance would require disproportionately expensive abatement measures.

Modelling undertaken in Dover's Stage 4 assessment utilised meteorological data for two separate years (2001 and 2002). The resultant modelled AQMA varied slightly in size and shape between the two sets of results. DEFRA has advised that the AQMA boundary need not be formally amended.

Background concentrations, derived from other sources e.g. domestic, commercial and industrial sectors, were estimated to contribute 2 % of the 266 µg/m³ standard and hence only ferry emissions have been considered within this assessment.

3.4 Required Reduction in Sulphur Dioxide Emissions

Dover's Stage 4 R&A (ERG, 2003) included modelling of the four scenarios as detailed in Table 3- to ascertain the effect of measures in reducing ambient SO₂ concentrations in 2005 (the compliance date for the relevant SO₂ objective).

Table 3.3 includes calculated percentage reductions in SO₂ emissions expected from each of the modelled scenarios as per the Stage 4 R&A Report. For completeness this table also contains corresponding emissions figures for the same scenarios as calculated by P&O Ferries. Some discrepancy exists between the two sets of data, however, percentage reductions will be verified following substantial trialling of Flue Gas Desulphurisation (FGD) scrubbers as detailed in Section 4.3.

Table 3-3: Summary of Stage 4 Modelling Scenarios and Predicted Emissions

Modelled Option	Description	% Reduction in SO ₂ Emissions from Baseline	
		Stage 4 Results	P&O Ferries' Calculations
1	use of 2 % sulphur HFO and 0.2 % gas oil by all ferries	27 %	25 %
2	use of 1.5 % sulphur HFO and 0.2 % gas oil by all ferries	46 %	44 %
3	one ship only fitted with a FGD scrubber	8 %	13 %
4	two ships only fitted with FGD scrubbers	16 %	27 %

Note: P&O Ferries' current fleet comprises 7 ships, one less than when the Stage 4 R&A was carried out. In addition, Seafrance has 4 ships and Norfolk Line has 2 (possibly rising to 3 later in 2004).

Contour plots of modelled concentrations included in the Stage 4 R&A indicated that only scenario 2 in which the sulphur content of fuel was reduced to 1.5 % was sufficient to reduce ambient levels to meet the SO₂ objective. This reduction in fuel sulphur is equivalent to a 46 % reduction in 2005 baseline SO₂ emissions.

To achieve an equivalent 46 % reduction in SO₂ emissions by fitting ships with FGD scrubbers such as those based on sea-water would require conversion of five to six ships.

Figure 3-1: Dover's AQMA – Declared on the Basis of Likely Breach of the 15-minute Mean SO₂ Objective



Source: Dover District Council's website (www.dover.gov.uk)

Note: Not to scale as reproduced

4 Proposed Management Measures

4.1 The Stakeholder Group

The 'Stakeholder Group' comprises representatives from Dover District Council's Pollution Team, The Dover Harbour Authority's Environmental Officer and is open to representatives of all ferry operating companies using the Port. The Group meets on a regular basis to discuss the Council's progress with regard to R&A, to exchange ideas regarding strategies for emissions reduction from the ferries and to report on the ferry companies' progress to date. The most recent meeting of the group was in January 2004.

It should be noted that Dover District Council has no statutory authority over the Port Authority or over the ferry operating companies that use the Port hence they are unable to control ferry movements or enforce measures upon the Port or ferry operators to ensure the 15-minute SO₂ Objective is met.

To date the two possible options identified by the Stakeholder Group as means by which the ferry companies may reduce the SO₂ problem in the Port of Dover are to run their fleet on lower-sulphur fuel or to retrofit seawater scrubbers to their engine exhaust stacks.

4.2 Reducing Sulphur in Fuel

An EU Commission proposal for revision of Directive 99/32/EC concerning the sulphur content of marine fuels proposed in November 2002 aimed to secure a 1.5 % limit for sulphur in fuel for North Sea and Baltic ships. The Commission was proposing to extend this limit to ferries in regular service to or from any EU Community port, and to ordain that the sulphur content of fuel used by vessels berthed in port should not exceed 0.2 %.

Currently P&O Ferries operates its fleet on Heavy fuel Oil (HFO) and Marine Gas Oil (MGO), the sulphur content and costs of which are detailed in Table 4-1. Switching to use of MGO only within the Port of Dover would result in significantly increased fuel costs for P&O Ferries, however, this is technically unfeasible because of the very short turnaround time. This increase on present day fuel costs could be reduced to 26 % if vessels were able to run berth to berth on fuel with 1.5 % sulphur content with generators continually using MGO. There would be no capital costs involved in ships switching to low-sulphur fuel.

Table 4-1: Sulphur in Fuel and Cost by Fuel Type

Operating scenario	Fuel type	S – content	Cost per ship per year	Total cost per ship per year
Current operations	HFO	< 2.4 %	£ 1 600 000	£ 1 900 000
	MGO	< 0.1 %	£ 300 000	
Alternative operations	HFO	< 1.5 %	£ 2 100 000	£ 2 400 000
	MGO	< 0.1 %	£ 300 000	

Source: P&O Ferries

Low-sulphur fuels for shipping may become more or less expensive in the future, however, should legislation enforce its use greater demand will inevitably result in higher fuel prices. This has not been accounted for in this appraisal.

The use of low-sulphur fuel by the Dover ship fleet may aid in the mitigation of elevated levels of ambient SO₂ in the Port of Dover area, however, it would result in transferral of the impact of SO₂ and carbon dioxide (CO₂) emissions to the location of the refinery from which it is sourced. CO₂ is a greenhouse gas, one of the primary drivers of climate change.

P&O Ferries has advised that it is not feasible for the ships using the Port of Dover to store two fuel types (of differing sulphur content) on board. Another alternative, connection to an on-shore power source, is not feasible because of short docking times and because of associated manoeuvrability issues. Typical power consumption per ship during an average docking period (approximately 30 minutes) is 1375 – 1500 kW.

4.3 Sea Water Scrubbing

Seawater scrubbing by means of Eco-Silencer is an alternative means of reducing SO₂ in exhaust gases. Eco-Silencers replace the silencer in the engine exhaust stack (or incinerator or boiler exhaust stack) and remove soot, reducing airborne noise and emissions which would otherwise be released into the atmosphere.

The Eco-Silencer works by encouraging hot exhaust gas to mix in a turbulent cascade with seawater. The surface area for contact between gas and water is high, and sufficient time for absorption of pollutants is provided to transfer the acid gases and particulates in the exhaust to the seawater. The seawater is then recirculated and solid particles removed from the exhaust gas are trapped in a settling tank where they can be collected for disposal. SO₂ removed from the exhaust goes into solution in seawater as sulphate and sulphite, both abundant constituent in natural seawater. Some wastewater is filtered to be released to the sea thus disposing of the sulphur.

P&O Ferries and BP Marine are currently jointly trialling the use of seawater scrubbers on the Pride of Kent, one of P&O Ferries' Dover fleet. Installation of eight Eco-Silencers (on four main and four auxiliary engines) cost P&O Ferries approximately £1.5 million. P&O Ferries has currently recorded around a 90 % reduction in SO₂ emissions when the scrubbers are operating, but expect to achieve up to 95 % reduction when full adjustments to the system have been undertaken. However, problems with the scrubbers, including seawater corroding the vessel's pipework, mean that the system will have to be replaced before the trial can continue. A second of P&O Ferries' fleet has been prepared to be fitted with Eco-Silencers once the trial has proved successful. **An Environmental assessment of the impact of seawater scrubbing is due to be published in the future.**

Capital costs involved in the fitting of exhaust gas scrubbers will approximate to £1 988 000 per ship for the Dover-based fleet, with annual maintenance costs in the region £ 30 000 per ship.

4.4 Evaluation of Measures

It is not the responsibility of the Dover Council to identify all the options. The broad basis have been posed in this Action Plan – the combinations are infinite, particularly when the unknown of the MARPOL agreement is taken into account. It is the opinion of the Council that it is the responsibility

of shipping companies to recognise the problems and consider their options in developing their scenarios.

Table 4-2 provides a matrix to evaluate variations on the two possible mitigatory measures in terms of possible impacts, both upon environmental media and otherwise.

It would appear from results in Table 4-2 that reduction of sulphur in fuel to 1.5 % would be the most effective method of achieving emissions reductions necessary in order to reduce ambient levels of SO₂ to levels sufficient to meet the 15 minute mean objective. However, figures presented are based on conversion of all ferries (fifteen in total) as compared to figures relating to predicted reductions achievable by adoption of FGD technology in one or two ships. Dover's Stage 4 Report estimated that in order to sufficiently reduce ambient levels of SO₂ to meet the 15 minute objective, the fitting of FGD scrubbers to four ferries may be sufficient.

Whereas the adoption of FGD scrubbers may result in additional benefits in terms of air quality by simultaneously reducing particulate emissions from the ships on which they are fitted, a switch to lower-sulphur fuel would result in increased emissions of both SO₂ and carbon dioxide (CO₂) at the refinery from which it is sourced. CO₂ is a greenhouse gas and the prime contributor to global warming. As far as the effects of the two mitigatory options on other environmental media is concerned, discharges to the sea from the FGD systems will contain a minor elevated concentration of sulphate and some absorbed particulate matter. It is estimated that the increase in sulphate concentration due to seawater FGD represents a very minor increase above the natural seawater concentration. Sulphates are not considered toxic to the marine environment; therefore, such a small increase is expected to be harmless to the environment. Heavy metal content of the particulates will be low and hence absorbed particulate matter in seawater discharge is not considered to be an issue.

Whether P&O Ferries decides to opt for switching to low-sulphur fuel or FGD abatement, there is likely to be some resultant impact upon transport and socioeconomic sectors in Dover. Both options represent substantial additional costs to P&O Ferries which may result in a rise in fares for their customers and hence affect their choice regarding preferred mode of Channel crossing. Should this additional cost result in P&O Ferries having to cut costs elsewhere, i.e. by reducing staff numbers, Dover's socioeconomics could be considerably affected.

Whilst Dover District Council has included the other ferry operators (Seafrance, Norfolk Lines) fully in the consultation process and both of these operators have attended stakeholder meetings in the past, to date no indication has been made by these as to the preferred measures planned to comply with EC Directives. Shipping companies are placed under restriction by the Department of Trade and Industry which prevents them from working together to take this issue forward, other than at third party meetings such as the stakeholder forum. In respect of actions and responses of the shipping operators in response to the Air Quality process, it is noted that at this stage participation is voluntary.

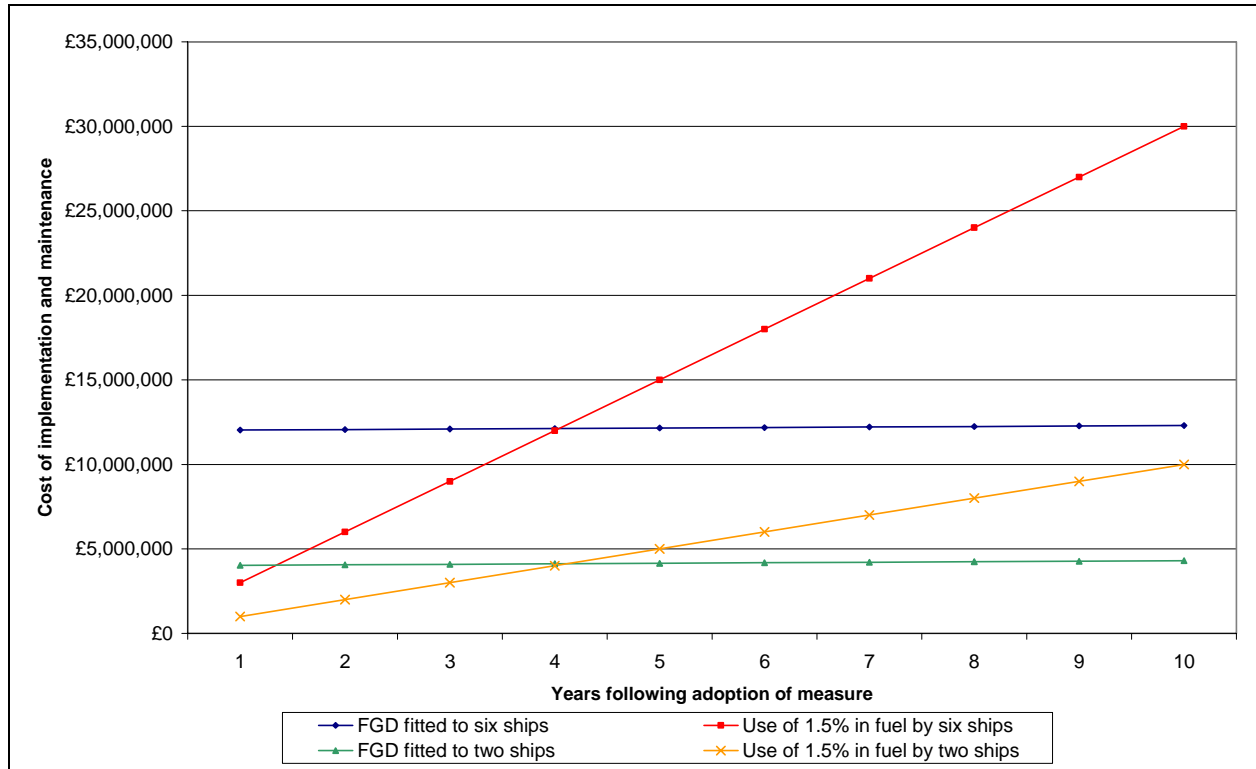
Whichever form of mitigation is adopted, the cost will be borne by the ferry operators. In terms of cost to the shipping industry, Figure 4-1 below demonstrates that when compared to switching ships to fuel with 1.5 % sulphur, the cost of fitting FGD to either two or six ships would be offset within approximately five years. Calculations have been made based on estimated costs presented in Sections 4.2 and 4.3 above and does not account for factors such as inflation, interest on borrowed capital or fuel cost predictions.

As mentioned previously, Dover DC has no statutory authority over either the Port Authority or ferry companies and hence any SO₂ – reduction strategy cannot be enforced by the council, only entered into voluntarily by the ferry companies. As discussed in Section 4.3, P&O Ferries is trialling the use

of FGD on one of its ships and has modified another on which FGD will be fitted once trialling has proved successful. The alternative, use of lower-sulphur fuels, is not a financially or commercially feasible option for P&O Ferries.

The remaining ferry companies operating from the Port of Dover have recently been unresponsive in terms of attending Stakeholder Group meetings and Dover DC are unaware of any measures they may be considering or implementing in order to reduce their SO₂ emissions.

Figure 4-1: Cost Comparison – FGD versus Low-Sulphur Fuel



4.5 Consideration of Other Local Authority Plans

Dover DC's Local Transport Plan and Local Transport Strategy relate primarily to road traffic issues, including regard to access routes to the Port of Dover. Issues relating to ferry movements are not included within these Plans.

As part of the Dover DC Corporate Plan, potential developers for the Dover Pride Initiative, which is a significant redevelopment of the St James area of Dover, have been made aware of the issues relating to pollution issues from shipping activities in Dover.

The Dover Harbour Authority has consulted Dover DC in relation to their Master Plan for the Port of Dover (Phase 1) August 2003.

Table 4-2: Matrix of Possible Mitigatory Measures and their Relative Merits

Impact	Reducing Sulphur in Fuel		Seawater Scrubbing		
	use of 2 % sulphur HFO and 0.2 % gas oil by all ferries ^(a)	use of 1.5 % sulphur HFO and 0.2 % gas oil by all ferries ^(a)	one ship fitted with FGD scrubber	two ships fitted with FGD scrubbers	four ships fitted with FGD scrubbers
% reduction in SO ₂ emissions (compared to baseline)	27 %	46 %	8 %	16 %	32 %
% reduction in ambient levels SO ₂ (compared to baseline)	27 %	45 %	8 %	18 %	32 – 36 % ^(b)
% reduction in size of AQMA	66 %	99 %	19 %	36 %	100 %
Other air pollutants	Increased SO ₂ and CO ₂ at refinery.	Increased SO ₂ and CO ₂ at refinery.	Also reduced particulates.	Also reduced particulates.	Also reduced particulates.
Noise	Not expected to be significant.	Not expected to be significant.	Not expected to be significant.	Not expected to be significant.	Not expected to be significant.
Other environmental	Not expected to be significant.	Not expected to be significant.	Not expected to be significant.	Not expected to be significant.	Not expected to be significant.
Transport	Possible change from present if ferry fares are increased.	Possible change from present if ferry fares are increased.	Possible change from present if ferry fares are increased.	Possible change from present if ferry fares are increased.	Possible change from present if ferry fares are increased.
Socio-economics	Possible negative effects if P&O Ferries forced to make staff cuts.	Possible negative effects if P&O Ferries forced to make staff cuts.	Possible negative effects if P&O Ferries forced to make staff cuts.	Possible negative effects if P&O Ferries forced to make staff cuts.	Possible negative effects if P&O Ferries forced to make staff cuts.
Cost	No figures available.	Increase of 26 % per year (£ 500 k per ship) upon current operations.	Initial outlay of almost £ 2 m, annual maintenance of £ 30 k.	Initial outlay of almost £ 4 m, annual maintenance of £ 60 k.	Initial outlay of almost £ 8 m, annual maintenance of £ 120 k.

Note: ^(a) Assumes a total of 15 ferries using reduced sulphur fuel

^(b) Estimated based on reductions achieved in modelled Scenarios 3 and 4 (one and two ships with FGD respectively).

5 Consultation and Reporting

5.1 Consultation Undertaken to Date

Following completion of Dover DC's Stage 3 R&A Report and declaration of the AQMA, Reports were made publicly available and the following stakeholders were consulted:

	Response		
BP			
District Councillors	✓		
Dover Town Council			
Dover Harbour Authority	✓		
East Kent Health Authority			
Environment Agency			
European Commission	✓		
European Ports Association			
Friends of the Earth	✓		

During this consultation period East Kent Health Authority conducted a questionnaire survey amongst residents within the AQMA. This survey resulted in some further enquiries and prompted some feedback. An open invitation public meeting was held in Dover Town Hall in June 2002. The purpose of this meeting was primarily to make local residents living within the AQMA aware of the air quality R&A process undertaken to date and the reasoning behind declaration of the AQMA. Dr Chandrakumar of the East Kent Health Authority provided information on the health effects of air pollutants. Councillor Mrs Munt, Dover's Environmental Portfolio Holder, chaired the meeting and, together with other Environmental Health Officers, addressed residents' questions. Residents were given details of future air quality assessment to be undertaken.

A further public meeting was held at Dover DC's offices in November 2003 (following completion of the Stage 4 R&A) in which residents living within the AQMA and adjacent areas were invited to learn about the current position with regard to air quality. Following this meeting, residents formulated a petition voicing their concerns over the burning of fossil fuels within the Port. This petition was passed on to the European Commission. Dover's Stage 4 Report raised some interest from the bunker oil industry as well as media groups.

Progress meetings with the Stakeholder Group have been ongoing throughout the consultation period. The group as a whole met in July 2002 and again in January 2004, in the interim period Dover DC and the Dover Harbour Authority have held regular consultation / progress meetings.

Responses from the consultation process as indicated in the above table (5.1) have been limited. District Councillors have been kept updated on progress with the Action Plan. The Media and The Maritime and Coastguard Agency is actively involved in the development implementation and enforcement of maritime environmental policy, including air pollution. As part of this Action Plan, initial consultation has been made with the MCA since publication of the Action Plan draft report and copies of this report and the Stage IV Review and Assessment have been sent to their Dover office. It is the intention to invite MCA to a future stakeholder meeting.

5.2 Proposed Consultation

In addition to making the AQAP publicly available, Dover DC is committed to maintaining regular meetings with the core Stakeholder Group. Appendix B is a signatory sheet by which the undersigned Stakeholder Group members agree to the proposed management measures proposed within this AQAP and agreed to implement these measures as far as is reasonably practicable. ~~The Stakeholder Group,~~ ~~through~~ Dover DC, must prepare a Progress Report on an annual basis for submission to DEFRA. **Details of any further consultation will be included in the progress report.**

6 Recommendations

Dover DC is committed to maintaining the two continuous air quality monitoring stations currently situated within the AQMA at East Cliff and Langdon Cliff. Following successful trialling of the FGD scrubbers and installation on the two P&O ferries, data captured from these two stations will be made available for comparison with predicted modelled reductions with actual reductions in measured ambient SO₂. Data will also be used for verification of any further modelling results.

Dover DC is committed to regular ongoing attendance at Stakeholder Group meetings and transparent public consultation at all stages of its review and assessment.

Both of the measures identified in this report (reducing sulphur in fuel and sea water scrubbing) have a cost implication to shipping companies. In regard to the localised sulphur dioxide problem, desulphurisation may appear to be the preferred option. Further investigation of secondary pollution by way of discharges to the sea need to be clarified.

7 References

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Appendix A European Policy and Legislation Relating to SO₂ in Shipping

A.1 Legislation Relating to the use of Heavy Fuel Oil (HFO)

Commission of the European Communities - COM(2003) 476 final, Amended proposal for a Directive of the European Parliament and of the Council amending Directive 1999/32/EC as regards the sulphur content of marine fuels.

The above proposal amends the existing Directive (1999/32/EC) which applied sulphur limits for fuels not including marine fuel. The amended proposal COM/2002/595 has been adopted to incorporate marine fuel and emissions from shipping.

The proposal (endorsed by European Parliament on 4 June 2003) is designed in particular to adopt limits for the maximum sulphur content allowed in marine fuels from the end of 2008, particularly in the North Sea, the English Channel and the Baltic Sea (0.5 % by mass). More specifically the objectives of the amendment are as follows:

- To place an obligation on the Member States to take all necessary steps to ensure that from 31 December 2008 marine fuels with a sulphur content of not more than 0.5 % by mass will be available in sufficient quantities to meet demand in all Community ports, and that from 31 December 2010 marine fuels with a sulphur content in excess of 1.5 % by mass will not be used in the areas of their territorial seas and in their exclusive economic zones.
- To impose the same obligations from 31 December 2012 - that is, that the sulphur content in marine fuels must not exceed 0.5 % by mass - in the territorial seas and exclusive economic zones of the Member States.
- To put in place a penalty system providing an effective deterrent; and to raise the rate of analysis of the samples to 50 % to reduce the risk of non-conformity.

A.2 Legislation Relating to the use of Marine Gas Oil (MGO)

Council Directive 93/12/EEC of 23 March 1993 relating to the sulphur content of certain liquid fuels; and Council Directive 99/32/EEC of 26 April 1999 relating to the sulphur content of certain liquid fuels and amending Directive 93/12/EEC.

In accordance with Directive 75/716/EEC, several EU Member States fixed a value of 0.2 % sulphur in fuel by weight.

Article 1 of Council Directive 93/12/EEC states that, in order to attain the particulate emission levels set in specific Community Directives, the sulphur content of diesel fuels placed on the market within the Community may not exceed:

- 0.2 % by weight as from 1 October 1994
- 0.05 % by weight as from 1 October 1996.

The directive also prescribed that Member States should take steps to ensure that the diesel fuels with a sulphur content not exceeding 0.05 % by weight are gradually made available.

Council Directive 99/32/EEC specifies that Member States shall take all necessary steps to ensure that gas oils, including marine gas oils, are not used within their territory as from:

- July 2000 if their sulphur content exceeds 0.2 % by mass
- 1 January 2008 if their sulphur content exceeds 0.1 % by mass.

Appendix B Stakeholder Group Signature Sheet

The undersigned members of the Stakeholder Group are in agreement with the content of this report and will abide, as far as is practicable, by the measures proposed to alleviate SO₂ pollution in Dover:

Brian Gibson – Dover District Council	
Nicola Jenkins – Environmental Officer, Port of Dover	
Dave Webb – Fleet Safety Manager, P&O Ferries	
Seafrance	
Norfolk Line Ferries	