DOVER
DISTRICT COUNCIL

Air Quality Action Plan

(Eastern Docks Dover)

Progress Report

November 2006

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Introduction

As part of the first round of the Air Quality Review & Assessment process, Dover District Council declared an Air Quality Management area for sulphur dioxide in the Port of Dover. The AQMA came into force on 20th June 2002. Further to the declaration, a final Air Quality Action Plan (2005) was completed following consultation which has subsequently been adopted by the Council.

In accordance with Policy Guidance LAQM.PG (03) sect. 3.36 Local Authorities have a requirement to submit annual action planning Progress Reports once the final action plan has been drawn up.

This report provides an update on original measures identified to improve levels of sulphur dioxide in the area of the Port of Dover and those reported in the Annual Progress Report 2005.

1. Air Quality Action Plan Progress

1.1 Monitoring

Since the adoption of the Action Plan the Council has continued to maintain the two continuous monitoring sites at Langdon Cliff (ZD3) and East Cliff (ZD4). The two sites were originally used to complement modelling data and assist in determining the extent of the declared AQMA.

Whilst some elevated levels of sulphur dioxide have been recorded at both monitoring stations since 2004, the number of exceedences has not breached the 15-minute objective (35 exceedences) for 2005. It is noted though that monitoring results for both 2005 and the first part of 2006 indicate that the number of exceedences on a rolling year total as much as 33 times. Closer interpretation of monitoring data show that exceedences are dependent to a large extent on meteorological conditions, where atmospheric temperature, humidity and wind direction are factors which influence the dispersion of elevated sulphur levels.

Policy guidance LAQM.PG (03) sect. 2.18 allows LAs to amend or revoke existing AQMAs where it considers it necessary. This has been considered by the Council. Due to the continued recording of elevated levels and the knowledge that during 2005 and the early part of 2006, the quality of bunker fuel burnt by the shipping operators remained unchanged it was decided that the AQMA should remain in place until there was sufficient robust evidence to justify amendment or revocation.

The Council's Updating Screening Assessment April 2006 identified the potential for the hourly objective for nitrogen dioxide to be exceeded and the proposal to carry out a detailed assessment of nitrogen dioxide at the Port of Dover is attached to this report as Appendix A. To provide monitoring data to support modelling work which will be undertaken, a new nitrogen dioxide analyser will be set up within the Eastern Docks. **This will monitor emissions from both**

shipping movements and HGVs within the port area. In order to be able to distinguish between the contribution from ships and HGVs it has been decided to close the East Cliff site and re-locate the sulphur dioxide analyser at the new site. This will also allow a closer study to determine whether the 24 hour mean (125ug/m3 not to be exceeded more than 3 times a year) and 1 hour mean (350ug/m3 not to be exceeded more than 24 times a year) objectives for sulphur dioxide are likely to be breached.

The decision to close the East Cliff site is also supported by a series of malfunctions of the analyser due to contamination from an undetermined localised source.

1.2 Consultation with Stakeholder Groups

The Council have continued to publicise all air quality reports on the Council website.

Regular stakeholder meetings are held with the port operators, and updates have been provided by the ferry operators in relation to trials on abatement technology. Initial trials on PO Ferries whilst initially unsuccessful, have recently reported encouraging results.

The Council have held public consultation meetings at regular stages of the Local Air Quality review process, the latest held at the Town Hall in Dover on 8th December 2005.

The Council presented a paper '*The Influence of International Ferries on Air Quality in a Coastal Town'* at the 1st International Conference on harbours and Air Quality at Genoa, Italy in June 2005. The paper can be read on the following link: -
http://www.fisica.unige.it/atmosfera/HAQ/download/Hedley-Gibson.pdf

1.3 Update on European Legislation EU Directive 99/32

International legislation governing the reduction of SOx and NOx emissions from shipping is being enforced, and both the European Union and the USA are planning to introduce additional regional laws to reduce emissions. In April 2005 the European Union finalised legislation limiting sulphur in marine fuels and the USA are planning to introduce additional laws to reduce emissions to air from ships.

From 19th May 2006 the Baltic Sea has become the first SECA (Sulphur oxide Emission Control Area). Ships sailing in SECAs must either use fuel oil with a maximum sulphur content of 1.5% m/m or fit an approved exhaust gas cleaning system or other technological method to reduce the emission of sulphur oxides to 6.0g SOx/kWh or less. The North Sea and English Channel will become a SECA in November 2007.

Locally, from 11th August 2006, all ferry operators commenced the use of low sulphur fuel (<1.5%) in line with EC Directive 2005/33, whereby operators of passenger vessels on regular services to or from any Community port should comply with the 1.5% S limit while they are in EU territorial seas.
It has been established that all local ferry operators have complied with this legislation and currently use the lower S fuels.

The Council will assess monitoring results which become available from the existing Langdon Cliff site and the proposed new site within the docks to evaluate improvements which may result from the introduction of the EU Directive.

It is clear that with the implementation of EU Directives there is every likelihood that substantial improvement in local sulphur dioxide ambient levels will be achieved. The Council is aware of moves by the shipping and oil industries to introduce emissions trading and notes recent reports published by SEAaT (Shipping Emissions Abatement and Trading). However, whilst the Council supports the principal of seawater scrubbing, it will be necessary to clarify any consents issued by regulators which allow some ships to exceed a prescribed relative limit (i.e. 1.5% sulphur fuel content) while others perform better than the limit.

Some extensive modelling work has already been published by the Council (Stage 4 Review and Assessment of Air Quality October 2003) which examined a number of different scenarios in relation to the use of ferries fitted with abatement technology, however it remains to be seen what emission trading arrangements will be acceptable and subsequent monitoring of EU and Local Objectives to be undertaken in the future. The Council will continue to monitor the situation through discussion with ferry operators, the Dover Harbour Board and SEAaT.

A summary of the above is shown in Table 2.1.

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Table 2.1 Update on Action Plan Measures

Action	Action Plan Description	Organisation responsible	Original Timescale	Progress with measures	Outcome to date	Comment
1	Dover DC is committed to maintaining the two continuous air quality monitoring stations currently situated within the AQMA at East Cliff and Langdon Cliff.	DDC	Ongoing – current SO_2 monitor at ZD3 East Cliff site to be re-located in Nov 2006 (see notes)	1. Dover DC continues to monitor SO_2 at the Langdon Cliff site 2. East cliff monitor to be re-located to new site within the AQMA in the Eastern Docks	2005 - 06 results showed no exceedences of the Objectives at these sites	Data capture of 90% achieved at Langdon Cliff site
2	Dover DC is committed to regular ongoing attendance at Stakeholder Group meetings with the Port of Dover and Ferry Operators, and transparent public consultation at all stages of its review and assessment.	DDC	Ongoing	Dover DC continues its commitment to regular ongoing attendance at Stakeholder Group meetings and public consultation	Consultation with Port of Dover & ferry operators continue – discussions with MCA on Port emissions	1. Joint paper on sulphur dioxide concentrations in Dover presented at International Conference in June 2005 – Genoa, Italy 2. Public meetings held and all information posted on DDC web pages 3. Continued consultation & dialogue with Port of Dover & ferry operators on abatement technology trials
3	Compliance with EU Directive 99/32 relating to the use of Heavy Fuel Oil (HFO) through mitigation measures (Likely to be flue gas desulphurisation (sea water scrubbing) or use of low sulphur fuel)	Ferry Operators	2008	EU Directive 2005/33 came into force on 11th August 2006	To be determined	Recent changes in fuel use by all Dover ferry operators to be monitored by DDC once emission trading objectives identified

Appendix 1

Environmental Research Group

King's College London

Proposal to the Dover District Council for the Detailed Assessment of Nitrogen Dioxide At the Port of Dover

July 2006

Introduction

This proposal is intended to assist the Council to continue to meet its local air quality management (LAQM) responsibilities as required by the Environment Act 1995.

The Council has recently completed its third round Updating and Screening Assessment. The report utilised both updated monitoring results and information relating to the District.

The USA examined nitrogen oxide (NOx) emissions from ships and modelled these emissions based on a series of assumptions. This initial screening exercise indicated that the 1-hour mean nitrogen dioxide (NO_2) objective is at risk of being exceeded in the port area. The modelling however did not take into account other sources in the area, such as emissions from road traffic and thus the results may be underestimated. The Council has previously established that NO_2 concentrations are high in the area and declared an AQMA based on road traffic along the A20 Townwall Street from the York Street roundabout to a point 140m west of the Eastern Docks entrance for annual mean NO_2.

One of the USA conclusions for nitrogen dioxide was that a Detailed Assessment is required at the Port of Dover due to potential exceedences of the hourly NO_2 objective.

Detailed Assessment of nitrogen dioxide for the Dover District Council

The LAQM. TG 03 guidance produced by DEFRA requires that the Council undertake a Detailed Assessment where it has identified a risk that an air quality objective might be exceeded at a location with relevant public exposure.

The guidance requires the use of in depth assumptions, and quality assured data. The purpose of which is to provide confidence in the decisions reached.

Thus the Detailed Assessment will enable the Council to identify with reasonable certainty whether or not a likely exceedence of the Air Quality Strategy objectives for NO_2 will occur. Where a likely exceedence is identified then the Detailed Assessment will need to be sufficiently detailed to determine both its magnitude and geographical extent.

The following sections summarise the proposed approach to be taken by ERG in order to fulfil the Council's requirements in respect of the Detailed Assessment.

Proposal outline

The ERG has previously assisted the Dover District Council with its modelling assessment of sulphur dioxide (SO_2) emissions from ferries at the port of Dover and its subsequent declaration of the AQMA in the Eastern Docks. To undertake this previous work the ERG used the results of monitoring and modelling together to provide strong evidence for the declaration. In a similar fashion to those of SO_2, the hourly objective for NO_2 is based on the number of peak periods of pollution during a

calendar year; in this instance it is 18 hourly periods of 200 µg m^{-3} or more. The ERG therefore proposes the use of a similar methodology to that used for the SO_2 studies, which were also of peak pollution periods.

This proposal utilises a combination of an analysis of monitoring results and an in depth modelling study incorporating the findings of the monitoring analysis. It is considered that this combination of techniques will provide the most robust conclusions. In isolation the monitoring analysis can only provide an understanding of concentrations at a specific location, whereas the dispersion modelling typically works best for long averaging periods rather than the peak periods that need to be reported on. The dispersion modelling will also need to incorporate both ship emissions (modelled as point sources) and emissions from road transport (modelled as line sources). The ERG has already made considerable progress in the development of advanced modelling techniques to predict air pollution from road transport, which meet the requirements of the TG03, these include the following developments:

- All major roads on an exact geographic basis;
- All minor roads on an exact geographic basis;
- Predictions plotted on Ordnance Survey base maps;
- Unique and advanced modelling methods;
- Validated against an extensive data set of up to date monitoring data;
- A best estimate of model uncertainty.

The ERG's models have been widely used by DEFRA and local authorities in the southeast for the purposes of modelled Detailed and Further assessments of both point and line emission sources. The Mayor for London has used the models to develop the Mayor's Air Quality Strategy, to undertake modelling for the London Emission Zone study and also by Transport for London in connection with the Congestion Charge Scheme.

Further analyses of monitored data to update and better understand the specific conditions when high concentrations of NO_2 have been observed.

1. The results of the NOx/ NO_2 monitoring undertaken by the Council will be used to confirm whether or not episodes of high pollution exceeding the government's air quality objectives are arising. An analysis of the monitored pollution data with meteorological data will be undertaken to enable meteorological conditions, including the precise wind direction and wind strength during the high pollution episodes. This monitoring will also be compared to concurrent SO_2 data from the other Dover sites on Langdon Cliff and East Cliff to establish whether there is any correlation between the different sources and emissions.

2. The analysis will use an improved pollution rose technique to identify sources of pollution. An example of the technique based on a monitoring site in the East Thames area is given below in Figure 1. The monitoring reported focuses on SO_2, rather than NO_2 but the same principles will be applied.

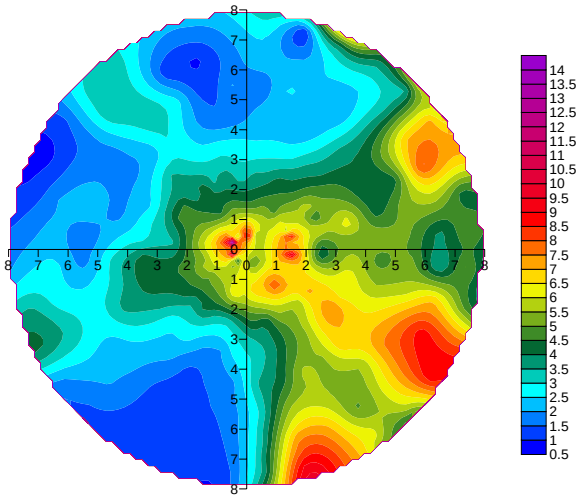


Figure 1 Pollution rose for SO_2 (ppb) at a background site in the East Thames area.

The technique uses polar coordinates to indicate pollutant concentrations associated with wind direction and speed in the same figure. Hence the axes shown in the above figure represent wind speed (metres per second).

The analysis described above has been included to highlight how it can be used to identify individual sources of pollutants. The site is situated in an area that has a high proportion of industrial activity and is therefore influenced by a complex mixture of sources. Figure 1 shows the pollution rose for SO_2 and indicates that there are three clear regions where a source has an influence (approximately 60, 120 and 160°). The concentration of SO_2 increases with increasing wind speed and such increases in concentration with wind speed are indicative of a high-level source e.g. a chimney stack, where the plume is brought down to ground-level. At the site therefore, it is likely that there are at least three stacks in the vicinity that have an influence on ground-level concentrations of SO_2.

It is also interesting to compare the SO_2 plot with that for PM_{10}. Figure 2 shows the same type of plot for PM_{10} and highlights sources at 20, 60 and 120°. At 120° the area of high PM_{10} concentration coincides with that for SO_2, which is indicative of a source that emits both PM_{10} and SO_2. The PM_{10} source at 120° is less distinct and might indicate a source that is an important emitter of SO_2 but less important for PM_{10}. Interestingly, the source at 20° is only a source of PM_{10} and not SO_2. The source at 20° also has an increasing PM_{10} concentration with wind speed, which might indicate a high-level source, but equally could be indicative of a wind-blown source where re-suspension becomes important at increasing wind speeds. These plots, together with some knowledge of the local environment in the vicinity of a monitoring site, therefore have the potential to highlight important individual source types.

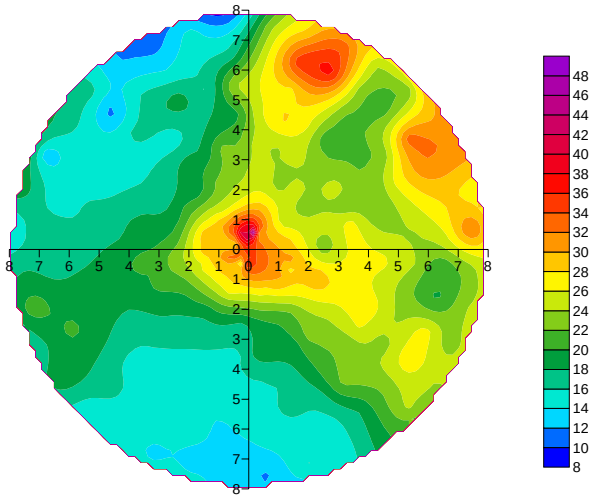


Figure 2 Pollution rose for PM_{10} (µg m^{-3}) at a background site in the East Thames area

It is proposed that this technique will be used to further highlight understanding of the source(s) of pollution arising from Eastern Docks.

Improved and updated modelling of the sources

The ERG used ADMS 3.1 for the SO_2 Detailed Assessment. This point source model has been validated in well-documented trials and has an appropriate pedigree for modelling point and industrial sources.

The project will re-assess the information for NO_2 (and SO_2) to determine both the magnitude and geographical extent of the area where the any exceedence of the objectives is identified.

Model verification will be undertaken in accordance with the TG03 guidance and the previous SO_2 modelling where appropriate.

Detailed Emissions Estimates

Understanding the emissions from the process and release conditions of the discharges are key factors. The ERG will develop an emissions inventory for the area based on emissions data from ferry activity and road transport. Details of ferry activity have been previously been used and these data will be up dated. Details of road transport from the previous Dover DA will also be up dated and used to understand the vehicle stock and activity in the port area.

Emissions of road sources will be on a 10m point basis, thus allowing emissions to be varied along each link. This approach allows, for example, emissions near junctions where vehicle idling is important to be increased. Second, the emissions sources are geographically accurate, enabling roundabout and complex road junctions to be modelled thoroughly. Third, maps of concentration will also be geographically accurate allowing more accurate assessments to be made of exposure.

Model estimates

Hourly sequential meteorological data from the Met. Office for the most recent (full) years of monitoring, i.e. 2002 to 2005 will be used. Data from Manston in Kent was previously used and the site will be used if such data are still available. The study area will focus on the identified receptor locations as agreed with the Council.

A careful treatment of background concentrations will be necessary to ensure that emissions are not double counted. Estimated background concentrations for the Dover area are available from the airquality.co.uk website and these will be examined for appropriateness. Alternatively modelled area sources from the NAEI will be used and checked against data from the Kent and Medway Air Quality Monitoring Network.

All model results will be verified as much as possible with concurrent monitored data, in accordance with the requirements of the TG03 guidance.

Sensitivity tests will also be used throughout the project to build further robustness and develop confidence in the results from the study.

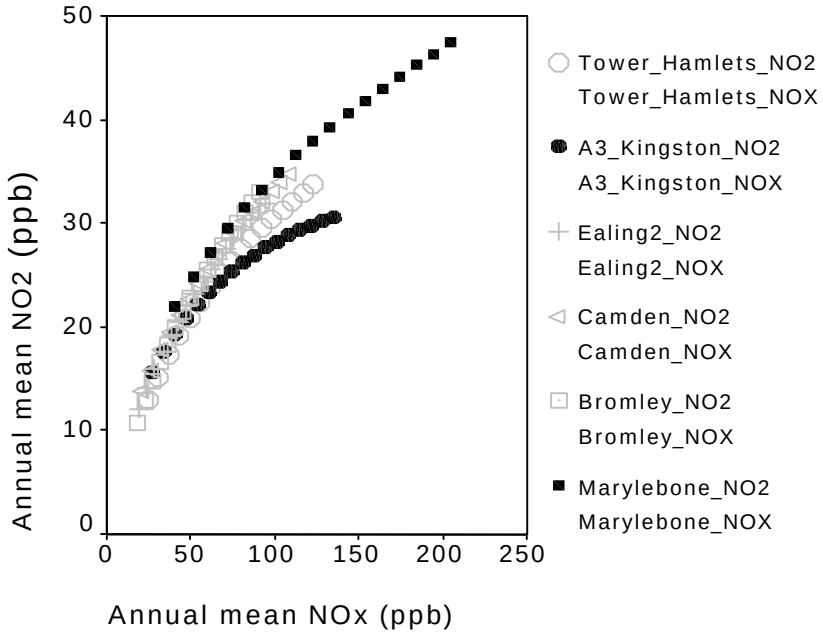
NOx and NO_2 Relationships

Understanding of the NOx/ NO_2 relationship is very important and previous ERG work has shown how the relationship changes with distance from source.

The modelling approaches adopted use the approach described by Carslaw et al. (2001) and a summary of the key points is given here. The relationship between hourly NOx and NO_2 has in the past been summarised by plotting NO_2 against NOx in different NOx 'bins', for example 0-20, 20-40 µg m^{-3} etc, (Derwent and Middleton, 1996). The resulting NOx to NO_2 relationship describes the main features of NO_x chemistry, first the NOx-limited regime where NO_2 concentrations increase rapidly with NOx and second the O_3-limited regime where a change in NO_X concentration has little effect on the concentration of NO_2. A third and final regime also exists where, once again NOx and NO_2 increase pro-rata, related to extreme wintertime episodes. In all cases, the precise relationship is always both year and site dependent.

Of more use than the hourly relationship discussed earlier is the relationship between the annual mean NOx and NO_2 concentrations. The construction of these curves is both site and year specific. When using these relationships it is important to differentiate between those applicable to background locations and those applicable to roadside locations for any given predicted year. A hierarchy of NOx and NO_2 relationships is summarised in Figure 3 below and these will be examined further based on the findings from the new and existing Dover sites.

Figure 3 NOx/ NO_2 relationships for different sites



The range of NO_2 concentrations, for a given NOx concentration, at the roadside are much larger than for background locations. This is because of a number of factors, including the relative contribution of the road to total NOx concentrations, the rapid fall-off in concentration away from a road and the rapid reaction between NO and O_3 to form NO_2.

A full report will be written outlining the results and methodology for each phase. The report will include recommendations for the Council's next actions. Three hard copies will be supplied. The full report will also be converted to PDF format to enable the Council to distribute the report with ease e.g. via the Internet.