



UK Emission Projections of Air Quality Pollutants to 2020

The results and assumptions of the 2007 to 2020 air quality pollutant emission projections

A report of the National Atmospheric Emissions Inventory
AEA Group

Compiled by the UK Projections Team, AEA



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UK Air Quality Emission Projections: 2007 to 2020

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Executive Summary

As part of the National Atmospheric Emission Inventory (NAEI) work carried out for Defra by AEA, projections of UK emissions are compiled to enable comparisons with international commitments to be made. At this time, projections have been compiled for the four National Emissions Ceiling Directive (NECD) pollutants (nitrogen oxides (NO_x), sulphur dioxide (SO₂), non-methane volatile organic compounds (NMVOCs), and ammonia (NH₃) plus PM₁₀ and PM_{2.5}).

The latest emission projections are based on:

- the Department of Energy and Climate Change (DECC) Updated Energy Projections 37 (UEP37) energy forecasts published in April 2009;
- the Department for Transport (DfT) 2008 traffic forecasts and TRL emission factors (NO_x and PM₁₀);
- North Wyke Research, BAU (III) preliminary agricultural projections (October 2008); and
- the 2007 emission estimates for each source sector from the NAEI.

The UEP37 energy projections were developed on the same basis as UEP32, including the impacts of policies and measures announced up to and including those in the Energy White Paper. The main changes from UEP32 to UEP37 were revised policy appraisals, revised economic growth assumptions (consistent with the analysis used for the April 22nd Budget), revised household projections, and updated fuel prices. Analysis by source sector experts has also integrated additional considerations of the likely emission reductions from regulatory measures, technological and abatement advances.

This set of emission projections was compiled in May 2009, and is referred to as UEP37 (2007). The energy trends that have been used to underpin the emission projections reported here are taken from the UEP37 “central, central, central” scenario, which refers to central fuel and carbon prices, central economic growth forecasts and central policy impacts. These are regarded as the best current forecast for future energy use, taking account of current and firm and funded policy measures.

The UEP37 (2007) emission projections show that the UK is likely to meet the NECD targets in 2010 for SO₂, NMVOCs and NH₃. Emissions of NO_x are forecast to exceed the ceiling in 2010. However, it is forecast that the NO_x ceiling will be achieved prior to 2015.

Uncertainty analysis indicates that:

- There is a 100% chance that the SO₂ ceiling will be met in 2010;
- There is close to a 100% chance that the NMVOC ceiling will be met in 2010;
- There is a 59% chance that the NH₃ ceiling will be met in 2010;
- There is only a 35% chance that the NO_x ceiling will be met in 2010.

The uncertainty analysis shows that future emissions of SO₂ can be estimated with most confidence as emission factors are relatively certain, being largely based on the sulphur content of fuels, and these are well characterised. In comparison, projections for NO_x, NMVOC and NH₃ are considerably more uncertain and this means that a much greater range of future emissions is predicted by the uncertainty analysis. In the case of NMVOC and NH₃, whilst the central ‘with measures’ projection is that the UK will meet its commitments, the uncertainty analysis suggests that there is a possibility that this will not happen (although this possibility is extremely slight in the case of NMVOC).

Key Findings by Pollutant

Oxides of Nitrogen (NO_x)

- Emissions in 2010 are projected to be **1217kt**. This is 18% below 2007, but is higher than the emissions ceiling for this pollutant (1167kt).
- Decreases in emissions are projected to occur across a number of sectors, with the most significant decreases in the power sector, road transport and industrial combustion. These sources are among the more significant sources of NO_x emissions.
- The only sector in which a notable increase is expected is petroleum refining.

Sulphur Dioxide (SO₂)

- Emissions in 2010 are projected to be **411kt**. This is 30% lower than emissions in 2007, and well below the emissions ceiling of 585kt.
- The sector which contributes the most to the expected significant decrease in emissions is the power generation sector, where emissions are expected to decrease through both tighter regulation and reduced coal consumption.
- A large increase in emissions is projected for refineries. This is based on a “worst case” scenario, assuming that there will be no additional effort to go beyond the requirements of the LCPD. The current economic downturn is likely to lead to a lower emission in this sector than currently projected.

Ammonia (NH₃)

- Emissions in 2010 are projected to be **291kt**, 1% lower than emissions in 2007. This is lower than the emissions ceiling of 297kt.
- Significant decreases are projected for a number of sources, most notably non-dairy cattle wastes, road transport and agricultural soils.
- These decreases are largely offset by other increases in the agriculture sector for dairy cattle and poultry wastes.

Non-Methane Volatile Organic Compounds (NMVOCs)

- Emissions in 2010 are projected to be **816kt**, 13% below emissions in 2007. This is well below the emissions ceiling of 1200kt for this pollutant.
- The reduction is driven by reductions in emissions from the distribution of oil products, NFR category 3D (which includes sources such as aerosols, household products and industrial adhesives), category 3A (paints and industrial coatings) 3B (surface cleaning) and reductions in leakage from the gas distribution system.
- No significant increases are expected.

Particulate Matter, sub-10 micron and sub-2.5 micron (PM₁₀ and PM_{2.5})

- Emissions of PM₁₀ and PM_{2.5} are projected to decrease by around 17% and 16% respectively from 2007 to 2010.
- The largest reductions in PM₁₀ emissions are projected to occur in the power stations, minerals industry and residential sectors.
- These projected reductions are similar for PM_{2.5}
- There are no significant increases projected in any sector for either PM₁₀ or PM_{2.5}

Summary of main changes

The main changes to the projections since the previous projections were reported in March are as follows:

- Update to energy projections. Projections are now based on UEP37, which takes into account updated economic forecasts, policy appraisals and carbon prices
- Update to projections for road transport. The results of this update for NO_x and PM₁₀ (and PM_{2.5}) are included in this report. Updated emissions for other pollutants will be included in the final draft report for these projections.
- Updated projections for some industry sectors to take planned closures, or closures since the most recent inventory into account.
- Off road machinery projections have been updated.
- Offshore emissions have been reviewed and revised.

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1 Introduction

1.1 SUMMARY OF THE AIR QUALITY PROJECTIONS METHOD & KEY DATA SOURCES

As part of the National Atmospheric Emission Inventory (NAEI) work carried out for Defra by AEA, projections of UK emissions are compiled to enable comparisons with international commitments to be made. This report summarises the main assumptions in the latest projections and the differences between these and a previous set of projections produced in January 2009.

Emission projections are compiled for the four pollutants covered under the National Emission Ceiling Directive (NECD) – nitrogen oxides (NO_x), sulphur dioxide (SO₂), non-methane volatile organic compounds (NMVOCs) and ammonia (NH₃) plus particulate matter (PM₁₀ and PM_{2.5}), with other air quality pollutants on request. There are two sets of projections referred to in this report. They are:

- UEP32 (2007). These projections are based on DECC UEP32 energy forecasts and the November 2007 traffic forecasts from DfT. They use 2007 NAEI source emission estimates as their starting point (except for road transport, the projections for this sector are still based on the 2006 NAEI estimates, and have yet to be updated). This set of emission projections is referred to here as UEP32 (2007).
- UEP37 (2007). These projections are based on DECC UEP37 energy forecasts and the DfT's 2008 traffic forecasts. The inventory baseline is the same as for the previous set of projections (2007). This set of emission projections is referred to here as UEP37 (2007).

Table 1.1 Projection definitions

Projection dataset	Date of DECC Energy Forecast publication	NAEI emission starting point	DECC energy forecasts, scenario used	Road transport data source and key assumptions
UEP32 (2007)	November 2008	2007 (2006 for road transport)	UEP32 central policies, central growth and central prices	Based on DfT's November 2007 traffic forecasts and includes Euro VI standards for HDVs
UEP37 (2007)	April 2009	2007	UEP37 central policies, central growth and central prices	Based on DfT's 2008 traffic forecasts, and TRL's updated NO _x and PM ₁₀ emission factors.

The results and assumptions behind previous emission projections can be found in Wagner et al 2009¹, Hobson and Passant 2008² Hobson and Li, 2007³, Hobson, 2005⁴ and Hobson, 2004⁵.

1.2 CONSISTENCY WITH GREENHOUSE GAS PROJECTIONS

CO₂ forecasts are produced by DECC and those that are consistent with the air quality projections provided in this report are presented in Table 4.13. Projections of non-CO₂ greenhouse gas emissions are also compiled by AEA and a summary of the results is presented in Table 4.14.

1.3 UK AIR QUALITY EMISSION COMMITMENTS

The UK has made commitments under the Gothenburg Protocol and the more stringent National Emissions Ceiling Directive (NECD) to reduce emissions of NO_x, SO₂, NMVOCs and NH₃ by 2010. The target emissions are provided in Table 1.2 below together with the UK's actual estimated emissions in 2007 (the latest year available). These targets are to be achieved in 2010 and subsequent years. The historical emissions data shows that the NMVOC and NH₃ reduction ceilings have already been reached. A large decline is needed between 2007 and 2010 if the UK is to meet

¹ Wagner et al, 2009, UK Emission Projections of Air Quality Pollutants to 2020, March 2009

² Hobson and Passant, 2008, Emission Projections 2006. The results and assumptions of the 2006 air quality pollutant projections. June 2008.

³ Hobson and Li, 2007. Emission Projections 2005. The results and assumptions of the 2005 air quality pollutant projections.

⁴ Hobson, 2005. Emission Projections. A report produced for AEQ, Defra, January 2005.

⁵ Hobson, 2004. Status Report on emission projections. March 2004.

its emission ceiling target for NO_x. Annual emissions of SO₂ need to be further reduced by 6 kilotonnes by 2010, to meet the UK's emission ceiling target.

Table 1.2: The UK's emissions in 2007 (as reported to the NECD) and the ceilings in 2010 that the UK is committed to.

Pollutant	Emissions in 2007 (Ktonnes)	Emissions ceiling target in 2010 (Ktonnes)	Reduction required between 2007 and 2010 (Ktonnes)
NO _x	1486	1,167	319
SO ₂	591	585	6
NMVOCs	942	1,200	0
NH ₃	289	297	0

The progress to target for each pollutant is shown graphically in Section 4 of this report, Emission Projection Results.

1.4 AIR QUALITY EMISSION REPORTING REQUIREMENTS

The NAEI provides the UK estimates of emissions of nitrogen oxides, carbon monoxide, ammonia, sulphur dioxide, NMVOC, persistent organic pollutants and heavy metals to be submitted to UN/ECE under the Convention on Long-Range Transboundary Air Pollution (CLRTAP). Member States are also required to submit emissions data for four pollutants under the NECD. As part of the commitments to the CLRTAP (under the Gothenburg Protocol) and NECD, countries are also required to submit emission projections for selected pollutants. These emission projections are compiled and reported as part of the NAEI programme, and data are provided to international emission inventory activities such as the EC's CORINAIR and EUROSTAT inventories. The emission results presented in this report are consistent with the NECD reporting obligations.

Projections data compiled under the NEC Directive have to be reported yearly by the 31st December. The LRTAP convention requires emission and activity projections to be submitted every 5 years by the 15th February in a specified format. UNECE guidelines are largely harmonised with the reporting requirements of the EU Monitoring Mechanism Decision / UNFCCC and NECD.

The two obligations, CLRTAP and NECD, have different requirements as regards scope of pollutants to be reported. However, they have been harmonised in line with the 2007 EMEP guidebook⁶ to include reporting for the same activity sectors. A summary of the main technical differences between the two reporting obligations in line with the updated EMEP guidebook is provided in Table 1.3 below.

Table 1.3: Comparison of Scope of NECD versus CLRTAP Reporting Mechanisms

	EU NECD	LRTAP Convention
Air pollutants	NO _x , SO _x , NMVOCs, NH ₃	NO _x , SO _x , CO, NMVOCs, NH ₃ , HMs, POPs, PM
Domestic aviation (landing and take-off cycle [LTO])	Included in national total	Included in national total
International aviation (LTO)	Included in national total	Included in national total
National navigation (Domestic shipping)	Included in national total	Included in national total
International inland shipping	Included in national total	Included in national total
Domestic aviation (cruise)	Not included in national total	Not included in national total
International aviation (cruise)	Not included in national total	Not included in national total
Maritime international shipping	Not included in national total	Not included in national total
Road transport	Emissions calculated based on fuel sold or consumed	Emissions calculated based on fuel sold ⁷

⁶ <http://www.eea.europa.eu/publications/EMEP/CORINAIR5/>

⁷ UK emissions are calculated based on fuel consumed

2 Emission Projections Methodology

The NAEI projection methodology broadly follows the methodology outlined in the EMEP / CORINAIR Emission Inventory Guidebook 2008.

In order to establish consistency between historic and projected emissions, emission inventories and emission projections should be based on the same structure. Therefore a similar method to that used to calculate historic emissions has been used to estimate future emissions. Historical emissions are calculated by combining an emission factor (for example, kilograms of a pollutant per million tonnes of fuel consumed) with an activity statistic (for example, million tonnes of fuel consumed).

For example:

$$E_{2007} = A_{2007} * EF_{2007}$$

where E = emission, A = activity and EF = emission factor, all for the year 2007.

For projected emissions:

$$E_{2010} = A_{2010} * EF_{2010}$$

Where E = emission, A = activity and EF = emission factor, all for the year 2010.

2.1 ACTIVITY DATA FORECASTS

To produce a projection, each source in the NAEI is linked to an activity driver. Examples of drivers may include forecasts of fuel use, vehicle kilometres, animal numbers or broader indicators such as forecasts of population, or economic indicators such as Gross Domestic Product (GDP) or Gross Value Added (GVA). The latest activity drivers are derived from a number of sources including the Department of Energy & Climate Change (DECC) latest energy forecasts from UEP37, a description of which was published as an addendum to the November 2008 forecasts in April 2009 (available at <http://www.berr.gov.uk/files/file51132.pdf>). The energy projections take account of the projected impacts of government policies that are deemed “firm and funded” at the time the projections are produced. The projections include those policies outlined in the 2007 Energy White Paper and the estimated net impact of the recent European Commission proposals on the EU Emission Trading System. They do not include policies that are still under consideration, for example any policies that may be derived from the recent UK Climate Change Act, the proposed EU Industrial Emissions Directive or the proposed EU Renewable Target for the UK. Energy projections are provided by DECC for the years 2010, 2015, 2020 and 2025.

Other sources that are used to derive activity drivers include (but are not limited to) information from the Department for Transport (DfT) for the road transport and aviation sectors and information from trade associations. Further detail is provided in Sections 3 and the table in Appendix 1 provides source and activity categories where either the emission factor or activity driver varies in the projections compared to the historic data. Appendix 2 summarises differences between UEP32 and UEP37.

2.2 FUTURE EMISSION FACTORS

In addition to changes in activity influencing emissions, improvements in abatement measures will reduce emissions. The implementation of more stringent abatement measures, often the result of established legal requirements, must be considered when estimating future emissions. Therefore the emission factors where relevant have been varied to account for this. The projections do not include the impact of additional policies and measures that are currently subject to review and have not yet been implemented into UK law. Regulations that have been taken into account include:

- The Large Combustion Plant Directive

- The IPPC Directive
- The Solvent Emissions Directive
- Marpol VI
- Sulphur Content of Liquid Fuels Regulations 2007
- European Directives & UK Regulations on Non Road Mobile Machinery, and
- European Directives & UK Regulations on vehicle emissions and fuel quality (legislation up to and including Euro 5 & 6 for light duty vehicles and Euro VI for heavy duty vehicles).

The impacts of these measures are discussed in more detail in Section 3 of this report.

In addition to legislation, emissions may be changed through closure of older, generally more polluting plant and/or commissioning of newer, generally less polluting plant. Such changes can affect the overall activity level within a sector as well as emission factors but for technical reasons it is preferable to deal with these in the projections as influencing emission factors only. Since historical emissions data are available up to 2007, at least some plant covered by the 2007 NAEI will already have closed (e.g. one of the UK's fletton brickworks, and one cement clinker production site) or new sites may have started up. Changes in the immediate future can also be taken into account, although a judgement needs to be made about the likelihood of the change actually occurring. In the current economic situation, a number of site closures have been announced or proposed and, where appropriate, the impacts of these closure have been considered in these projections.

2.3 GENERAL ASSUMPTIONS: THE “WITH MEASURES” PROJECTIONS SCENARIO

The projections method presented here assumes in general that:

- All operators comply with new legislation;
- New abatement is applied to sources in order to meet the limits imposed by new regulations or in response to the impacts of trading mechanisms, but further emission reductions by voluntary actions over and above those levels are not achieved, unless this occurs anyway through actions in response to non-environmental factors e.g. replacing older, more polluting plant with newer technology on economic grounds.

Cases where the projections do include reductions that might be considered as ‘voluntary’ include:

- Projections from coating processes include the impact of product reformulation which in some cases may exceed the requirements of legislation;
- Power station emission projections are based on site- or plant design-specific fuel projection data (from UEP37) and anticipated plant modifications (from consultation with operators) that in some cases may go over and above the minimum legislative requirements;
- Similarly for other heavy industry sectors, such as cement and iron & steel, the projections are based on site-specific emissions data and known plant closures & modifications.

These exceptions aside, it is considered that the “with measures” projections scenario that is presented in this report, drawing on the “central, central, central” analysis of UEP37 and only modelling the impacts of “firm and funded” policies, is a conservative estimate of future emissions. Further reductions may be achieved due to voluntary measures or unexpected / additional impacts of EU and UK policy measures. Work to explore “with additional measures” projections scenarios (i.e. taking account of likely future policies and measures) is ongoing, funded by Defra, to identify how the UK may progress and aim to meet its NO_x NECD target sooner than forecast here.

2.4 QA / QC

The projections dataset is based on a database system into which quality assurance and quality control procedures have been built over several years. The projections database links to the main NAEI database, which helps to ensure that time series consistency between the historic and projected emissions is maintained. The main NAEI database consists essentially of a table of activity data and a table of emission factors for the NAEI source categories, which are multiplied together to produce

emission estimates. The projections database consists of activity drivers for each source -activity combination and a table of future emission factors.

The NAEI is subject to BS EN ISO 9001: 2000 and is audited by Lloyds and AEA Group internal QA auditors to test elements including authorisation of personnel to work on inventories, document control, data tracking and spreadsheet checking and project management.

In summary, the existing QA/QC system incorporates the following checking activities:

- Spreadsheet calculations are checked using internal consistency
- Calculations and data sources are referenced within spreadsheets;
- Data entry into the database is peer-checked;
- Consistency checks are made to compare future projected emissions against historic estimates. A designated auditor identifies sources where large increases or decreases in emissions are expected and inventory staff are required to explain these changes to satisfy the auditor; and
- A final check is made by comparing the emissions generated in the latest dataset against previous projection versions. A designated checker identifies sources where there have been significant changes and inventory sector experts are required to explain these changes.

2.5 DEVELOPMENT OF THE PROJECTIONS SYSTEM

Development of the AEA projections system is ongoing, with recent focus on improvement of the documentation of assumptions and calculations that underpin the projections, and development of a more systematic approach to the design and layout of spreadsheets used to store those assumptions and calculations. The database system is also being reviewed, so that options for improving the design can be identified and, where possible within the existing programme of work, carried out.

The current projections database is set up to produce the 'With Measures' projection scenario described in Section 2.3, and is designed to enable the management of variable input parameters to enable scenario analysis of different combinations of future economic, policy and technological factors, through data inputs to represent:

- Ranges of source-specific activity forecast drivers, e.g. from the "high", "central" and "low" ranges of parameters within the DECC energy projections. These cover several combinations of forecasts of future fuel & carbon prices, future economic growth rates or a range of policy appraisal data to enable consideration of the uncertainty of policy impacts for a given sector;
- Ranges of future factors, by pollutant & by source, to reflect the likely emission reductions from different technological and systematic options that may be pursued across different source sectors, in response to policy measures or through voluntary actions.

The focus for further development is to develop future emission factors for alternative options such as voluntary reductions or legislative measures that are not yet 'firm and funded'. This will enable greater functionality and sector-specific detail in the development of "with additional measures" scenarios, whilst maintaining consistency with NAEI historic data and related GHG emission projections.

These improvements to the existing projections database system, will allow more focus on scenario analysis, particularly to enable policy appraisal (covering both AQ and GHG emission impacts) from the development of Climate Change policy (e.g. from the development of Carbon Budgets).

3 Projections Methodology by Source Sector

This section provides details of the approach taken to forecasting emissions for the most important sectors where the activity data or emission factors differ from the 2007 baseline.

3.1 PROJECTIONS BASED ON THE DECC ENERGY MODEL

Projected fuel consumption for stationary sources is predominantly based on the outputs from the DECC energy model. This affects emissions from combustion in the energy, industry, services and residential sectors. In addition, the economic growth indices presented for various economic sectors are used to project emissions from some of the industrial processes included within the inventory.

DECC's energy projections are based on the DECC Energy Model, a partial-equilibrium model of the whole UK energy market⁸. The projections are updated regularly and the dataset used in this analysis is referred to as Updated Energy Projections 37 (UEP37) and this provides energy forecasts for 2010, 2015, 2020 and 2025.

The projections are based on an analysis of historical trends in energy use and their relationship to such factors as economic growth and fuel prices. They also take into account the impact of existing government policies on energy and the environment. The projections take into account the impact of the policies announced in the 2007 Energy White Paper and the estimated net impact of the European Commission's proposals on the EU Emissions Trading System. They do not include the impact from the Climate Change Act 2008, the Renewable Energy Consultation related to the proposed EU Renewable Target or the proposed EU Industrial Emissions Directive, or any policies still under consideration when the projections were being produced in April 2009.

Assumptions about fossil fuel prices, economic growth and other relevant factors are used in the model to investigate possible scenarios for UK energy demand and supply. The headline UK CO₂ projections based on UEP37 are presented in Table 3.1.

Table 3.1: Headline UK CO₂ Projections, from UEP37 (Mt CO₂)

Mt Carbon Dioxide	1990	2010	2015	2020	2025
Central Central Central Scenario	592	504	503	481	484

Fossil Fuel Price Assumptions

The projections are based on fossil fuel price assumptions which were published in May 2008 by the Energy Group Market Analysts based on prevailing market opinion and following a short public consultation. A low, central, high, and high-high price range is used due to the level of uncertainty with projecting future fossil fuel prices. This analysis is based on a range of \$45/bbl to \$150/bbl (in 2007 prices). Current prices have been in the region of \$44/bbl, which might result in a very different range being used in the future. These are unchanged from UEP32.

The main changes from the previous energy forecasts, (UEP32, published in November 2008) include updating the economic growth assumption to reflect the UK economic position in April 2009 and ensure it is consistent with HM Treasury Budget forecasts, revisions to household projections and revised policy appraisals and carbon price assumptions.

The UEP37 projections have been developed to include the purchase of allowances under the EU ETS. In terms of electricity generation, the key assumptions are:

- A flat CO₂ price of €34/t CO₂ in the central scenario
- Plant operations are constrained by environmental limits and the current Large Combustion Plant Directive applies. The proposed Industrial Emissions Directive is not included.

⁸ http://hmccc.s3.amazonaws.com/pdfs/Final_Report_Dec_2008.pdf

- Energy White Paper measures of a banded Renewables Obligation are included but projections do not include any assumptions about targets under the Renewables Directive as the strategy is still being consulted on.
- Some closure of non opted – out coal – fired capacity is assumed

A list of measures included in the UEP37 projections aside from the EU-ETS is shown in Table 3.2 below. Further detail can be found in Annex C, table C1-C3 of the Updated Energy and Carbon Emissions Projections paper (UEP32) published by DECC in November 2008⁹.

Table 3.2 Energy White Paper policies included in the central case analysis in UEP37

Sector	Policy
Energy supply	CCS demonstration project Changes to the renewables obligation
Business	Carbon reduction commitment Products policy Energy performance of Building's Directive Business smart metering
Transport	Further improvements in vehicle efficiency Domestic aviation included in EU-ETS
Residential	Better billing Real time displays and smart metering Product policy Supplier obligation DCLG – zero carbon homes Energy performance of Building's Directive
Public sector	Carbon reduction commitment Carbon neutral government Products policy EPBD – Energy Policy Buildings Directive

3.2 ROAD TRANSPORT

This section set out the Key Assumptions and Main Changes to Road Transport Emissions Projections (Base 2009), as compared to previous projections (Base 2008). At present these apply only to NO_x and PM. For NMVOCs, NH₃ and other pollutants, work is in progress updating the projections presented in this report, applying the same Key Assumptions and Methodological changes where relevant (including new emission factors) as outlined below; for these pollutants, the road transport projections are based on the old assumptions and methodologies (Base 2008).

In terms of Key Assumptions, the changes (for NO_x and PM) include:

- Updated traffic forecasts (Dec 2008) for Great Britain (GB) produced by ITEA Division of the Department for Transport (DfT). The DfT figures are central forecasts relative to 2003 and represent a continuation of existing or likely policies. For Northern Ireland (NI), traffic is assumed to grow at GB rates due to lack of useable traffic projections data for NI. For London, a different set of growth factors as provided by Transport for London (TfL) is used; they represent slower growth rate than the DfT's traffic forecasts for London (Dec 2008).
- Data from DfT (originated from the National Travel Survey) showing additional annual mileage (60%) done by diesel cars compared with petrol cars; this information is used to derive different petrol car/diesel car mix on different road types (previously assumed the split was the same everywhere). Information from this dataset on variation in car annual mileage by engine sizes has also been used.

⁹ <http://www.berr.gov.uk/files/file48514.pdf>

- Revised diesel penetration rate in the car fleet based on more recent estimates from DfT. It is now assumed that diesel car sales rise to 39% by 2010, then 43% by 2020 and stay constant thereafter. This is a slower penetration rate than previously assumed for which the assumptions were 41% by 2010, 47% by 2020 and 50% by 2025.
- Revised catalytic failure assumptions (as agreed with DfT) based on new evidence on fitting of replacement catalysts and taking into account of Regulations Controlling Sale and Installation of Replacement Catalytic Converters and Particle Filters for Light Vehicles for Euro 3 (or above) LDVs after June 2009.
- Revised survival rate and sales projections after a recent NAEI study (2009) on reviewing the vehicle turnover assumptions used in the NAEI road transport emission projections.
- Speed data is updated after review of speed data from various DfT sources for different road and area types. This is consistent with the speed data used in the 2007 NAEI.
- Using current higher diesel share of cars on the road in Northern Ireland (NI). It is assumed that GB "catches up" with NI so that percentage of diesel cars on road in NI grow from current high rate to level reached in GB by 2025.
- Implementation of Euro 5 (2010/2011) and Euro 6 (2015/2016) standards for LDVs and Euro VI standards (2013) for HGVs and buses using scaling factors advised by TRL (2009). These are based on Directive's emission limit values and taken into account durability requirements. It is also assumed that SCR used to limit NO_x emissions from HDVs at Euro VI leading to a cold start emission penalty during warm-up.
- The effect of biofuels is taken into account using biofuel consumption data consistent with current RTFO and EU Biofuels Directive and scaling factors for effects of different biofuels on air quality emissions based on a recent NAEI study (AEA, 2008).
- The impact of the London Low Emission Zone (LEZ) scheme (Phase 1-4) is included as in previous projections (Base 2008).
- Revised fleet composition data for TfL buses (also provided by TfL).

Other important methodological changes made to the latest road transport emissions projections include the revised hot exhaust emissions factors for NO_x and PM using new speed-emission factor relationships from TRL (April 2009). The new emission factors are used in conjunction with the revised emission degradation with mileage functions and revised effects of fuel quality on emissions, where applicable. Emissions from London Taxis are estimated for the first time using the new TRL emission factors and fleet information provided by TfL.

In addition, both the cold start and evaporative emission calculation methodology used in the NAEI are revised using COPERT III and COPERT IV methods respectively. These are based on recommendations of TRL (2007) and from the two recent AEA studies (2009) on reviewing the implementation of new cold start and evaporative emission methodologies in the NAEI.

3.3 OTHER TRANSPORT

For aviation, the projected growth has not been taken from UEP37. Instead forecasts of growth have been taken from DfT's UK air passenger demand and CO₂ forecasts report, published in April 2008. <http://www.dft.gov.uk/pgr/aviation/environmentalissues/ukairdemandandco2forecasts/>. Projected emission factors for NO_x have been calculated based on a percentage reduction from current level, as described in the EEA/EMEP Guidebook. NO_x emission factors are expected to decrease due to tightening of emissions regulations. Technology for the reduction of NO_x emissions (engines fitted with double annular combustion chambers) has already been implemented for some new aircraft, e.g. the B737-600.

The off-road machinery forecasts are based on anticipated changes in activity and changes in legislation affecting emissions from these machinery (known as the Non-Road Mobile Machinery emission directives, NRMM). These are the specific EU NRMM Directives and the Sulphur Content of Liquid Fuels Regulations (SCLF, 2007). The NRMM Directives set out emission limits (in terms of grams/KWh) for hydrocarbons, NO_x and PM for four stages with corresponding implementation dates. Further details on the SCLF Regulations can be found in Section 3.6.

It has been assumed that there is no change in agricultural fuel use activity levels from the 2007 inventory. Activity in the house and garden sector was assumed to grow in line with projected household numbers and activity in the industrial off road sector was assumed to grow in line with the growth in the construction sector. Both these datasets were provided by DECC. For aircraft support equipment it has been assumed that growth in activity in this sector is in line with growth in air passenger demand.

Growth in the shipping sector has been taken from UEP37 and it has been assumed that all ships will comply with the Marpol VI agreement requiring marine fuel oil to have a sulphur content no higher than 1.5%. Whilst legally, Marpol only applies to ships in the North Sea as this has been designated a sulphur emissions control area (SECA), it has been assumed that ships in other UK waters will also meet this standard due to no data being available on the split between fuel consumption in the north sea against other areas being available.

Entec have recently completed a study to further enhance the way shipping emissions are estimated in the NAEI. They have developed a gridded shipping inventory for UK waters and provided estimates of NO_x, SO₂, PM₁₀, PM_{2.5}, NMVOCs and CO₂ emissions for 2010, 2015 and 2020. Some final assessments are being made on the reconciliation of calculated fuel consumption with the figures for shipping published by DECC in DUKES before the new projections are incorporated into the NAEI emission projections.

The rail emission projections are based on the DECC energy consumption forecasts for this sector.

3.4 THE REVISED LARGE COMBUSTION PLANT DIRECTIVE (LCPD, 2001/80/EC)

The revised Large Combustion Plant Directive applies to combustion plants with a thermal input equal to or greater than 50MW. The plants must also comply with the IPPC Directive (96/61/EC recently codified in Directive 2008/1/EC).. These include power stations, petroleum refineries, steelworks and other industrial processes running on solid, liquid or gaseous fuels. While new combustion plants must meet the emission limit values (ELVs) given in the LCPD, member states can choose to meet obligations for existing plants (those in operation pre 1987) by:

- (a) Complying with ELVs for NO_x, SO₂ and particles, or
- (b) Operating within a national emissions reduction plan (NERP) that would set an emission ceiling for each pollutant.

Individual power plants may 'opt out' and instead accept a limit on their operating hours for the period 2008 – 2015, provided that they made a declaration to do so by 30th June 2004.

The UK has opted to implement a combined approach. Operators were given the option of meeting LCPD requirements by participating in the UK NERP. The NERP enables plant operators to trade emission allowances for SO₂, NO_x and PM, while preventing them from emitting an amount of these pollutants that is greater than that for which they hold emission allowances. Those that didn't opt for this approach will follow the ELV approach.

However, under the Environment Agency's Regulatory Framework for LCP in power stations in England & Wales a limit of 1.8 tonnes of NO_x per GWh electrical generation is applied for coal-fired power stations which do not burn low volatile coal.

Power stations

DECC have provided forecasts of SO₂ emissions from coal-fired power stations (UEP37 power station data) and so this data has been used in the projections. NO_x emissions from coal-fired power plant

have been estimated on a plant-by-plant basis taking into account whether the plant has opted for the NERP or ELV approach. The emissions allowed under the NERP have been taken from the April 2008 LCPD National Plan and the ELVs have been taken from the LCPD¹⁰. It has been assumed that plants following the ELV approach emit the maximum allowed and therefore the emission projections may be conservative for this sector. However, analysis of recently reported NO_x emissions data suggests that coal-fired power plant were operating to previous LCPD limits and not below, and so it would perhaps be optimistic to assume this changes in the future. For PM₁₀, future emissions for the coal-fired power station sector have been estimated based on 2007 implied emission factors for FGD¹¹ and non-FGD plant.

For gas-fired power plant, the implied NO_x emission factor in 2007 was lower than that required under the LCPD and therefore NO_x emission factors have been held constant in future years.

For detail on the approach adopted to estimate emissions from refineries, the iron and steel sector and other industrial plant covered by the LCPD, see the following sections.

3.5 RENEWABLE ENERGY

UEP37 provides an estimate of the projected total energy supplied from renewable sources in future years. A further breakdown into the following categories has been provided by DECC:

- Wind
- Large hydro
- Co-firing
- Waste
- Other (excluding co-firing)

In the latest projections an estimate of the energy supply in future years from landfill gas and sewage gas has been taken from SKM's May 2008 report for DECC, which looked at the constraints on the growth of UK renewables generating capacity¹². Growth in these categories has been assumed to be in line with the "medium growth" scenario in SKM's report. The "Other" category now consists of energy obtained from straw and poultry litter.

3.6 SULPHUR CONTENT OF LIQUID FUELS DIRECTIVE 2000 (1999/32/EC), THE SULPHUR CONTENT OF LIQUID FUELS (ENGLAND AND WALES) REGULATIONS 2007 (SI 2007/79)

It has been assumed that non-marine consumers will comply with the Sulphur in Liquid Fuels Regulations. For gas oil a sulphur content of no more than 0.2% now is required and by 2008 no more than 0.1%. For fuel oil the requirement was that from 2003 the sulphur content must not have exceeded 1%.

3.7 MARPOL VI

As stated in section 3.3, it has been assumed that all ships will comply with the Marpol VI agreement requiring marine fuel oil to have no higher than 1.5% sulphur content in 2005 & beyond. Alternatively, ships must fit an exhaust gas cleaning system or use any other technological method to limit SO₂ emissions. Whilst legally, Marpol VI will only apply to ships in the North Sea (as this has been designated a SO₂ emission control area) it has been assumed that ships in other UK waters will also meet this standard due to no data on the split between fuel consumption by ships in the North Sea against other areas being readily available.

3.8 IRON & STEEL AND OTHER INDUSTRIAL COMBUSTION SOURCES

The large iron and steel combustion plant and other large other industrial combustion plants are regulated under the LCPD (under the NERP and ELV). The activity of those plants following the ELV

¹⁰ <http://www.defra.gov.uk/environment/airquality/eu-int/eu-directives/lcpd/index.htm>

¹¹ Flue Gas Desulphurisation

¹² http://www.skmconsulting.com/news/2008/UK_renewable+energy.htm

approach has been assumed to vary in line with UEP37 energy forecasts and the ELV have been applied, where applicable. For those smaller plant that are not regulated under the LCPD, again UEP37 energy forecasts have been used to predict future activity levels. No further emission factor reductions have been applied to these plants.

For all other pollutants (not affected by the LCPD), historic emission factors have been used when making future forecasts on emissions from this source and therefore assume no additional abatement from the latest reported year in the historical inventory (currently 2007).

In May 2009, Corus announced the beginning of consultations that could lead to the mothballing of their Teesside operations. Although no final decision has been announced yet, we have revised the iron and steel projections based on the assumption that Teesside will be closed by the start of 2010 and that Corus' remaining two integrated steelworks (and Monckton Coke & Chemical) continue to emit at 2007 levels. This is obviously one of the more uncertain parts of the projections since Teesside may actually be kept in operation or, if mothballing does occur, be subsequently reopened at some point.

Activity in the iron & steel foundries sector has been kept constant in future years.

3.9 SOLVENT USE

Projected emissions of NMVOCs from the industrial coatings, decorative paint and printing sectors have been taken from data provided by the British Coatings Federation (BCF). For the other solvent sectors, growth in activity has been assigned to the most relevant economic projections provided by DECC and emission factors have either been held constant (UK legislation has already led to the implementation of effective VOC control in some sectors and no further significant reduction is likely) or else been varied to model the reduction in emissions due to more stringent emission controls as a result of the Solvent Emission Directive (1999/13/EC).

3.10 CEMENT PRODUCTION

Activity data for the cement sector is assumed to remain constant from 2007 (however the impact of a plant closure is reflected in the emission factors for this sector). Emission factors have been varied based on known developments at UK cement works, including:

- 1) closure of Northfleet works in mid 2008;
- 2) closure of Barrington works at the end of 2008;
- 3) mothballing of Westbury works in January 2009
- 4) mothballing of one out of the two kilns at each of South Ferriby & Ketton works at the end of 2008
- 5) the construction of an SO₂ scrubber at Dunbar works, at the end of 2007

Emission factors are calculated by assuming that 50% of the production lost due to the closure of Northfleet will be made up by increased production at other cement works owned by Lafarge and the rest by importing cement clinker. Production from Barrington, Westbury, South Ferriby and Ketton is assumed not to be transferred elsewhere since these closures are in response to falling demand at the end of 2008 due to the poor economic climate. The scrubber system at Dunbar is assumed to reduce SO₂ and PM₁₀ emissions by 50% from 2008 onwards. These assumptions are largely based on information given at www.lafargecement.co.uk. It is assumed that there will be no change in emissions beyond 2010. In reality, improving economic conditions may bring increased demand for cement in time, meaning that mothballed kilns are put back into operation, and this aspect of the projections needs to be reviewed periodically.

3.11 REFINERY EMISSIONS

Combustion source emissions at refineries have been projected to change in line with forecasts of activity provided in UEP37 and the impact of the LCPD. However, the burning of petroleum coke as part of the process of catalyst regeneration, and consumption of gas oil in engines is explicitly excluded from the LCPD and therefore these are expected to grow in line with UEP37 forecasts with

no further abatement being assumed. It has been assumed that all other fuels are accounted for within the national plan.

Emissions of NMVOC from process sources are assumed to remain constant into the future. Discussion with UKPIA have not revealed any areas where emissions are expected to be reduced in the next few years, and the assumption is also consistent with recent historical trends of near constant emissions relative to refinery throughput over the past few years.

3.12 SULPHURIC ACID MANUFACTURE

SO₂ emissions from sulphuric acid manufacture have been declining for many years as a result of closure of some plant and reduction in production, with perhaps some emission reduction measures as well, and the sector is now a relatively minor source of SO₂. Projections for this sector are based on the DECC economic growth forecast for the chemicals sector.

3.13 QUARRYING

Fugitive PM₁₀ emission factors from quarrying have been reduced by 31% between 2000 and 2010. The reductions are due to actions being taken including greater enclosure of equipment, improvements to roads and water sprays to suppress dust. Activity has been assumed to change in line with anticipated growth or decline in the construction industry as provided in UEP37.

3.14 PETROL STATIONS

NMVOC emission factors are varied to reflect regulation of petrol terminals and petrol stations. Stage 1 controls, which relate to recovery of evaporative emissions during storage, transport, loading and unloading of petrol, have been in place for a few years and it is assumed that there is no further change in the level of control of these emissions. Stage II controls relate to the recovery of petrol vapour during vehicle refuelling and control of these emissions will be required by 2010 at existing petrol stations with annual throughputs of 3500 m³ or more and new petrol stations with an annual throughput of 500 m³ or more. It is assumed that 51% of petrol in 2010 will be sold by petrol stations subject to the Stage 2 controls (this figure is taken from "Consultation paper on the implementation of Petrol Vapour Recovery Stage II Controls, Air and Environment Quality Division, DEFRA, November 2005). It has been assumed that this figure is also appropriate for 2015 and 2020, although this may be conservative since trends in recent times have been for the closure of many small petrol stations.

3.16 AGRICULTURE

North Wyke Research provided NH₃ emissions arising from the agricultural sector in October 2008. The data was based on outputs from the NARSES model (National Ammonia Reduction Evaluation System). Some revisions were made to the model structure, in addition to the inclusion of year specific livestock numbers and nitrogen fertilizer use. The projections show a steady decline in emissions from UK agriculture, largely due to declining livestock numbers and nitrogen fertiliser use.

3.17 WASTE EMISSIONS

Projections of emissions of NMVOC have been based pro-rata on emissions projections for methane (in common with the approach in the historical estimates). The methane projections were generated using MELMod, the model developed by AEA under contract to Defra and based on previous models developed by AEA, Land Quality Management & Golder Associates.

3.18 OFFSHORE OIL AND GAS EMISSIONS

Combustion emissions from the oil & gas exploration and production sector are primarily due to gas burning and flaring at (mainly) offshore sites. In addition, methane and NMVOC are emitted from oil storage, loading and unloading processes (both offshore and at onshore terminals).

The projections of combustion and flaring emissions from this sector are based on forecasts of sector gas use (Personal communication: Steven Oxley, DECC. Data are consistent with UEP37) that are

available to 2025. For the combustion and flaring sources, the future emission factors applied to calculate projected emission estimates of air quality pollutants are kept constant from the 2007 NAEI emission factors. Note that over recent years, industry emissions data exhibits no clear trend in AQ pollutant emission factors from oil & gas combustion and flaring sources.

The projected emissions of NMVOCs from oil storage, loading and unloading have been estimated based on analysis conducted through consultation with industry experts to analyse the source-specific trends in emissions compared to activity. This is consistent with the method used for the non-CO₂ greenhouse gas projections. This analysis aims to reflect industry improvements to abate these emissions through the increased application of new technologies to minimise tank loading and unloading losses and other fugitive emissions from storage vessels. The underlying activity data to inform the projections is the forecast of UK oil production trends to 2050, provided by DECC.

3.19 OTHER PROCESSES

There are a number of source sectors in the inventory which are made up of only a very small number of installations and therefore closure of even a single site can have a very significant impact on emissions. In the current economic climate, a number of installations have been closed since the end of the 2007 base year, or are very likely to close this year and so the projections have been revised to reflect this:

- Fletton Bricks – closure of Stewartby brickworks in early 2008, so future emissions are assumed to be equal to the 2007 emission for the Whittlesey site only.
- Carbon Black – both sites assumed to close in 2009.

Elementis Chromium is also closing but this has not been included in the projections because this closure was identified after finalisation of the projections (it is a very minor source of PM₁₀ although important as a source of chromium.) This closure will be included in the next set of projections. A number of other closures or possible closures have not been included explicitly in the projections, either because they are not certain to occur (e.g. the Quinn glass plant in Elton which is facing possible closure because it does not have planning permission) or because individually they will have a relatively minor impact on sectoral emissions (e.g. a number of non-fletton brickworks). In the latter case, UEP37 assumes sharp decreases in manufacturing output and so we have assumed that the closures are consistent with the UEP forecasts and therefore do not need to be explicitly taken into account.

4. Emission Projection Results

The UEP37 (2007) projections for the four NECD pollutants (SO₂, NO_x, NMVOCs and NH₃) plus PM₁₀ and PM_{2.5} are presented here by NFR Codes. The results are compared with the UEP32 (2007) projections in Tables 4.1 – 4.6.

In addition, the latest DECC carbon dioxide emission forecasts (from UEP37) are also provided for the central – central scenario in Table 4.7 and the current UK non-CO₂ GHG projections are presented in Table 4.8.

Section 4.10 provides analysis of historic and projected emissions by pollutant, to illustrate the key source sectors in 2007 and 2010, together with an indication of the most significant underlying data and assumptions that inform the emission trends from those sources. In addition to this key sector analysis, for each pollutant a “distance to target indicator” analysis has been conducted, and is presented in Section 4.11. This analysis outlines the trajectories towards 2010 NECD targets for NO_x, SO₂, NH₃ and NMVOC.

4.1 NITROGEN OXIDES (NO_x)

The analysis of the trend from 2007 to 2010 indicates that:

- Emissions in 2010 are projected to be **1212kt**. This is 18% below 2007, but is higher than the emissions ceiling for this pollutant (**1167kt**).
- The latest projections indicate that the NO_x emissions ceiling will be met by 2015.
- The sources that have contributed the most to the projected decrease in emissions are power generation, and road transport (HGVs and buses)
- The only sector in which a notable increase is expected is petroleum refining.

Table 4.1 details the 2007 emissions, and projected emissions based on both UEP37 and UEP32, with a comparison of the two 2010 projections. Comparing the totals in 2010, the overall impact of the changes from UEP32 to UEP37 are small, however the differences in individual categories are in some cases quite significant. Notable changes include:

- A significant decrease in emissions from power generation. This is as a direct result of changes to the energy projections, which for this sector have been affected both by the economic downturn, and the assumed higher price of carbon.
- An increase in emissions from sector 1A2f. There have been a number of changes at a more detailed level within this sector. For the most part, projected fuel consumption has been revised downwards, but the effect of this has been offset by the increased emission factor assumed for natural gas consumption (based on an analysis of the LCPD data) and an increase in projected emissions from off road machinery.
- Revised policy appraisals have led to increased emissions in 2010 in the residential and public administration sectors.

Table 4.1. Predicted NO_x emissions for those NFR sectors covered under the NECD using DECC's UEP37 energy projections, compared with UEP 32 (Ktonnes).

	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A1a	360.5	260.8	287.4	261.3	266.2	146.3	145.8	-9%	Projection revised down, as a result of the revised economic forecasts, and to a lesser extent, a higher value assigned to the price of carbon.
1A1b	26.0	28.7	33.9	28.9	35.2	29.1	36.1	-15%	Projection revised down due to updating of methodology to include more data and to remove some inconsistencies in the previous calculations.
1A1c	51.4	45.2	60.7	38.8	47.8	33.4	35.6	-25%	Change dominated by projected decrease in oil & gas sector own gas use (UEP37)
1A2a	18.8	13.0	20.8	13.1	20.8	13.2	20.7	-38%	Inclusion of assumptions regarding the closure or mothballing of certain iron and steel plants in response to the economic downturn
1A2f	229.7	206.4	177.1	159.5	147.6	144.6	152.8	17%	Decreases in fuel consumption offset by increased emission factor assumed for natural gas due to updating of methodology to include more data and to remove some inconsistencies in the previous calculations. Updates to off road machinery method have led to an increase in emissions for this source.
1A3ai(i)	10.8	10.8	13.1	12.1	13.9	11.9	15.2	-18%	Projected decrease in future emission factors based on the EEA/EMEP Guidebook
1A3aii(i)	2.1	2.1	2.7	2.4	2.9	2.4	3.1	-22%	Projected decrease in future emission factors based on the EEA/EMEP Guidebook
1A3bi	137.0	112.8	135.4	85.1	93.9	69.5	73.4	-17%	Major update to method for road transport - see method section of report
1A3bii	54.7	41.5	38.6	30.9	28.9	21.2	21.7	8%	Major update to method for road transport - see method section of report
1A3biii	248.4	177.6	185.5	94.6	95.2	39.0	39.9	-4%	Major update to method for road transport - see method section of report
1A3biv	1.3	1.5	1.0	1.2	0.7	1.0	0.4	45%	Major update to method for road transport - see method section of report
1A3c	38.7	27.8	28.7	27.4	28.7	27.3	28.7	-3%	Projected fuel use for rail linked to decreased economic growth assumptions
1A3dii	109.3	98.5	61.4	102.2	63.5	102.2	63.5	60%	Improved interpretation of energy statistics.

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	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A3eii	4.8	3.7	4.9	2.1	3.7	0.9	1.9	-24%	Revisions to model for off road machinery
1A4a	22.4	23.0	15.8	23.2	15.7	23.1	15.2	45%	Service sector fuel use revised upwards in response to the inclusion of revised policy appraisals now included within the energy model
1A4bi	99.0	98.8	93.0	86.1	82.5	75.9	66.6	6%	Revisions to policy impacts have led to projected changes in the fuel types being used. Revised household projections have also affected projected natural gas use.
1A4bii	0.9	0.8	0.9	0.8	1.0	0.8	1.0	-14%	Off road machinery projections revised in line with new household assumptions
1A4ci	0.7	0.4	0.4	0.4	0.4	1.5	0.4	0%	No change
1A4cii	39.0	30.1	25.3	15.7	11.6	8.9	5.4	19%	Updates to the off road machinery model
1A5b	23.5	22.7	23.5	22.7	23.5	22.0	23.5	-3%	Projected emission factors for military aviation improved, based on the EEA/EMEP Guidebook
1B1b	0.3	0.2	0.3	0.2	0.3	0.2	0.3	-35%	Inclusion of assumptions regarding the closure or mothballing of certain iron and steel plants in response to the economic downturn (iron and steel - flaring)
1B2ai	0.1	0.1	0.1	0.1	0.1	0.1	0.1	4%	Not significant
1B2c	2.1	1.9	1.4	1.6	1.4	1.3	1.4	35%	Emissions from oil & gas sector flaring have been revised, to link to UEP37 forecasts of future sector gas use. No revision to future factors.
2B2	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0%	No change
2B5	0.5	0.4	0.6	0.4	0.7	0.5	0.8	-34%	Projection is based on economic growth index for chemicals and manmade fibres, from the DECC energy model. This has been revised down in line with revised economic growth forecasts.
2C	1.4	1.0	1.6	1.1	1.6	1.1	1.7	-35%	Inclusion of assumptions regarding the closure or mothballing of certain iron and steel plants in response to the economic downturn
4F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	No change
5B	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0%	No change
6C	1.5	1.5	1.6	1.5	1.6	1.6	1.6	-5%	Projection for chemical waste incineration is based on growth index for chemicals and manmade fibres, which has been revised down.
6D	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0%	No change
Total	1485.9	1212.4	1216.9	1014.5	990.5	780.2	758.0	0%	Over all change is small

4.2 SULPHUR DIOXIDE (SO₂)

- Emissions in 2010 are projected to be **411kt**. This is 30% lower than emissions in 2007, and well below the emissions ceiling of **585kt**.
- The majority of the decrease in emissions is in the power generation sector, where emissions are expected to decrease significantly. This is based on the energy forecasts which have been revised downwards due to the lower economic growth assumptions and the higher price of carbon.
- A significant increase is, however, projected for the refineries sector. This is based on an updated analysis of the LCPD. Fuels and emission sources that had previously been assumed to be included under the LCPD (and therefore contribute to the bubble) are now known to be outside of the scope of the LCPD. These sources include catalyst regeneration, which is a significant source of SO₂. It is assumed that sources within the bubble will emit up to the bubble, and that therefore emissions outside of the scope of the LCPD are additional.

Table 4.2 details the 2007 emissions, and projected emissions based on both UEP37 and UEP32, with a comparison of the two 2010 projections. Comparing the totals in 2010, the overall impact of the changes from UEP32 to UEP37 amounts to a small increase in emissions. At a sectoral level, there are some quite significant changes, which include:

- A significant decrease in emissions from power generation. This is as a direct result of changes to the energy projections, which for this sector have been affected both by the economic downturn, and the assumed higher price of carbon.
- A considerable increase in emissions from refineries, as described above.
- An increase in the projected emissions from national navigation. The outputs from the DECC energy model allocate all fuel for shipping as gas oil, while led to an underestimation of emissions from this source (i.e. fuel oil was excluded) in the previous projections.
- A decrease in emissions from the residential sector due to a decline in the projected use of solid and liquid fuels.
- Decreased emissions from iron and steel, taking into account the effect of plant closures due to the economic downturn.

Table 4.2. Predicted SO₂ emissions for those NFR sectors covered under the NECD using DECC's UEP37 energy projections, compared with UEP 32 (Ktonnes).

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A1a	285.5	136.0	163.3	90.1	104.2	67.9	68.3	-17%	Projection revised down, as a result of the revised economic forecasts, and to a lesser extent, a higher value assigned to the price of carbon.
1A1b	79.0	100.9	52.9	102.1	52.9	103.3	52.9	91%	Updated analysis of LCPD, affecting emissions from fuel oil and petroleum coke combustion
1A1c	4.7	3.4	4.8	3.3	4.7	3.3	4.5	-30%	Emissions from coke production expected to decline with the closure or mothballing of steelworks
1A2a	15.7	10.1	17.4	10.1	17.1	10.1	16.9	-42%	Inclusion of assumptions regarding the closure or mothballing of certain iron and steel plants in response to the economic downturn
1A2f	75.6	73.8	76.2	69.9	73.7	66.8	62.6	-3%	Reduced emissions from cement production due to plant closures during 2008, and installation of abatement equipment. Changes to projected emissions for other industry based on an updated analysis of the LCPD in conjunction with the UEP37 energy projections for this sector. Emissions from lime production revised down in line with economic growth and fuel combustion estimates from UEP37.
1A3ai(i)	0.7	0.8	0.9	0.9	0.9	1.0	1.0	-9%	Small change to interpretation of aviation forecasts
1A3aii(i)	0.2	0.2	0.2	0.2	0.3	0.3	0.3	-13%	Small change to interpretation of aviation forecasts
1A3bi	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0%	No change

UK Air Quality Emission Projections: 2007 to 2020

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A3bii	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0%	No change
1A3biii	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0%	No change
1A3biv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	No change
1A3c	1.9	1.3	1.0	1.3	1.0	1.3	1.0	29%	Sulphur emission factors have been revised to be constant from 2007, since these are within the limits of the SCOLF Directive.
1A3dii	48.9	32.3	16.9	33.6	17.5	33.6	17.5	91%	Improved interpretation of energy statistics.
1A3eii	0.4	0.4	0.4	0.4	0.5	0.4	0.6	8%	Off road projections updated to include new information about the introduction dates for new technologies
1A4a	4.7	5.6	3.2	5.4	2.9	5.2	2.6	72%	Service sector fuel use revised upwards in response to the inclusion of revised policy appraisals now included within the energy model
1A4b	21.9	9.8	15.5	1.9	11.1	1.6	8.5	-37%	Revisions to policy impacts have led to projected changes in the fuel types being used, which means that solid and liquid fuel use in this sector is projected to be lower than the previous projections indicated.
1A4ci	0.2	0.2	0.2	0.2	0.2	3.3	0.2	0%	No change
1A4cii	3.1	3.2	2.3	3.1	2.3	3.1	2.3	35%	Off road projections updated to include new information about the introduction dates for new technologies
1A5b	5.1	5.1	5.1	5.1	5.1	5.1	5.1	0%	No change
1B1b	9.8	7.2	9.9	7.2	9.9	7.2	9.9	-27%	Coke production and iron and steel (flaring) revised down to account for plant closures due to the economic downturn
1B2ai	0.2	0.2	0.1	0.1	0.1	0.1	0.1	35%	Oil & gas sector projections method revised. Minor change.
1B2c	0.2	0.2	0.1	0.1	0.1	0.1	0.1	35%	Oil & gas sector projections method revised. Minor change.
2A7	15.9	8.3	8.3	8.3	8.3	8.3	8.3	0%	No change
2B5	5.8	2.3	6.0	2.8	6.6	3.4	7.2	-63%	Carbon black manufacture is now expected to fall to zero. Emissions from other sources are projected based on the economic growth index for chemicals and manmade fibres, which has been revised down
2C	8.1	6.3	8.8	6.8	9.2	7.3	9.7	-28%	Iron and steel emissions revised to account for plant closures. Other metal production is projected using the economic growth index for non-ferrous metals, which has been revised down.
6C	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0%	No change
Total	590.7	410.8	396.8	356.1	331.8	335.8	282.9	4%	

4.3 NON-METHANE VOLATILE ORGANIC COMPOUNDS (NMVOCs)

The UK had met its NMVOC NECD target of **1,200 kilotonnes** prior to 2007. The projection results show that the emissions are expected to continue to fall in the future.

- Emissions in 2010 are projected to be **816kt**, 13% below emissions in 2007. This is well below the emissions ceiling of 1200kt for this pollutant.
- Notable decreases are projected for petrol storage and distribution, natural gas distribution, surface cleaning and NFR category 3D, which includes printing, household products and aerosols.
- Significant increases are not projected for any NFR sectors.

Table 4.3 details the 2007 emissions, and projected emissions based on both UEP37 and UEP32, with a comparison of the two 2010 projections. The updated projections for 2010 indicate that emissions will be slightly higher than the previous projections indicated, although they will still be lower than 2007 and well below the emissions ceiling. At a sectoral level, there are some quite significant changes, which include:

- Emissions in sector 3D are higher than the previous projections indicated. This is because emissions from “other solvent use” were previously assumed to include some regulated processes, and were therefore expected to decrease by half. This assumption has been revisited and it no longer seems likely that these other uses include regulated processes, and so the emissions are therefore assumed to remain constant.
- The emissions trend for oil & gas sector flaring (1B2c) has been revised, with the emissions forecast to track the DECC forecasts in industry gas use. This increases emissions projected for 2010, but then shows a greater decline out to 2020. In addition, the NMVOC emission projections from oil loading, unloading and storage (1B2a) have been revised to reflect (i) industry information on abatement, and (ii) for the future emissions trend to track UK oil production forecasts. Similar to the revised flaring emissions trend, the 2010 emissions are now slightly higher than previously estimated, with a greater decline in emissions over the longer term to 2020 and beyond.
- These significant increases have been mostly offset by decreases for chemical processes and residential combustion.

Table 4.3. Predicted NMVOC emissions for those NFR sectors covered under the NECD using DECC’s UEP37 energy projections, compared with UEP 32 (Ktonnes).

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A1a	4.6	4.2	3.6	4.2	3.8	4.2	3.7	17%	The energy projections indicated an increase in "other" renewables, which has lead to increased emissions from poultry litter.
1A1b	0.3	0.3	0.4	0.3	0.5	0.3	0.5	-34%	Revisions to energy projections for OPG and natural gas
1A1c	0.6	0.5	0.7	0.4	0.5	0.4	0.4	-26%	Minor change. Emissions track DECC forecast of sector own gas use.
1A2a	0.7	0.3	0.8	0.3	0.8	0.3	0.8	-60%	Emissions from iron and steel revised to account for plant closures due to the economic downturn
1A2f	24.1	22.9	23.7	16.6	20.1	15.4	20.5	-4%	Emissions from off road machinery revised to account for new information on the introduction dates for new technologies

UK Air Quality Emission Projections: 2007 to 2020

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A3ai(i)	1.0	1.1	1.2	1.2	1.2	1.3	1.4	-9%	Small change to interpretation of aviation forecasts
1A3aii(i)	0.7	0.8	0.8	0.9	0.8	1.0	0.9	1%	Small change to interpretation of aviation forecasts
1A3bi	41.4	36.3	36.3	26.8	26.8	25.3	25.3	0%	Not updated
1A3bii	7.4	5.9	5.9	5.0	5.0	5.1	5.1	0%	Not updated
1A3biii	18.4	13.6	13.6	9.0	9.0	4.8	4.8	0%	Not updated
1A3biv	7.9	8.3	8.3	4.2	4.2	3.0	3.0	0%	Not updated
1A3bv	12.8	12.8	12.8	12.8	12.8	12.8	12.8	0%	Not updated
1A3c	3.7	2.7	2.8	2.6	2.8	2.6	2.8	-3%	Energy projections for rail have been revised down in line with the revised economic assumptions
1A3dii	5.3	4.8	3.0	4.9	3.1	4.9	3.1	60%	Improved interpretation of energy statistics.
1A3eii	0.7	0.7	0.8	0.4	0.6	0.2	0.3	-15%	Off road projections updated to include new information about the introduction dates for new technologies
1A4a	0.9	0.9	0.9	0.9	0.9	0.9	0.8	4%	Service sector fuel use revised upwards in response to the inclusion of revised policy appraisals now included within the energy model
1A4bi	42.0	37.2	39.5	33.7	37.5	33.4	36.0	-6%	Revisions to policy impacts have led to projected changes in the fuel types being used, which means that solid and liquid fuel use in this sector is projected to be lower than the previous projections indicated.
1A4bii	9.9	5.0	5.7	1.3	6.1	1.2	6.3	-13%	Off road projections updated to include new information about the introduction dates for new technologies
1A4ci	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0%	No change
1A4cii	7.0	5.8	5.9	3.2	3.5	1.9	1.4	-3%	Off road projections updated to include new information about the introduction dates for new technologies
1A5b	1.7	1.7	1.7	1.7	1.7	1.7	1.7	0%	No change
1B1b	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-31%	Coke production and iron and steel (flaring) revised down to account for plant closures due to the economic downturn
1B2ai	75.8	71.2	61.6	33.9	44.5	17.0	36.3	16%	Estimates of VOCs from oil & gas sector loading, unloading and storage have been revised to reflect industry information on abatement and for projections to track UK oil production forecasts.
1B2aiv	30.9	30.9	30.9	30.9	30.9	30.9	30.9	0%	No change
1B2av	36.2	24.2	24.0	22.1	21.3	20.3	20.1	1%	Projections are based on the DECC energy forecasts for road transport petrol, which have been revised up

UK Air Quality Emission Projections: 2007 to 2020

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1B2b	39.4	23.1	22.6	20.8	20.2	18.6	16.2	2%	The method for estimated VOC emissions from gas leakage has been improved in consultation with UKD. It now takes into account the planned improvements to the gas supply network, rather than the amount of gas supplied.
1B2c	25.7	20.2	17.0	18.2	17.0	16.5	17.0	19%	Estimates of VOCs from oil & gas sector flaring have been revised due a method change. Emissions are now projected to track sector gas use forecasts.
2A7	3.8	2.0	2.1	2.0	2.1	2.0	2.1	-5%	Projected emissions from glass and asphalt manufacture are based on industrial economic growth indices from UEP37, which have been revised down due to the economic downturn.
2B5	32.8	24.2	35.8	29.4	42.7	34.8	50.4	-32%	Chemical industry emissions are projected based on economic growth indices from UEP37, which have been revised down.
2C	1.7	1.0	1.9	1.0	1.9	1.0	1.9	-49%	Emissions from iron and steel production processes have been revised down to account for plant closures due to the economic downturn.
2D1	0.2	0.1	0.2	0.1	0.2	0.2	0.2	-16%	Projections for this sector are based on an economic growth index, which has been revised down.
2D2	79.0	79.2	79.2	79.2	79.2	79.2	79.2	0%	No change
3A	118.1	108.4	109.5	102.1	102.8	98.5	98.8	-1%	Emissions from this sector have been reviewed and revised. Some sectors which were previously assumed to remain constant are now projected to change in line with the economic growth indices in UEP37.
3B	30.5	18.6	21.1	20.3	21.2	21.6	21.3	-12%	Emissions from this sector have been reviewed and revised. Some sectors which were previously assumed to remain constant are now projected to change in line with the economic growth indices in UEP37.
3C	14.9	10.1	12.3	11.2	13.5	12.2	14.8	-18%	Projections are based on economic growth indices from UEP37, which have been revised down.
3D	241.8	219.6	203.5	227.7	211.1	234.3	217.6	8%	Emissions from other solvent use no longer assumed to include regulated processes, and are therefore not expected to decrease.
4F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	
6A	9.7	9.5	9.5	9.1	9.1	8.7	8.7	0%	No change
6C	6.4	6.4	6.4	6.4	6.4	6.4	6.4	-1%	Chemical waste incineration is now projected based on an economic growth index for the chemicals industry, which is projected to decline.
6D	1.7	1.7	1.7	1.7	1.7	1.7	1.7	0%	No change
Total	941.5	816.1	807.7	746.7	767.5	725.0	755.5	1%	

4.4 AMMONIA (NH₃)

The 2007 based projections using UEP37 and North Wyke Research preliminary BAU(III) agricultural projections show that the UK will meet its NH₃ ceiling of **297 kilotonnes** in 2010 by a small amount.

- Emissions in 2010 are projected to be **291.5kt**, 1% lower than emissions in 2007. This is slightly (5.5ktonnes) lower than the emissions ceiling of 297ktonnes.
- The main contributors to this small decrease from 2007 are passenger cars, non-dairy cattle wastes, and agricultural soils.
- These decreases are largely offset by other increases in the agriculture sector for dairy cattle and poultry wastes.

Table 4.4 compares the current projections, with the previous projections, which were based on UEP32. The current projections are slightly higher than the previous set of projections, and the main reason for this is the inclusion of emissions from muirburn, which were excluded from the previous projections.

Table 4.4. Predicted NH₃ emissions using DECC's UEP37 and North Wyke Research BAU (III) preliminary agricultural projections, compared with the projections using UEP37 (Ktonnes)

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A1a	0.7	0.7	0.2	0.8	0.4	0.8	0.6	296%	The energy projections indicated an increase in "other" renewables, which has lead to increased emissions from poultry litter.
1A1c	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-16%	Collieries coal combustion is projected based on other industrial coal use, which has been revised down.
1A2a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	
1A2f	0.5	0.3	0.3	0.3	0.3	0.2	0.3	-4%	Change due to revisions to the off road machinery model, to account for new information about the introduction dates for new technologies.
1A3bi	6.2	4.4	4.4	2.0	2.0	1.5	1.5	0%	Not updated
1A3bii	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0%	Not updated
1A3biii	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	Not updated
1A3biv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	Not updated
1A3eii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-19%	Revisions to the off road machinery model to account for new information about the introduction dates for new technologies
1A4a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1%	Service sector fuel use revised upwards in response to the inclusion of revised policy appraisals now included within the energy model

UK Air Quality Emission Projections: 2007 to 2020

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A4bi	1.7	1.3	1.5	1.1	1.4	1.1	1.3	-14%	Revisions to policy impacts have led to projected changes in the fuel types being used, which means that solid and liquid fuel use in this sector is projected to be lower than the previous projections indicated.
1A4bii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1%	Revisions to the off road machinery model to account for new information about the introduction dates for new technologies
1A4ci	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	No Change
1A4cii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2%	Revisions to the off road machinery model to account for new information about the introduction dates for new technologies
1B1b	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-37%	Emissions from coke production revised down to account for plant closures due to the economic downturn
1B2aiv	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	No Change
2A7	0.5	0.4	0.5	0.4	0.6	0.5	0.6	-28%	Projected emissions from glass manufacture are based on industrial economic growth indices from UEP37, which have been revised down due to the economic downturn.
2B5	3.8	3.1	3.8	3.3	4.1	3.5	4.4	-18%	Emissions from ammonia use are projected using an economic growth index from UEP37, which has been revised down.
2C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-21%	Emissions from metal production are projected using an economic growth index from UEP37, which has been revised down.
2D1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	No Change
2D2	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0%	No Change
3D	1.2	1.3	1.3	1.3	1.3	1.4	1.4	0%	No Change
4B13	17.3	17.3	17.3	17.3	17.3	17.3	17.3	0%	No Change
4B1a	71.2	74.6	74.6	73.9	73.9	74.5	74.5	0%	No Change
4B1b	62.7	58.6	58.6	57.4	57.4	56.1	56.1	0%	No Change
4B3	11.0	11.5	11.5	11.4	11.4	11.3	11.3	0%	No Change
4B6	4.9	5.1	5.1	5.8	5.8	6.5	6.5	0%	No Change
4B8	20.9	19.9	19.9	19.2	19.2	18.4	18.4	0%	No Change
4B9	31.7	33.8	33.8	33.7	33.7	33.4	33.4	0%	No Change
4D1	42.6	41.2	41.2	43.9	43.9	43.8	43.8	0%	No Change
4F	7.8	7.8	1.9	7.8	1.9	7.8	1.9	299%	Inclusion of estimate for muirburn
6A	3.1	3.1	3.1	3.1	3.1	3.1	3.1	0%	No Change
6B	5.5	5.5	5.5	5.5	5.5	5.5	5.5	0%	No Change

UK Air Quality Emission Projections: 2007 to 2020

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
6C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-12%	Chemical waste incineration is now projected based on an economic growth index for the chemicals industry, which is projected to decline.
6D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	No Change
7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0%	No Change
Total	294.9	291.5	286.2	289.6	284.8	288.1	283.5	2%	

UK Air Quality Emission Projections: 2007 to 2020

4.5 PM₁₀

Particulate emissions are not covered under the NECD and therefore there is no emission ceiling in 2010.

- Emissions of PM₁₀ are projected to decrease by around 17% from 2007 to 2010.
- The largest reductions in PM₁₀ emissions are projected to occur in the power stations, residential, and minerals industry sectors.
- No notable increases are expected

Table 4.5. Predicted PM₁₀ emissions for those NFR sectors covered under the NECD using DECC's UEP37 energy projections, compared with UEP 32 (Ktonnes).

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A1a	9.5	5.8	6.4	4.4	4.5	3.8	3.5	-8%	Predominantly due to decreased coal consumption projected as part of UEP37
1A1b	1.5	1.3	1.6	1.4	1.7	1.4	1.7	-16%	Projection revised down in line with the revised energy projections.
1A1c	0.3	0.3	0.3	0.2	0.3	0.2	0.2	-22%	Minor changes only, to oil & gas sector estimates from gas combustion.
1A2a	1.9	1.2	3.0	1.2	2.9	1.2	2.9	-58%	Iron and steel sector emissions revised to take account of plant closures due to the economic downturn
1A2f	12.2	10.7	11.2	7.3	7.7	6.5	6.9	-4%	Significant decreases are projected for other industrial combustion, due to revised estimates for this sector within UEP37. Emissions from cement production are also expected to be lower than the previous projections due to plant closures and the installation of abatement equipment. These reductions have been partially offset by a projected increase from off road machinery.
1A3ai(i)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-9%	Small change to interpretation of aviation forecasts
1A3aii(i)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-22%	Small change to interpretation of aviation forecasts
1A3bi	5.9	5.6	5.8	3.0	3.0	1.2	1.6	-3%	Major update to road transport
1A3bii	4.4	3.3	6.6	1.5	3.2	0.5	1.3	-51%	Major update to road transport
1A3biii	4.6	2.7	3.4	1.1	1.4	0.3	0.5	-20%	Major update to road transport
1A3biv	0.1	0.1	0.7	0.0	0.7	0.0	0.7	-90%	Major update to road transport
1A3bvi	9.6	9.6	10.0	10.5	10.8	11.2	11.3	-5%	Major update to road transport
1A3c	0.7	0.5	0.5	0.5	0.5	0.5	0.5	-3%	Rail energy projections revised down
1A3dii	7.9	7.1	3.1	7.4	3.2	7.4	3.2	127%	Improved interpretation of energy statistics.
1A3eii	0.4	0.3	0.4	0.2	0.3	0.0	0.3	-9%	Revisions to the off road machinery model to account for new information about the introduction dates for new technologies
1A4a	0.7	0.8	0.5	0.8	0.5	0.8	0.5	49%	Service sector fuel use revised upwards in response to the inclusion of revised policy appraisals now included within the energy model
1A4bi	18.3	14.5	16.4	12.0	15.0	11.8	14.1	-12%	Revisions to policy impacts have led to projected changes in the fuel types being used, which means that solid and liquid fuel use in this sector is projected to be lower than the previous projections indicated.
1A4bii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-8%	Revisions to the off road machinery model to account for new information about the introduction dates for new technologies
1A4ci	2.2	0.0	0.0	0.0	0.0	0.2	0.0	0%	No change

UK Air Quality Emission Projections: 2007 to 2020

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A4cii	3.9	2.9	2.3	1.3	0.8	0.8	0.2	27%	Revisions to the off road machinery model to account for new information about the introduction dates for new technologies
1A5b	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0%	No change
1B1b	0.4	0.3	0.4	0.3	0.4	0.3	0.4	-15%	Coke production and iron and steel (flaring) revised down to account for plant closures due to the economic downturn
1B2c	1.2	1.1	0.8	0.9	0.8	0.7	0.8	35%	Minor changes only, to oil & gas sector flaring emission estimates.
2A1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	-27%	Projections are based on economic growth indices, which have been revised down.
2A4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	
2A7	14.0	9.1	11.7	10.2	12.9	10.9	13.7	-22%	Projections are based on economic growth indices, which have been revised down.
2B5	0.5	0.4	0.6	0.5	0.6	0.5	0.7	-34%	The majority of emissions in this sector are based on economic growth indices, which have been revised down. Emissions from carbon black production are expected to fall to zero.
2C	7.3	6.3	7.5	6.7	7.5	7.0	7.5	-16%	Projections are based on economic growth indices, or assumptions about plant closures, and have therefore been revised down.
2D1	0.8	0.7	0.8	0.8	0.8	0.8	0.8	-16%	Projections for this sector are based on an economic growth index, which has been revised down.
3A	5.4	5.5	5.6	4.7	4.8	4.6	4.6	-3%	Projections for ace and automotive coatings are based on economic growth indices, which have been revised down.
3C	0.2	0.1	0.2	0.1	0.2	0.2	0.2	-34%	Projections for this sector are based on an economic growth index, which has been revised down.
4B1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0%	No change
4B8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0%	No change
4B9	9.0	9.0	9.0	9.0	9.0	9.0	9.0	0%	No change
4D1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0%	No change
4F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	
6C	4.4	4.4	4.4	4.4	4.4	4.4	4.4	0%	No change
6D	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0%	No change
7	1.8	1.9	1.9	2.0	2.0	2.0	2.0	0%	No change
Total	135.5	111.9	121.5	98.6	106.2	94.7	99.8	-8%	

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4.6 PM_{2.5}

Particulate emissions are not covered under the NECD and therefore there is no emission ceiling in 2010.

- Emissions of PM_{2.5} are projected to decrease by around 16% from 2007 to 2010.
- The most significant reductions in PM_{2.5} emissions are forecast in the road transport (HGVs), power stations and mineral products sectors.
- There are no significant increases projected for PM_{2.5}

Table 4.6. Predicted PM_{2.5} emissions for those NFR sectors covered under the NECD using DECC's UEP37 energy projections, compared with UEP 32 (Ktonnes).

NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A1a	5.2	3.6	3.7	2.9	2.8	2.6	2.3	1%	Predominantly due to decreased coal consumption projected as part of UEP37
1A1b	0.7	0.6	0.7	0.6	0.8	0.7	0.8	-17%	Projection revised down in line with the revised energy projections.
1A1c	0.3	0.3	0.3	0.2	0.3	0.2	0.2	-15%	Minor changes only, to oil & gas sector estimates from gas combustion.
1A2a	1.4	0.9	2.2	0.9	2.2	0.9	2.2	-58%	Iron and steel sector emissions revised to take account of plant closures due to the economic downturn
1A2f	9.2	8.1	8.3	5.5	5.6	4.9	5.1	-2%	Significant decreases are projected for other industrial combustion, due to revised estimates for this sector within UEP37. Emissions from cement production are also expected to be lower than the previous projections due to plant closures and the installation of abatement equipment. These reductions have been partially offset by a projected increase from off road machinery.
1A3ai(i)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4%	Small change to interpretation of aviation forecasts
1A3aii(i)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-17%	Small change to interpretation of aviation forecasts
1A3bi	5.3	5.0	5.2	2.7	2.7	1.1	1.4	-3%	Major update to road transport
1A3bii	4.0	2.9	6.0	1.4	2.9	0.5	1.2	-53%	Major update to road transport
1A3biii	4.2	2.4	3.0	1.0	1.2	0.3	0.4	-22%	Major update to road transport
1A3biv	0.1	0.1	0.5	0.0	0.6	0.0	0.6	-94%	Major update to road transport
1A3bvi	5.3	5.3	5.5	5.8	5.9	6.2	6.2	-2%	Major update to road transport
1A3c	0.6	0.5	0.5	0.5	0.5	0.5	0.5	-5%	Rail energy projections revised down
1A3dii	7.4	6.7	3.0	7.0	3.1	7.0	3.1	128%	Improved interpretation of energy statistics.
1A3eii	0.4	0.3	0.3	0.1	0.2	0.0	0.2	-41%	Revisions to the off road machinery model to account for new information about the introduction dates for new technologies
1A4a	0.5	0.5	0.4	0.5	0.4	0.5	0.4	31%	Service sector fuel use revised upwards in response to the inclusion of revised policy appraisals now included within the energy model

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NFR	2007	2010 (UEP37)	2010 (UEP 32)	2015 (UEP37)	2015 (UEP 32)	2020 (UEP37)	2020 (UEP 32)	2010 Comparison (% change from UEP32)	Reason for change in 2010
1A4bi	10.2	8.8	9.5	7.8	8.9	7.7	8.5	-12%	Revisions to policy impacts have led to projected changes in the fuel types being used, which means that solid and liquid fuel use in this sector is projected to be lower than the previous projections indicated.
1A4bii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-12%	Revisions to the off road machinery model to account for new information about the introduction dates for new technologies
1A4ci	1.3	0.0	0.0	0.0	0.0	0.1	0.0	0%	No change
1A4cii	3.0	2.3	1.8	1.0	0.6	0.6	0.1	75%	Revisions to the off road machinery model to account for new information about the introduction dates for new technologies
1A5b	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0%	No change
1B1b	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-15%	Coke production and iron and steel (flaring) revised down to account for plant closures due to the economic downturn
1B2c	1.2	1.1	0.8	0.9	0.8	0.7	0.8	13%	Minor changes only, to oil & gas sector flaring emission estimates.
2A1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-26%	Projections are based on economic growth indices, which have been revised down.
2A4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	
2A7	6.2	4.3	5.6	4.8	6.1	5.1	6.5	-22%	Projections are based on economic growth indices, which have been revised down.
2B5	0.5	0.3	0.5	0.4	0.5	0.5	0.5	-24%	The majority of emissions in this sector are based on economic growth indices, which have been revised down. Emissions from carbon black production are expected to fall to zero.
2C	3.4	3.0	3.5	3.2	3.5	3.4	3.5	-9%	Projections are based on economic growth indices, or assumptions about plant closures, and have therefore been revised down.
2D1	0.7	0.6	0.7	0.6	0.7	0.7	0.7	-6%	Projections for this sector are based on an economic growth index, which has been revised down.
3A	1.9	1.9	2.0	1.6	1.7	1.6	1.6	-2%	Projections for ace and automotive coatings are based on economic growth indices, which have been revised down.
3C	0.1	0.0	0.1	0.0	0.1	0.1	0.1	-33%	Projections for this sector are based on an economic growth index, which has been revised down.
4B1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	No change
4B8	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0%	No change
4B9	1.6	1.6	1.6	1.6	1.6	1.6	1.6	0%	No change
4D1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	No change
4F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	
6C	4.4	4.4	4.4	4.4	4.4	4.4	4.4	0%	No change
6D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0%	No change
7	0.6	0.6	1.7	0.6	1.7	0.6	1.8	-63%	PM speciation for fireworks revised
Total	82.1	68.5	74.2	58.6	62.2	54.7	57.1	-6%	

4.7 HISTORIC AND PROJECTED AIR QUALITY EMISSIONS

Figure 4.1: NO_x Emissions & Projections By Sector Compared to NECD Target

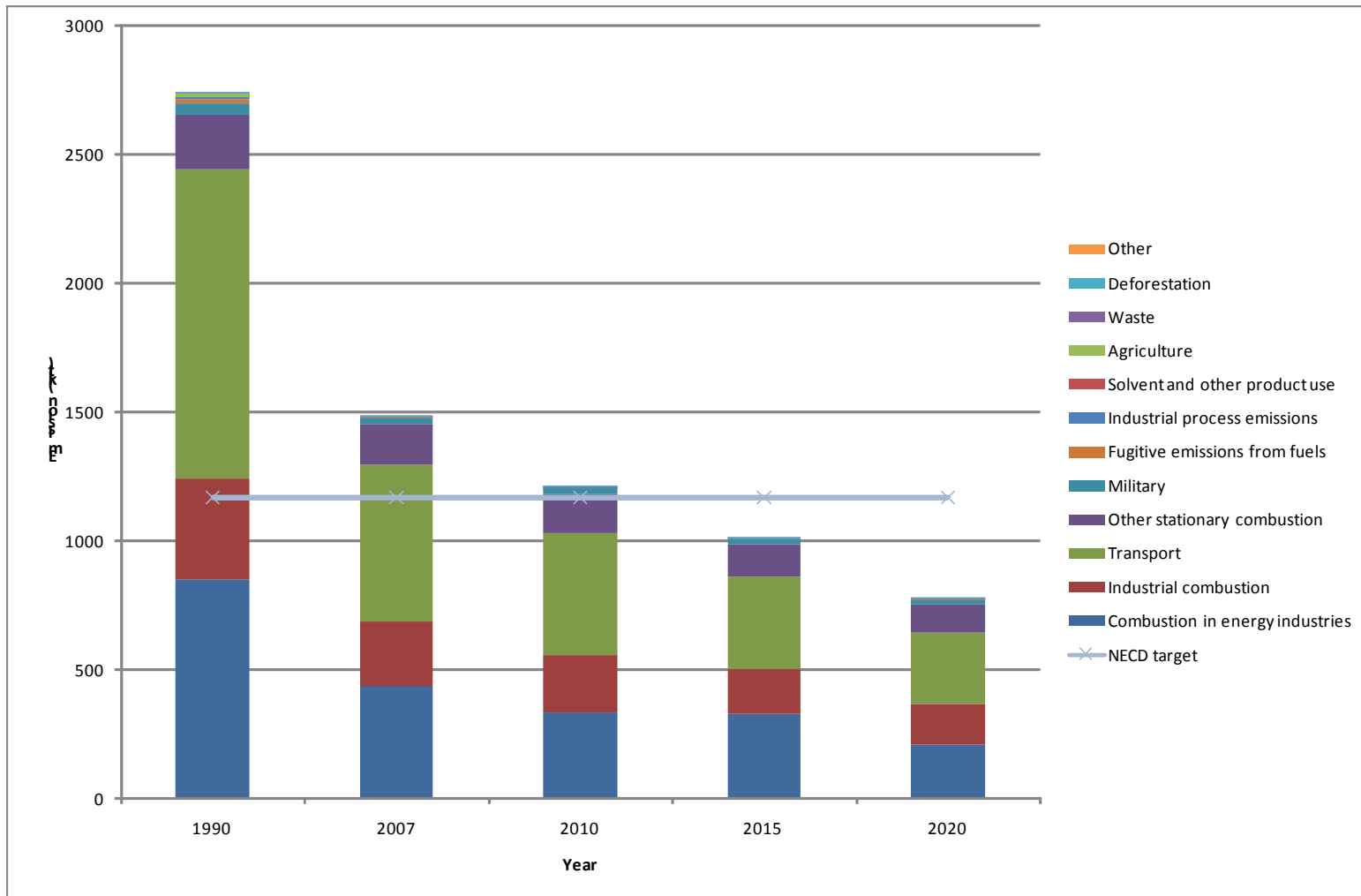


Figure 4.2: SO₂ Emissions & Projections By Sector Compared to NECD Target

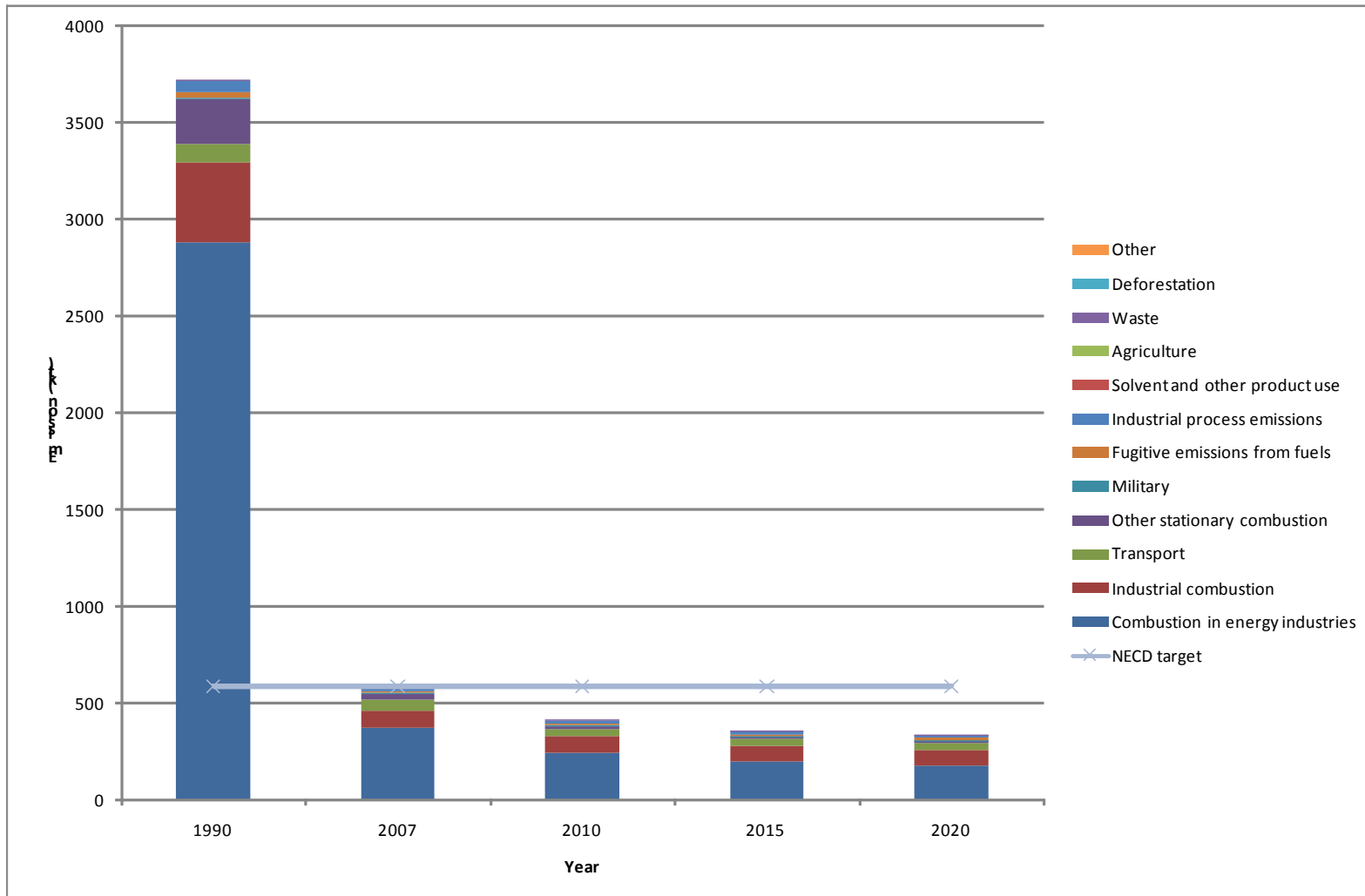


Figure 4.3: NMVOC Emissions & Projections By Sector Compared to NECD Target

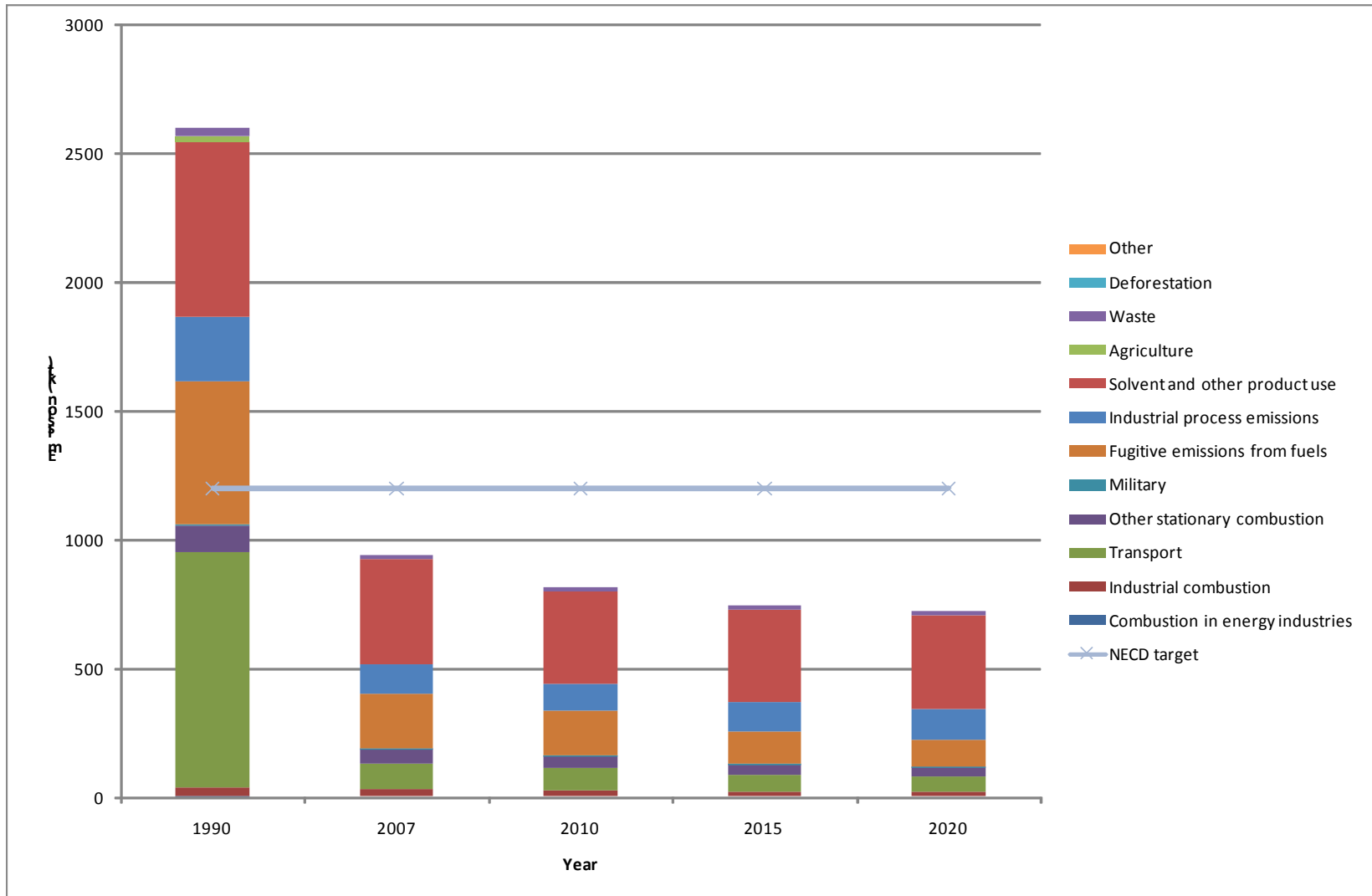


Figure 4.4: PM₁₀ Emissions & Projections By Sector

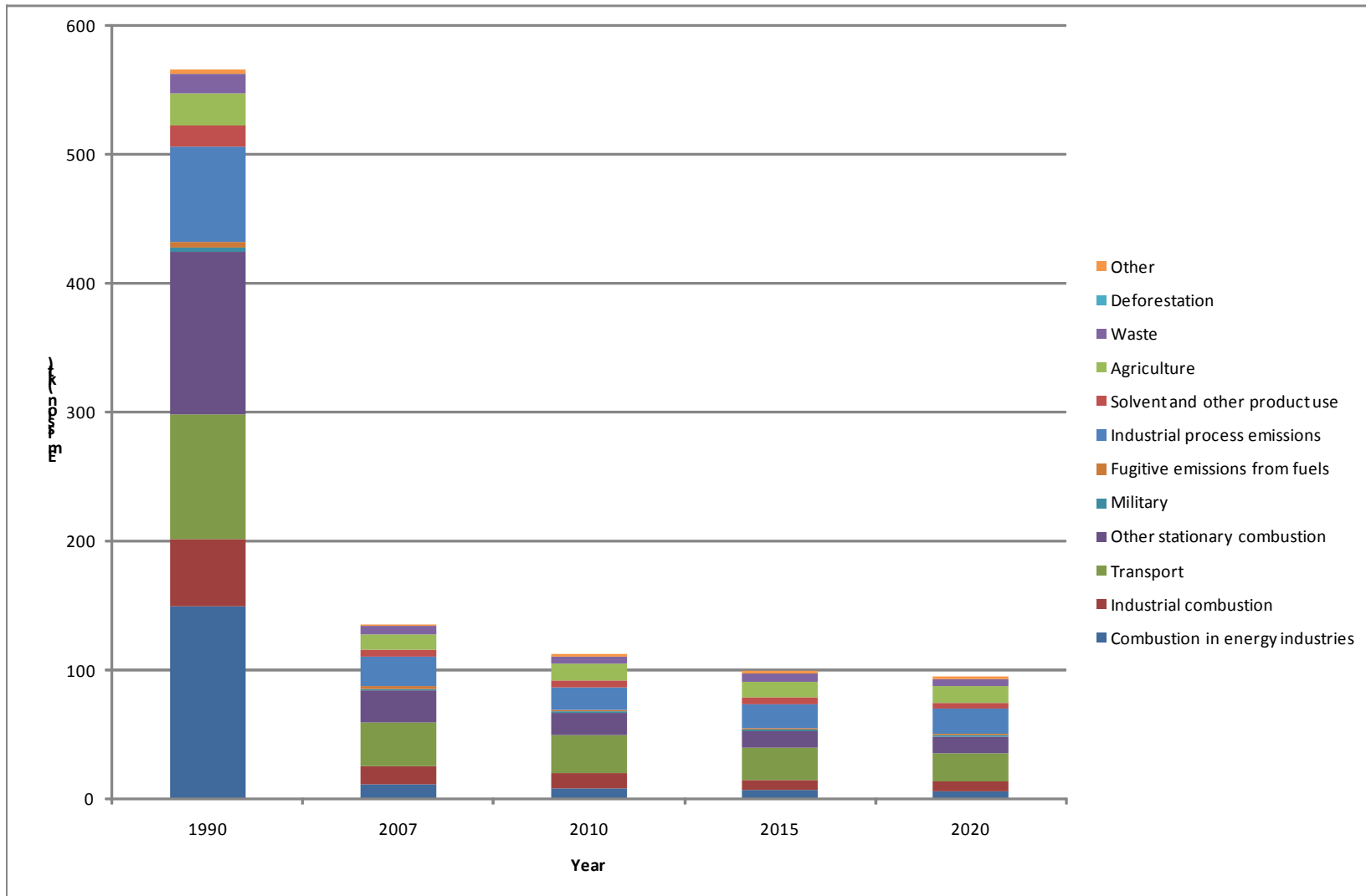


Figure 4.5: NH₃ Emissions & Projections By Sector Compared to NECD Target

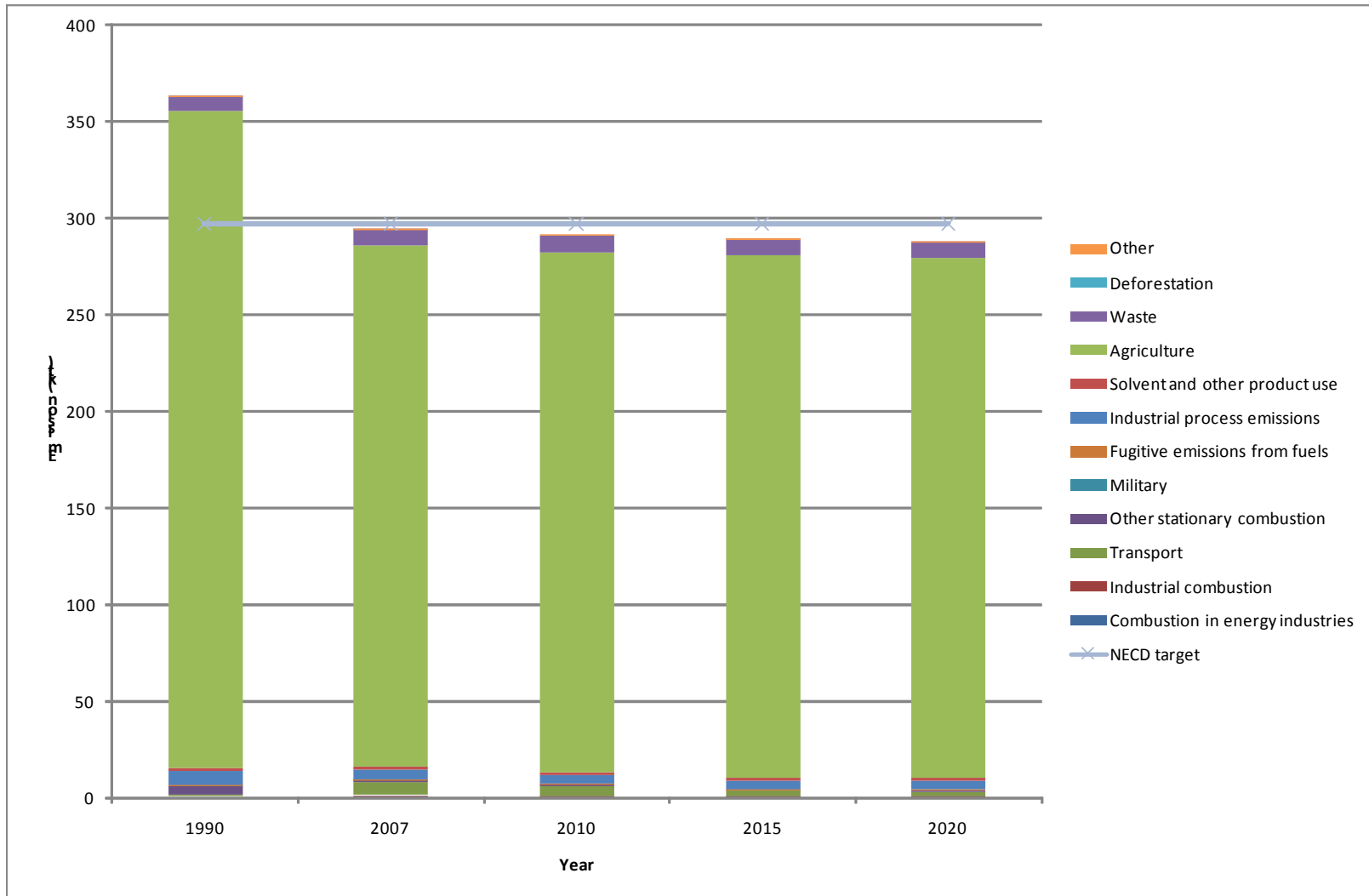
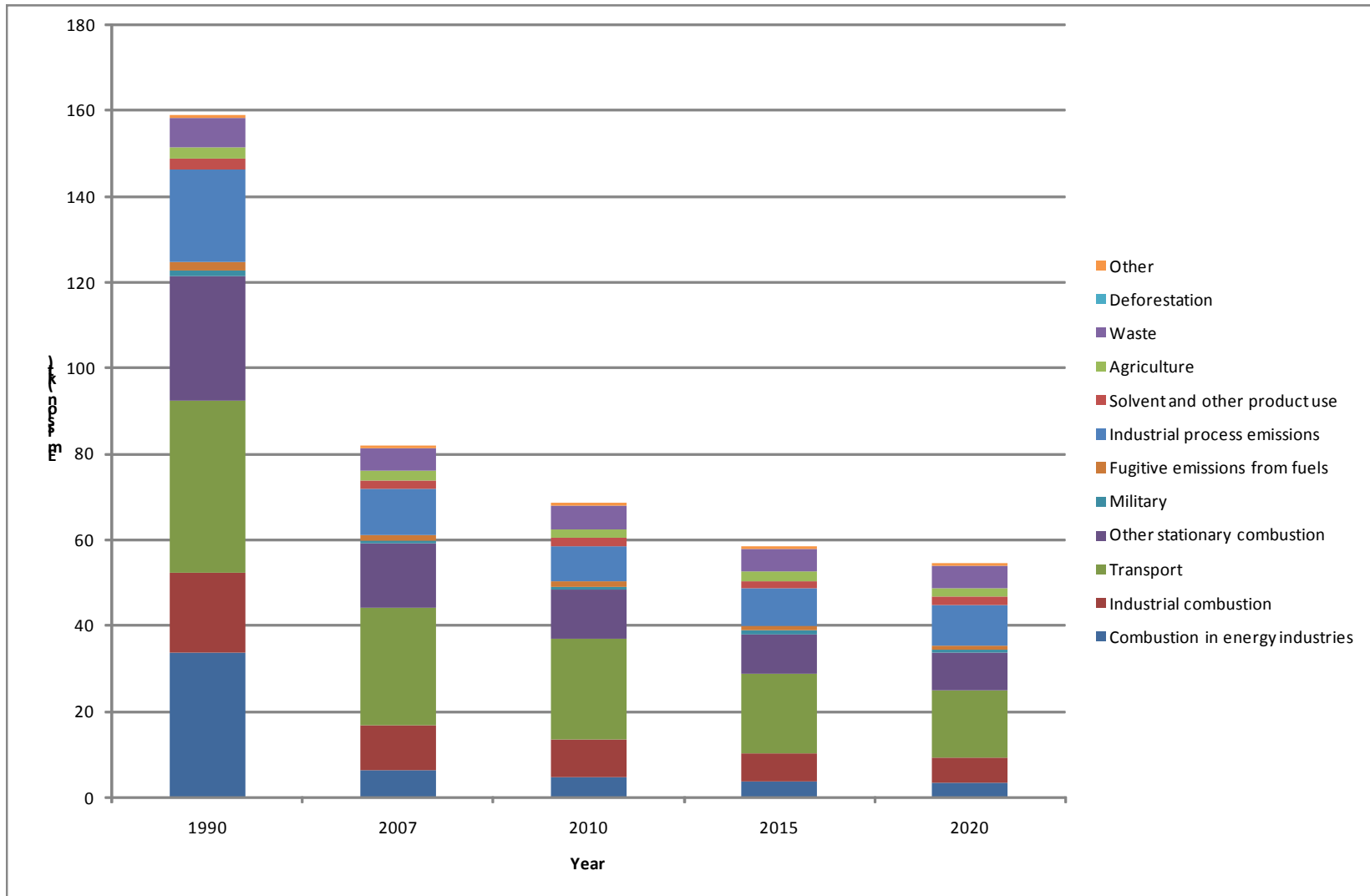


Figure 4.6: PM_{2.5} Emissions & Projections By Sector



4.8 CARBON DIOXIDE PROJECTIONS FROM DECC UEP37

Table 4.7 UK Historic and Predicted Carbon Dioxide Emissions in DECC's UEP37 central – central – central scenario (Mtonnes CO₂)

	2006	2010	2015	2020
Energy supply	220.8	187.3	190.0	172.6
Business	91.9	83.4	84.1	84.8
Industrial processes	13.9	12.5	13.2	13.5
Transport	133.5	128.1	131.3	131.3
Residential	81.3	78.6	68.5	60.5
Public	10.5	10.4	10.3	10.2
Agriculture	4.3	4.6	4.6	4.6
LULUCF (net)	-2.0	-1.4	0.8	2.7
Waste management	0.4	0.4	0.4	0.4
Total net CO ₂ Emissions	554.5	503.8	503.2	480.7

4.9 UK NON-CO₂ GHG PROJECTIONS

Table 4.8: UK Projections of non-CO₂ Greenhouse Gases, consistent with UEP37 (Mtonnes CO₂)

	2006	2010	2015	2020
Methane	49.1	47.3	44.9	43.3
N₂O	38.3	38.6	39.0	38.6
HFCs	9.2	9.0	8.3	6.9
PFCs	0.3	0.2	0.2	0.2
SF₆	0.9	0.7	0.7	0.7

Both the CO₂ and non-CO₂ greenhouse gas projections presented above are based on UEP37. The inventory baseline for these projections is 2006. These projections are consistent with those published in the UK's 5th National Communication to the UNFCCC¹³.

¹³ http://decc.gov.uk/en/content/cms/what_we_do/change_energy/the_issue/strategy/strategy.aspx

4.10 2007 AND 2010 PROJECTION ANALYSIS

The projections to 2010 have been analysed to highlight the key source sectors for emissions (at 2007) and for the projected emission reductions at 2010. In the tables below, for each pollutant the emission sources that show the most significant increases or decreases in the forecasts to 2010 are highlighted. Tables 4.9 to 4.14 list these sectors by NFR code for each pollutant. Where the overall emission reduction is dominated by a single NAEI source, the reasons behind the changes for that source have been noted.

4.10.1 Oxides of Nitrogen (NO_x)

Table 4.9 shows the NFR codes and associated NAEI sources that are forecast to show the most significant changes in NO_x emissions between 2007 and 2010. The four sources identified account for around 80% of the total change in emissions from 2007 to 2010. In general, the changes in emissions can be assigned the forecast trends in fossil fuel demand within the DECC energy projections and implementation of regulatory controls.

Table 4.9: Source sectors expected to show the most significant changes in NO_x emissions between 2007 and 2010

NFR	NFR NAME	Proportion of 2007 emission, %	Reduction in emissions between 2007 and 2010, %	Main sources in NFR Code	Activity Data Source	Comment
1 A 1 a	Public Electricity and Heat Production	24	28	Power stations – coal	DECC – UEP37	NO _x controls to achieve LCPD requirements on coal-fired power stations. Significant reductions in fuel use in the power sector are projected in UEP37, in line with the lower economic growth forecasts and the higher projected price of carbon.
				Power stations - natural gas		
1A2f	Other combustion in industry	15	10	Industrial off-road mobile machinery - gas oil	NAEI	Activity data is uncertain for this sector. Emission reductions reflect changes in mobile machinery fleet, replacement of older more-polluting engines with modern lower emission equipment. Emission projections for this source have been updated to reflect new information about the introduction dates of new technologies.
1A3biii	R.T., Heavy duty vehicles	17	28	Road transport - HGV articulated - motorway driving	DfT	Emission reductions are expected because of penetration of higher Euro standard vehicles in the fleet. Emissions for this sector have been updated to include the most recent traffic forecasts, and new emission factors and other assumptions.
1A3bi	R.T., Cars	9	18	Road transport – Diesel cars - rural driving	DfT	See comment above

Increases in NO_x emissions are also projected for the following sectors but these sectors are minor components of the 2007 inventory, and as such their impact on the projections is minimal, compared to the key sectors highlighted above:

- 1A1b – Petroleum refining, 2% of 2007 NO_x emission, 10% increase
- 1A3a(ii) – Domestic civil aviation (LTO), 0.1% of 2007 NO_x emission, 1% increase
- 1A3b(iv) – Road transport, motorcycles, 0.1% of 2007 NO_x emission, 18% increase
- 1A4a – Commercial and public sector combustion, 2% of 2007 NO_x emission, 2% increase

4.10.2 Sulphur Dioxide (SO₂)

Overall, emissions of SO₂ are projected to decrease by 30%, and Table 4.10 shows the NFR codes and associated NAEI sources that are forecast to make the most significant contribution towards this trend. In general, the changes in emissions can be assigned to the projected trends in fossil fuel demand in UEP37 and implementation of regulatory controls.

Table 4.10: Source sectors expected to show the most significant changes in SO₂ emissions between 2007 and 2010

NFR	NFR NAME	Proportion of 2007 emission, %	Reduction in emissions between 2007 and 2010, %	Main sources in NFR Code	Activity Data Source	Comment
1A1a	Public Electricity and Heat Production	48	52	Power Stations - coal	DECC -UEP 37	The main cause of this reduction is the implementation of Flue Gas Desulphurisation (FGD) at some of the coal-fired power stations, to meet the requirements of LCPD. UEP37 predicts a large decrease in coal use in power stations from 2007 to 2010, reflecting the effects of the economic downturn, and the higher projected price of carbon.
1A3d(ii)	National Navigation	8	34	Shipping coastal	DECC -UEP 37	The DECC energy projections include all shipping fuel under "Gas Oil", which therefore means that the split between gas oil and fuel oil is uncertain – a change in this split could have a significant effect on projected SO ₂ emissions. Projected shipping fuel use is expected to decrease in line with the economic forecasts.

The two sources highlighted in Table 4.10 are responsible for more than 90% of the projected decrease in SO₂ emissions. A significant increase is projected in only one sector, refineries. The refineries projection is based on a worst case scenario. This assumes that the refineries are unlikely to reduce emissions further than the requirements under the LCPD. Not all emissions associated with refineries are captured by the LCPD and these emissions are therefore additional. This scenario now seems unlikely due to expected decreases in fuel demand due to the current economic downturn.

4.10.3 Ammonia (NH₃)

Ammonia emissions are dominated by agriculture sources (about 92% of emissions) but the projected changes in emissions for this sector compared to 2007 are all less than 10%. Table 4.11 shows the NFR codes and associated NAEI sources that are forecast to show the most significant changes in NH₃ emissions between 2007 and 2010.

Table 4.11: Source sectors expected to show the most significant changes in NH₃ emissions between 2007 and 2010

NFR	NFR NAME	Proportion of 2007 emission, %	Reduction in emissions between 2007 and 2010, %	Main sources in NFR Code	Activity Data Source	Comment
1A3bi	R.T., Passenger cars	2	29	Road transport - cars with catalysts - rural driving	DfT	The sharp decline is due to emission factors for petrol cars rapidly declining with successive Euro standards from early generation (Euro 1) catalyst vehicles. These showed high levels of NH ₃ emissions produced as a by-product of the NO _x reduction process on the catalyst surface during moments when the engine was running in fuel rich regimes. Data from catalyst and engine manufacturers showed that as a result of better engine management systems these fuel rich excursions have reduced leading to lower NH ₃ emissions from more modern cars, since Euro 1 standards.
				Road transport - cars with catalysts - urban driving		
4D1	Agricultural soils	14	3	Agricultural soils, N fertiliser application	North Wyke Research	The agricultural projections show a dip in emissions of fertilisers forecast for 2010, although forecasts for 2015 and 2020 are then marginally higher.
4B1b	Non-dairy cattle wastes	21	6	Non-dairy cattle wastes	North Wyke Research	Based on a projected decline in livestock numbers

The North Wyke Research agriculture projections also indicate increases in projected emissions from dairy cattle wastes, which largely offsets the projected decrease in non-dairy cattle wastes.

4.10.4 Non-Methane Volatile Organic Compounds (NMVOCs)

Table 4.12 shows the NFR codes and associated NAEI sources that are forecast to show the most significant changes in NMVOC emissions between 2007 and 2010. The main decreases in NMVOC emission forecasts are due to implementation of regulation and the replacement of older technology with more efficient or less polluting equipment.

Table 4.12: Source sectors expected to show the most significant changes in NMVOC emissions between 2007 and 2010

NFR	NFR NAME	Proportion of 2007 emission, %	Reduction in emissions between 2007 and 2010, %	Main sources in NFR Code	Activity Data Source	Comment
1B2av	Distribution of oil products	4	33	Petrol stations - vehicle refuelling; Petrol (unleaded)	DECC-UEP37	Improvement due to installation of Stage 2 vapour controls (required on all larger petrol stations by 2010). Replacement of older technology with more efficient/less polluting equipment, lower petrol sales.
1B2b	Natural gas	4	41	Gas leakage - Natural gas supply	Gas network operators	Gas leakage is affected by the condition of the pipe work. The gas networks are currently undergoing a 30 year renewal plan, which is projected to lead to significant improvements in the gas leakage rates.
3A	Paint and industrial coatings	13	8	Decorative paints – trade and retail	BCF data, DECC – UEP37 growth indices	A number of sources within this sector are now projected based on economic growth indices, which have led to a projected decrease from 2007 to 2010. Other sources within this sector are projected based on consultations with the BCF. Emissions from industrial coatings decrease due to changes in usage as well as increasing use of alternatives to high solvent products as well as increased use of end-of-pipe abatement
3B	Surface cleaning	3	39	Dry cleaning	Population, DECC – UEP37 growth indices	The main reason for the projected reduction in this category is the impact of the SED.
3D	Other VOCs	26	9	Aerosols, Household Products, Industrial adhesives	Population, BCF data, DECC – UEP37 growth indices	Within the projections methodology, there are two key factors in the reduction cited here: (1) the impacts of the SED and (2) some sources which were previously expected to remain constant have now been projected based on the relevant economic growth indices within UEP37.

There are small reductions for almost all other VOC sources, with no significant increases expected.

The 3A activities should be covered by the Solvent Emission Directive and Paints Directive, in addition to some of the 3D activities also covered by the Solvent Emission Directive. Inventory data for 3D include solvent use not covered elsewhere including a wide range of materials and activities including

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industrial uses and domestic solvent use in cleaning, cosmetics, and car care. Some industrial uses will have control under SED. Emission inventories for some parts of 3D are uncertain and likely to overestimate use, particularly with respect to VOC consumed in use. In the absence of data on consumption, the historical inventory for 2007 assumes all material is released but consultation with the solvent industry is planned in order to address this issue in the next version of the inventory.

4.10.5 Sub-10 Micron Particulate Matter (PM₁₀)

Table 4.13 shows the NFR codes and associated NAEI sources that are forecast to show the most significant changes in PM₁₀ emissions between 2007 and 2010. The main decreases in PM₁₀ emission forecasts are due to implementation of regulation and the replacement of older technology with more efficient or less polluting equipment.

Table 4.13: Source sectors expected to show the most significant changes in PM₁₀ emissions between 2007 and 2010

NFR	NFR NAME	Proportion of 2007 emission, %	Reduction in emissions between 2007 and 2010, %	Main sources in NFR Code	Activity Data Source	Comment
1A1a	Public Electricity and Heat Production	7	39	Power station - coal	DECC - UEP37	The main cause of this reduction is the implementation of Flue Gas Desulphurisation (FGD) at some of the coal-fired power stations, to meet the requirements of LCPD. The analysis of PM10 factors for coal-fired plant with and without FGD indicates a clear link between FGD and lower PM10 emissions, and this is reflected here. UEP37 also projects a significant decrease in coal consumption in power stations, reflecting the lower economic growth assumptions and a higher price for carbon.
1A3biii	R.T., Heavy duty vehicles	3	42	Road transport - HGV articulated - motorway driving	DfT	Emission reductions are expected because of penetration of higher Euro standard vehicles in the fleet. Emissions for this sector have been updated to include the most recent traffic forecasts, and new emission factors and other assumptions.
1A4bi	Domestic combustion	13	21	Coal combustion	DECC - UEP37	Domestic solid fuel combustion is expected to decrease significantly in UEP37. This projection has been revised based on improved policy appraisals, which are expected to lead to fuel switching in the domestic sector. Emissions from natural gas consumption are expected to increase slightly.

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NFR	NFR NAME	Proportion of 2007 emission, %	Reduction in emissions between 2007 and 2010, %	Main sources in NFR Code	Activity Data Source	Comment
2A7	Bricks & ceramics	10	35	Fletton Bricks & Quarrying	DECC -UEP 37	Emissions within this sector are mostly projected based on economic growth indices within UEP37. These project a decline from 2007 to 2010, in line with the current economic downturn. Emissions from fletton brick production are expected to decrease due to the closure of one of the manufacturing plants.

4.10.5 Sub-2.5 Micron Particulate Matter (PM_{2.5})

Table 4.14 shows the NFR codes and associated NAEI sources that are forecast to show the most significant changes in PM_{2.5} emissions between 2007 and 2010. The main decreases in PM_{2.5} emission forecasts are due to implementation of regulation and the replacement of older technology with more efficient or less polluting equipment.

Table 4.14: Source sectors expected to show the most significant changes in PM_{2.5} emissions between 2007 and 2010

NFR	NFR NAME	Proportion of 2007 emission, %	Reduction in emissions between 2007 and 2010, %	Main sources in NFR Code	Activity Data Source	Comment
1A1a	Public Electricity and Heat Production	6	31	Power station - coal	DECC - UEP37	The main cause of this reduction is the implementation of Flue Gas Desulphurisation (FGD) at some of the coal-fired power stations, to meet the requirements of LCPD. UEP 37 also projects a significant decrease in coal use between 2007 and 2010.
1A3biii	R.T., Heavy duty vehicles	5	42	Road transport - HGV articulated - motorway driving	DfT	Emission reductions are expected because of penetration of higher Euro standard vehicles in the fleet. Emissions for this sector have been updated to include the most recent traffic forecasts, and new emission factors and other assumptions.
1A4bi	Domestic combustion	12	13	Coal combustion	DECC - UEP37	Domestic solid fuel combustion is expected to decrease significantly in UEP37. This projection has been revised based on improved policy appraisals, which are expected to lead to fuel switching in the domestic sector. Emissions from natural gas consumption are expected to increase slightly.
2A7	Bricks and ceramics	8	32	Fletton bricks and quarrying	DECC -UEP 37	Emissions within this sector are mostly projected based on economic growth indices within UEP37. These project a decline from 2007 to 2010, in line with the current economic downturn. Emissions from fletton brick production are expected to decrease due to the closure of one of the manufacturing plants.

4.11 REDUCTIONS FOR IPPC/IPC PROCESSES

A simple analysis has been carried out to provide estimates of the reductions in emissions that occur for those processes subject to regulation under IPC or IPPC. The analysis requires those NAEI source categories to be identified that cover such processes. In some cases, such as refineries, an NAEI source category consists only of processes which are regulated under IPC or IPPC. In other cases, for example 'other industrial combustion', only a proportion of the processes which make up the sector will be regulated under IPC/IPPIC. In the latter case, we have made estimates of the fraction of emissions that comes from regulated processes. The results are shown in Table 4.14 but do not include ammonia since over a zero small proportion of UK emissions are from sources which are regulated under IPPC/IPC.

Table 4.14 Emissions from processes regulated under IPPC/IPC (in ktonnes)

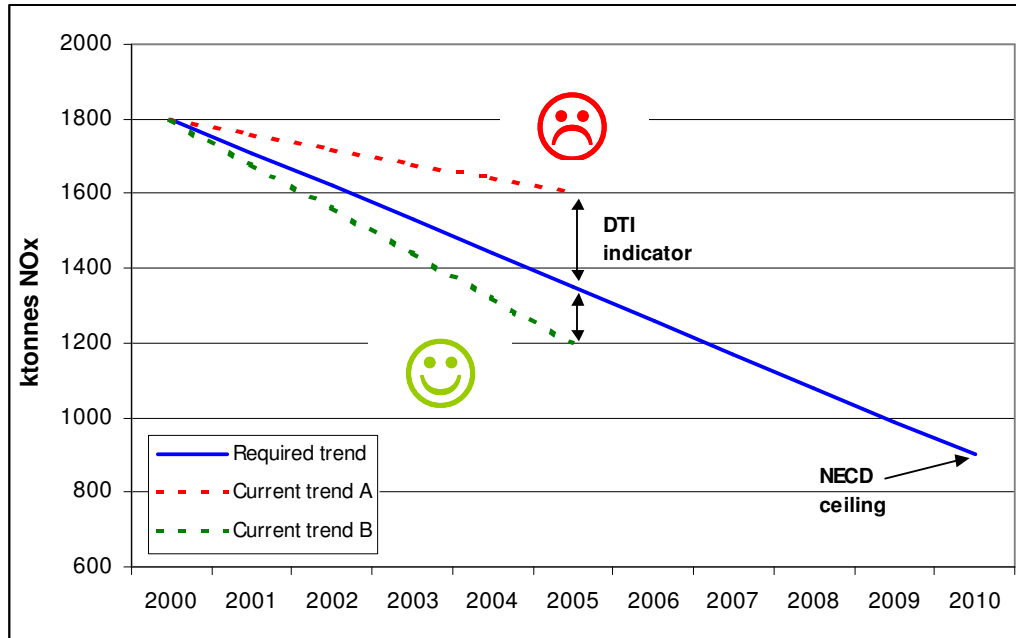
	2007	2010	% change
NO_x	464	349	-25%
SO₂	448	294	-34%
NMVO_C	85.4	68.3	-20%
PM₁₀	19.4	13.4	-31%

The results show that reductions in emissions from processes regulated under IPPC/IPC are predicted to be greater in percentage terms than reductions in emissions from all sources. This is to be expected since these regulated processes would be subject to emission controls, whereas the total UK emissions would include sources that were not regulated.

4.12 DISTANCE TO TARGET INDICATOR ANALYSIS

A distance-to-target indicator (DTI) analysis is a useful means of assessing progress towards the 2010 ceiling targets for UK emissions of air quality pollutants. The DTI measures the deviation in percentage points of the trend in actual emissions from a (hypothetical) linear path between 1990 emissions and the projected emissions for 2010. A positive value indicates the need to do more to be on track to meet the target in 2010, whilst a negative value indicates that the UK is on track to meet its target in 2010. The DTI is based on a hypothetical trend line and as such it is only an indicative measure of progress to meet the targets. The UK could potentially have a positive DTI score up to 2009 but still meet the ceiling targets in 2010, if all mitigation action is undertaken in the final year. An indicative example of the DTI approach is provided in Figure 4.7 below.

Figure 4.7. Distance-to-target Indicator Analysis (DTI): Example



The graphs below illustrate the historical trends and projected emissions to 2010 (indexed emissions 1990-2010), against the linear path to meet the 2010 NECD targets (Figures 4.8 to 4.13).

The historic data of NO_x and NH₃ match the linear target path quite well and it can be assumed that the underlying assumptions and methodologies of the projected data are in line with the historic time series. Note that the NO_x projected trend remains above the 2010 target path, indicating that more emission reductions are required to meet the UK's NECD target for that pollutant.

NM_{VOC} and SO_x show slight deviations between the historic time series and their associated linear target path, with the trajectory in recent years moving close to the linear path in most cases. The graphs illustrate that the NH₃, SO₂ and NM_{VOC} targets are expected to be met.

Figure 4.8. NO_x Emission Trends: Actual Reductions to date plotted against the linear path to the 2010 NECD Target

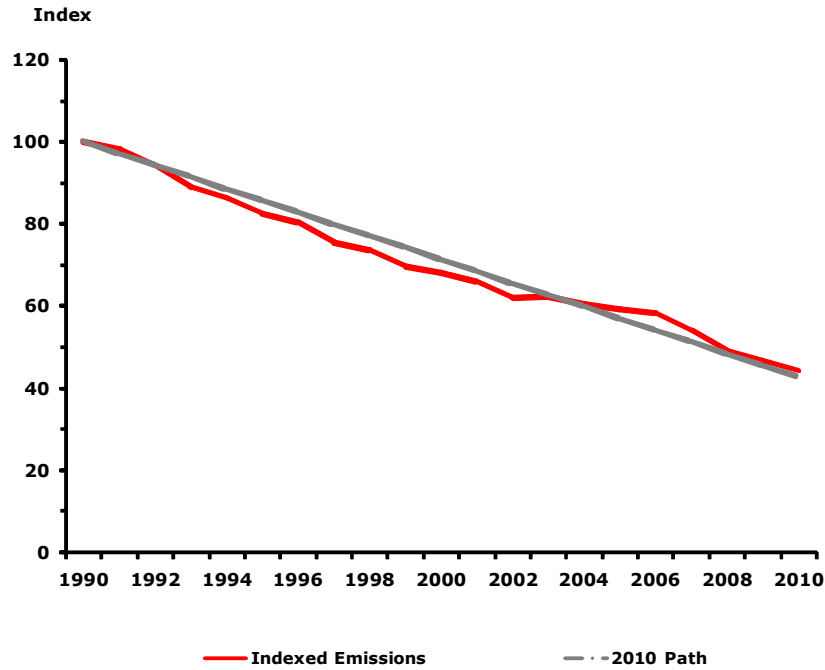


Figure 4.9. SO₂ Emission Trends: Actual Reductions to date plotted against the linear path to the 2010 NECD Target

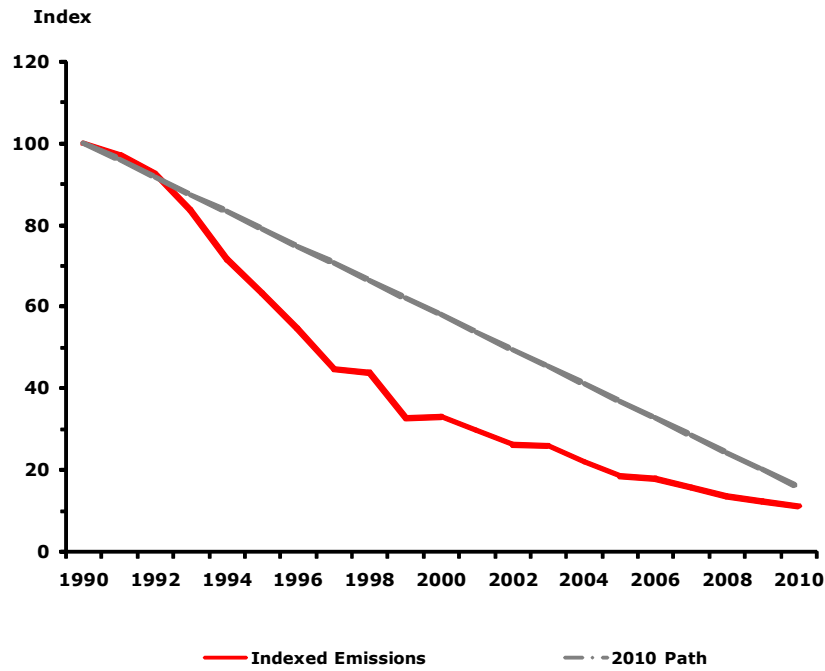


Figure 4.10. NH₃ Emission Trends: Actual Reductions to date plotted against the linear to the 2010 NECD Target

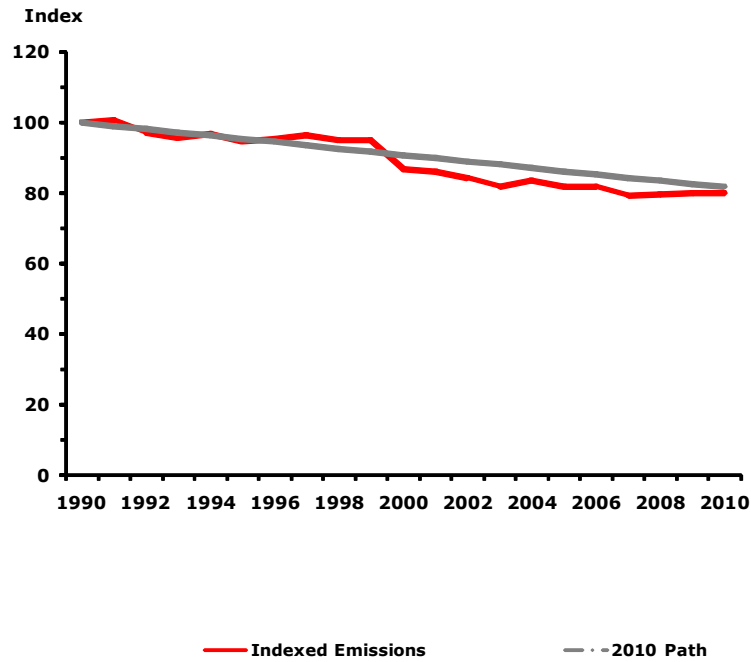
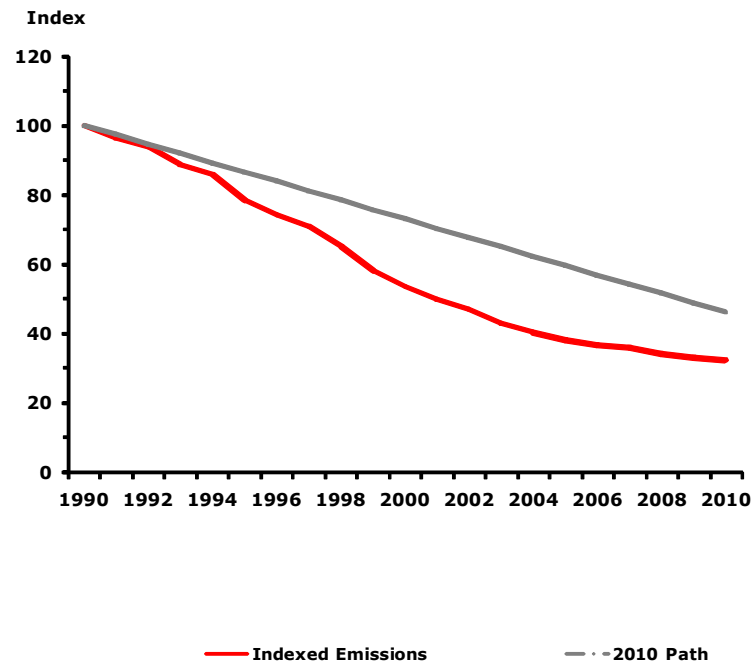


Figure 4.11. NMVOC Emission Trends: Actual Reductions to date plotted against the linear path to the 2010 NECD Target



5. Uncertainties

5.1 INTRODUCTION

The emission projections presented in this report are subject to uncertainty in three main areas: (1) base emission factor and activity data, (2) emission factor trends and (3) activity data trends. These are discussed in turn below.

Activity data and (more importantly) emission factors used as a starting point for the emission projections are uncertain. This uncertainty will vary from source to source and from pollutant to pollutant: for example, emission factors for SO₂ emissions from combustion sources are based on the sulphur content of fuels – a parameter that is fairly well understood. On the other hand, emission factors for PM₁₀ from quarrying activities are very uncertain being based on limited data which may not be fully appropriate to UK conditions and requiring many assumptions to be made. Any uncertainty in the 2007 emission estimates is also inherent in the projected emission estimates. An analysis of the impact of these uncertainties on the projections has been carried out and is described in Section 5.2.

The emission projections require judgements to be made as to how emission factors will change in response to legislation and other factors. In some cases, this can be stated with confidence since emission factors are well-understood and are even sometimes specified by the legislation e.g. emission limit values (ELV) given in the LCPD, or sulphur contents specified in the Sulphur Content of Liquid Fuels Directive. In other cases, emission factors are poorly characterised and there is limited information on how abatement options will affect emissions. Examples of this would again include PM₁₀ from quarrying activities. In most cases, uncertainty in emission factor trends would fall between these extremes – trends cannot be predicted with exactitude, but neither are predictions likely to be seriously wrong, at least in the short term. Projections are currently made for 2010, 2015 and 2020 and, in the first case at least, it is fairly easy to make robust judgements about trends in emission factors providing that historical emission factors are reasonable good, and that factors such as legislation affecting the sector are understood. For longer-term projections, uncertainty in emission factor trends become much more important and it is likely that projections will be biased towards overestimating emission factors (being based on a knowledge of currently available abatement measures and other technology). No assessment is currently made of the impact on projections of uncertainty in emission factor trends, and it is recommended that the uncertainty analysis be developed to include this.

Activity drivers are, like emission factor trends, likely to be much more certain in the shorter term than the long. A measure of the uncertainty is already given by the various scenarios produced by DECC. In the case of non-energy related sources, such as industrial processes, there is likely to be a much greater level of uncertainty. For these sources, activity drivers are based either on the broad indicators of economic output that are generated as part of the DECC model, or else selected from other projections data (e.g. population projections, industry data etc.), or even assumed to remain constant with time. Currently, we have no estimates of uncertainty associated with these activity drivers and no assessment is made of the impact of uncertainty on projections. It is recommended that the uncertainty analysis be developed to include this.

5.2 UNCERTAINTY ANALYSIS METHOD

The impact of uncertainty on the emission projections has been analysed using specific software for the task (@Risk™). The approach involved the use of probability distribution functions to describe input parameters in the calculation of projected emissions rather than discrete values. The probability distribution functions were chosen from a selection of generic types (e.g. triangular or rectangular) but all types require the minimum value and maximum value for a given parameter to be defined, together with some other measure or measures such as the mean or mode of the distribution.

The software tool then performed a calculation by sampling individual data values from each of the probability distributions on the basis of probability density and entered these values into

the emission projection calculation. The resulting emission estimates were recorded and then this process was repeated many more times (20,000 iterations were used for the analysis) in order to build up an output distribution of the projected emission estimates.

The probability distribution functions for each parameter were chosen either to reflect the variation in the available data or by expert judgement. Generally speaking, the probability distribution functions for stationary sources were based on expert judgement while those for road transport were based on some analysis of available data. In both cases though, the process of selecting functions was fairly unsophisticated due to the limited resources available for completion of the analysis.

The mean values for the projected emission totals were recorded, as well as the 95% confidence limits i.e. the emission at the 2.5% cumulative probability and the 97.5% cumulative probability.

It should be noted that the uncertainty analysis only looks at the uncertainty in underlying emissions data and not in the projected trends in activities and emission factors. In other words, emissions from a given source are assumed to be equally uncertain in all years, but the trend in emissions (in relative terms) is assumed to be constant.

5.3 UNCERTAINTY ANALYSIS RESULTS

The following results were obtained:

Table 5.1: Summary of Uncertainty Analysis results (emissions are shown in Ktonnes)

Pollutant	2010		2015		2020	
	2.5 percentile	97.5 percentile	2.5 percentile	97.5 percentile	2.5 percentile	97.5 percentile
NH ₃	244	342	241	342	240	340
NOx	1054	1384	903	1128	688	872
SO ₂	383	433	330	377	309	357
NMVOC	750	911	686	842	666	823

Overall the results suggest:

- There is a 100% chance that the SO₂ ceiling will be met in 2010;
- There is close to a 100% chance that the NMVOC ceiling will be met in 2010;
- There is a 59% chance that the NH₃ ceiling will be met in 2010;
- There is only a 35% chance that the NOx ceiling will be met in 2010.

As might be expected, the analysis shows that future emissions of SO₂ can be estimated with most confidence as emission factors are relatively certain, being largely based on the sulphur content of fuels, and these are well characterised. In comparison, projections for nitrogen oxides, NMVOC and ammonia are considerably more uncertain and this means that a much greater range of future emissions is predicted by the uncertainty analysis. In the case of NMVOC and ammonia, whilst the central 'with measures' projection is that the UK will meet its commitments, the uncertainty analysis suggests that there is a possibility that this will not happen (although this possibility is extremely slight in the case of NMVOC). In the case of NOx, where the 'with measures' projection suggests that the UK will miss the NECD target in 2010, the uncertainty analysis suggests that this is also not certain, and that there is a chance that the commitment will actually be met.

As already stated, the uncertainty analysis only considers one of the three sources of uncertainty within the projections, and so the ranges presented here are likely to be underestimates of the full uncertainty. This could mean that there is a greater risk in reality that the UK will not meet its commitments than has been indicated by the analysis here. However, as discussed in Section 5.1, the elements missing from the uncertainty analysis (activity trends, emission factor trends) are more uncertain in the longer term and so their

impact on the 2010 projection may not be very great. Development of the uncertainty method is needed in order to quantify uncertainties more fully.

6. Recommendations

There are many improvements made to the historic emissions inventory with each compilation cycle that filter through to the projection estimates. The current UEP37 projections and the previous projection estimates using UEP32 are both based on the 2007 UK inventory.

It is anticipated that some improvements will be incorporated prior to the development of the 2008 “with measures” projections for air quality pollutants.

The following improvements mentioned in the previous UEP32 report have been addressed and incorporated in the UEP37 estimates where appropriate:

- NO_x emissions from Power Plants: Review the assumptions regarding the Emission Limit Values for power stations and conclude whether it is reasonable to assume that operators may aim to emit below the ELV.
 - *We do not anticipate that power plants will reduce their emissions below the ELV based on discussions with the Environment Agency (chapter 3.4).*
- Petroleum Refineries: Discuss with DECC how to account for a switch away from fuel oil to natural gas or methods to ensure consistency
 - *The methodology has been revised based on discussion with DECC taking into account the forecasts of refinery throughput and efficiency of production.*
- Transport: Incorporate improvements in assumptions about future vehicle fleet and align it with new emission factors and forecast activity from DfT. Make improvements to assumptions about alternative vehicles and fleet.
 - *The Road Transport data have been updated with the latest DfT figures and TFL emissions factors for NO_x and PM₁₀ (chapter 3.2).*
- Railway sector: To improve the projections, the first step required is an overhaul of the NAEI method for historic data, to develop a more rigorous analysis of the train fleet, speeds, fuels and technologies. A review of the rail projections to incorporate the impacts of the Directives, looking at future rail activity data (train km) and turnover in the rail/engine fleet. These data are not readily available currently to enable such development.
 - *This sector remains uncertain due to the lack in existing background data. We used the existing methodology given that these are the most reliable data currently available.*
- Shipping: Improving and developing shipping fuel use data is a high priority, to derive a better estimate for both national and international shipping fuel use.
 - *The revision of the shipping inventory, both the historic and projected data, will be based on a revision to shipping fuel use data and other related work which is ongoing with DECC and Entec (chapter 3.3).*
- Off-road: Looking into the future activity of off-road machinery due to the high uncertainty with this area.
 - *The emission factors of the off road sector have been reviewed and updated (chapter 3.3).*
- Industrial Processes: Update projections to reflect any plant closures in recent months which are not already taken account of, plus any closures likely to occur in the next 2 years. Identify areas where current activity drivers might be too high as a result of the current economic conditions.
 - *The projected activity data have been revised taking into account any plant closures based on discussions with the Environment Agency and plant operators (chapter 3.8).*
- Cement: SO₂ emission factors are based on projection from the 2006 Pollution Inventory (PI) and need to be updated to take account of reductions in emissions recorded in the 2007 PI. The projections for other pollutants are also need to be revised, however only those for PM₁₀ increase between 2007 and 2010 (by 4%) as a result.
 - *We reviewed the data for this sector. For more detail please see chapter 3.10.*
- Offshore oil & gas
 - *We reviewed the data for this sector. For more detail please see chapter 3.18.*
- Sinter plants: PM₁₀ is an issue requiring correction:

- *We reviewed the existing data and updated the future factors.*
- Aviation: Consideration needs to be given to improvements in engine technology and fuel efficiency of aircraft.
- *The information in the EEA/EMEP Guidebook has been reviewed and improved emission factors for NO_x incorporated.*

The following specific sector improvements mentioned in the UEP32 report have not been addressed due to their lower priority. It is recommended that these be reviewed in advance of the compilation of the next set of emission projections:

- Decorative Paint: Review and discuss incorporation of the Paints Directive, VOC speciation as well as the forecasts with British Coatings Federation (BCF). The existing projections for the coating and printing industry were supplied more than 5 years ago and therefore require review. We are instigating a process of consultation with the industry to see whether these projections should be revised.
- Domestic Combustion: Discuss with DECC whether their energy projections take into account the expected improved efficiency of boilers.
- Industrial Adhesives: Review of this sector gathering any data available from users or the British Adhesives and Sealants Association (BASA). We will address this issue during the preparation of the next UK Inventory summer 2009.
- Other industrial combustion: Investigate whether reductions of SO₂ are likely at the main UK coal-fired autogeneration plant. We will contact Alcan and/or EA to see what plans there are for reducing SO₂ from the plant.
- PM from Power Stations: Review the use of the emission factor for filterable PM recommended by the US EPA for all natural gas combustion sources. This will need to be reviewed as part of the inventory compilation process.
- Road Transport: Update SO₂ projections to reflect the further reduction in the Sulphur content of fuels

Further improvement of future factors is recommended. The main ones that are recommended for review in the next projections compilation cycle are:

- Chemical industry: In April this year Elementis Chromium announced the closure of their site at Eaglescliffe at the end of June, and so emissions from the sector 'chemical industry (chromium chemicals)' will be zero in 2010. It is a very small source of PM₁₀ and will not have a significant impact in total PM₁₀ emissions but it is a major source of Cr and Cr (VI) in particular so significant in that sense.
- Dry cleaning: The emission factors that are currently being used are fairly old and will be reviewed in the next set of projections.

As a general issue, the next few months will bring new data such as 2008 emissions data in the Pollution Inventory, Scottish Pollutant Release Inventory and the Northern Ireland Inventory of Sources and Releases, as well as the 2008 energy statistics in the Digest of UK Energy Statistics. Further information on proposed closures is also possible. The next version of the projections should aim to make use of these new data wherever possible.

The DECC UEP data, DfT's traffic forecast and the North Wyke Research NH₃ projections represent the sources responsible for the majority of changes between the historic NAEI 2007 data and the 2010 projected emissions. To fully understand the trends in historic and projected emissions it is essential to not only understand the historic baseline (NAEI dataset) but also to have an understanding of the underlying assumptions that form the basis for the DECC, DfT, North Wyke Research and other datasets used to project historic NAEI data.

Approaching the 2010 NECD, it is essential to provide emission estimates that predict emission in 2010 as accurately as possible. In addition to the current method of reviewing the final emission estimates we estimated the uncertainty in the emission trends to narrow down the uncertainty range and thus minimise any overestimation of total projected emissions in 2010, especially for NO_x. The final results will be available in the final report.

We were not able to incorporate the uncertainty estimates from DECC, DfT, North Wyke Research in our overall uncertainty values because the short time frame of the UEP37 compilation did not allow for such labour intensive analysis. Therefore, more detailed analysis of the uncertainty of the underlying activity data submitted by data providers such as DECC, DfT, North Wyke Research is recommended.

7 Conclusions

Projections based on UEP37 and the 2007 NAEI have been compiled for the four National Emissions Ceiling Directive (NECD) pollutants (nitrogen oxides (NO_x), sulphur dioxide (SO₂), non-methane volatile organic compounds (NMVOCs), and ammonia (NH₃)) plus PM₁₀ and PM_{2.5}.

The UEP37 energy projections are based on the latest analysis of policy and regulatory impacts on energy use in each economic sector, together with forecasts of fuel and carbon prices. Analysis by source sector experts has also integrated additional considerations of the likely emission reductions from regulatory measures, technological and abatement advances.

The UEP37 (2007) emission projections show that the UK is likely to meet the NECD targets in 2010 for SO₂, NMVOCs and NH₃. Emissions of NO_x are forecast to exceed the ceiling in 2010. However, it is forecast that the NO_x ceiling will be achieved prior to 2015.

Uncertainty analysis indicates that:

- There is a 100% chance that the SO₂ ceiling will be met in 2010;
- There is close to a 100% chance that the NMVOC ceiling will be met in 2010;
- There is a 59% chance that the NH₃ ceiling will be met in 2010;
- There is only a 35% chance that the NO_x ceiling will be met in 2010.

The uncertainty analysis shows that future emissions of SO₂ can be estimated with most confidence as emission factors are relatively certain, being largely based on the sulphur content of fuels, and these are well characterised. In comparison, projections for NO_x, NMVOC and NH₃ are considerably more uncertain and this means that a much greater range of future emissions is predicted by the uncertainty analysis. In the case of NMVOC and NH₃, whilst the central 'with measures' projection is that the UK will meet its commitments, the uncertainty analysis suggests that there is a possibility that this will not happen (although this possibility is extremely slight in the case of NMVOC).

Key Findings by Pollutant

Oxides of Nitrogen (NO_x)

- Emissions in 2010 are projected to be **1217kt**. This is 18% below 2007, but is higher than the emissions ceiling for this pollutant (1167kt).
- Decreases in emissions are projected to occur across a number of sectors, with the most significant decreases in the power sector, road transport and industrial combustion. These sources are among the more significant sources of NO_x emissions.
- The only sector in which a notable increase is expected is petroleum refining.

Sulphur Dioxide (SO₂)

- Emissions in 2010 are projected to be **411kt**. This is 30% lower than emissions in 2007, and well below the emissions ceiling of 585kt.
- The sector which contributes the most to the expected significant decrease in emissions is the power generation sector, where emissions are expected to decrease through both tighter regulation and reduced coal consumption.
- A large increase in emissions is projected for refineries. This is based on a "worst case" scenario, assuming that there will be no additional effort to go beyond the requirements of the LCPD. The current economic downturn is likely to lead to a lower emission in this sector than currently projected.

Ammonia (NH₃)

- Emissions in 2010 are projected to be **291kt**, 1% lower than emissions in 2007. This is lower than the emissions ceiling of 297kt.
- Significant decreases are projected for a number of sources, most notably non-dairy cattle wastes, road transport and agricultural soils.

- These decreases are largely offset by other increases in the agriculture sector for dairy cattle and poultry wastes.

Non-Methane Volatile Organic Compounds (NMVOCs)

- Emissions in 2010 are projected to be **816kt**, 13% below emissions in 2007. This is well below the emissions ceiling of 1200kt for this pollutant.
- The reduction is driven by reductions in emissions from the distribution of oil products, NFR category 3D (which includes sources such as aerosols, household products and industrial adhesives), category 3A (paints and industrial coatings) 3B (surface cleaning) and reductions in leakage from the gas distribution system.
- No significant increases are expected.

Particulate Matter, sub-10 micron and sub-2.5 micron (PM₁₀ and PM_{2.5})

- Emissions of PM₁₀ and PM_{2.5} are projected to decrease by around 17% and 16% respectively from 2007 to 2010.
- The largest reductions in PM₁₀ emissions are projected to occur in the power stations, minerals industry and residential sectors.
- These projected reductions are similar for PM_{2.5}
- There are no significant increases projected in any sector for either PM₁₀ or PM_{2.5}

Appendix 1

The table below is a summary of the future source and fuel categories where either the emission factor or the activity driver varies from the historic year.

Table A.1: Future source and fuel categories

Source Name	Projection Emission Factor	Projection Activity Factor
Agricultural	Agricultural projections (NH3) provided by North Wyke Research in October 08	Agricultural projections (NH3) provided by North Wyke Research in October 09
Aircraft	New off road emission projections provided by John Norris in May 09.	New off road emission projections provided by John Norris in May 09.
Coating manufacture	Historic Emission Factor for 2007	Calculated from DECC UEP37 (April 2009)
Crude oil loading from onshore facilities	NM VOC from onshore loading - controls at Hound Point	Calculated from DECC UEP26 white paper scenario (December 2006)
Decorative paint - retail decorative	BCF projections provided in Nov05 to Michael Harryman, Defra	BCF projections provided in Nov05 to Michael Harryman, Defra
Domestic combustion	Sulphur in liquid fuels (starts in 2005 at 1% "S" for fuel oil) Gas oil starts in 2000 with 0.2% down to 0.1% by 2008	Calculated from DECC UEP37 (April 2009)
Dry cleaning	NM VOC driver - Environmental Protection Act & Solvents Directive	NAEI NM VOC future factors 2009
Film coating	NM VOC driver - Environmental Protection Act & Solvents Directive	Calculated from DECC UEP37 (April 2009)
Gas leakage	Provided by Transco	Gas leakage data from Dave Lander (UKD, 2007)
Gasification processes	NM VOC driver - Environmental Protection Act & Solvents Directive	Calculated from DECC UEP26 white paper scenario (December 2006)
House and garden machinery	New off road emission projections provided by John Norris in May 09.	New off road emission projections provided by John Norris in May 09.
Industrial adhesives - other	NM VOC driver - Environmental Protection Act & Solvents Directive	Calculated from DECC UEP37 (April 2009)
Industrial adhesives - pressure sensitive tapes	NM VOC driver - Environmental Protection Act & Solvents Directive	Calculated from DECC UEP37 (April 2009)
Industrial coatings	BCF projections provided in Nov05 to Michael Harryman, Defra	BCF projections provided in Nov05 to Michael Harryman, Defra
Industrial off-road mobile machinery	New off road emission projections provided by John Norris in May 09.	New off road emission projections provided by John Norris in May 09.
Miscellaneous industrial/commercial combustion	Sulphur in liquid fuels (starts in 2005 at 1% "S" for fuel oil) Gas oil starts in 2000 with 0.2% down to 0.1% by 2008	Calculated from DECC UEP37 (April 2009)

Source Name	Projection Emission Factor	Projection Activity Factor
Other industrial combustion	NOx emission limit values (ELV) that should have been used in the 2004 inventory as a result of LAPC.	Calculated from DECC UEP37 (April 2009)
Petrol stations	NM VOC driver - Environmental Protection Act & Solvents Directive	Calculated from DECC UEP37 (April 2009)
Petrol terminals	NM VOC driver - Environmental Protection Act & Solvents Directive	Calculated from DECC UEP37 (April 2009)
Petroleum processes	NM VOC driver - Environmental Protection Act & Solvents Directive	Emission factors calculated from DECC UEP26 white paper scenario (December 2006)
Power stations	Emission factors calculated from DECC UEP37 power station data (April 2009)	Calculated from DECC UEP37 (April 2009)
Printing - heatset web offset	NM VOC driver - Environmental Protection Act & Solvents Directive	BCF projections provided in Nov05 to Michael Harryman, Defra
Printing - metal decorating	NM VOC driver - Environmental Protection Act & Solvents Directive	BCF projections provided in Nov05 to Michael Harryman, Defra
Printing - other flexography	BCF projections provided in Nov05 to Michael Harryman, Defra	BCF projections provided in Nov05 to Michael Harryman
Printing - other offset	NM VOC driver - Environmental Protection Act & Solvents Directive	BCF projections provided in Nov05 to Michael Harryman
Printing - overprint varnishes	BCF projections provided in Nov05 to Michael Harryman, Defra	BCF projections provided in Nov05 to Michael Harryman
Printing - print chemicals	NM VOC driver - Environmental Protection Act & Solvents Directive	BCF projections provided in Nov05 to Michael Harryman
Printing - publication gravure	BCF projections provided in Nov05 to Michael Harryman	BCF projections provided in Nov05 to Michael Harryman
Printing - screen printing	BCF projections provided in Nov05 to Michael Harryman	BCF projections provided in Nov05 to Michael Harryman
Public sector combustion	Historical emission factors used.	Calculated from DECC UEP37 (April 2009)
Public sector combustion	Sulphur in liquid fuels (starts in 2005 at 1% "S" for fuel oil) Gas oil starts in 2000 with 0.2% down to 0.1% by 2008	Calculated from DECC UEP37 (April 2009)
Railways	Sulphur in liquid fuels (starts in 2005 at 1% "S" for fuel oil) Gas oil starts in 2000 with 0.2% down to 0.1% by 2008	Calculated from DECC UEP37 (April 2009)
Refineries - combustion	A combination of UEP37 activity data, future emissions taken from LCPD report annex, operator own data	Calculated from DECC UEP37 (April 2009)

Source Name	Projection Emission Factor	Projection Activity Factor
Seed oil extraction	NMVOC driver - Environmental Protection Act & Solvents Directive	Calculated from DECC UEP37 (April 2009)
Shipping - coastal	EFs for coastal and fishing fuel oil have been reduced in line with Marpol VI agreements which limits S content in the North Sea 1.5%. Whilst it only applied to ships in the North sea it was been assumed that all ships in any UK waters will meet the limits	Calculated from DECC UEP37 (April 2009)

Appendix 2

Table A.2 briefly summarises the main changes in the general assumptions between UEP30, UEP32 and UEP37. UEP37 was interim projections of CO₂, produced to inform the carbon budgets, using economic growth assumptions consistent with the April 22nd Budget. The report associated with these projections is an addendum to the UEP32 report. The main changes from UEP32 can be summarised as:

- Updated policy appraisals
- Updated economic growth assumptions
- Updated carbon price
- Updated household projections

Table A2: UEP30, UEP32 and UEP37

Section	UEP 30	UEP32	UEP37	Comment
General Assumptions				
Policies	First stage projections exclude EU ETS and White Paper Proposals. The second stage include the White Paper and EU ETS carbon price for UK sectors	Projections take into account the impact of policies that are firm and funded. They do not include Climate Change Bill, the Renewable Energy Consultation related to the Renewable Target or the proposed EU Industrial Emissions Directive	The UEP37 Projections include the same policies and measures as UEP32 – i.e. those that are firm and funded. Updated policy appraisals are included.	New policies and measures will be announced during Summer 2009 to achieve the carbon reductions required for the carbon budgets
Fossil Fuel Scenario	Based on central fossil fuel price scenario assumptions and a range reflecting the low, central high carbon savings estimated through EWP proposals.			
Projections	2020	Project out to 2025; covers the Carbon budget period on year by year basis	Projections provided to 2025	
Baseline Projections and revised key assumptions				
Units	Given in Carbon	Now presented in Carbon dioxide	No change	
Oil Prices \$/bbl (2007 prices) in 2020	Low price of \$26/bbl High price of \$83/bbl Central price of \$55/bbl	Low price of \$45/bbl High price \$95/bbl (High-high price of \$150/bbl) Central price of £70/bbl (in 2020 - consistent with the Energy Group Market Analysts)	Fossil fuel price assumptions not updated from UEP32	

UK Air Quality Emission Projections: 2007 to 2020

Section	UEP 30	UEP32	UEP37	Comment
Economic Growth		Adjusted to March 2008 budget and global credit crisis consistent with HM treasury Budget Forecasts.	Economic growth assumptions revised down, in line with the Treasury's growth projections in the Budget.	GDP growth in 2010 revised down significantly.
Population		Population and household statistics revised in line with ONS October 2007 changes	Household projections are slightly higher, predominantly affecting domestic gas use projections.	Domestic gas use has been revised up for 2010, 2015 and 2020
EU ETS	Assumed Carbon price: 20 €/tonne CO ₂ to 2010 25 €/tonne CO ₂ from 2015-2020	Projections include the purchase of allowances under the EU ETS. Assumed carbon price: 25 € / tonne CO ₂	Carbon price revised to €34/tonne CO ₂	Main impact of this change is on the power sector, but the impact is masked by the overall decrease in electricity demand due to the economic downturn.
Headline UK emissions carbon dioxide projections	Changes compared to 1990: 2010 (-16%) 2015 (-18%) 2020 (-22%)	Changes compared to 1990: 2010 (-15%) 2015 (-20%) 2020 (-26%) Central assumptions emissions slightly higher in the near term than the longer term. Due to: Higher fuel price assumptions suggesting lower projected demand, 5% reduction in electricity from major producers, however emissions have increased due to higher levels of coal use. Changes in EU wide cap result in an overall reduction in UK emissions in 2020 compared with UEP30.	Changes compared to 1990: 2010 (-15%) 2015 (-20%) 2020 (-25%).	These percentage changes on 1990 include in the impact of emissions trading. This means that the actual fuel consumption trends (used to calculate the AQ pollutant projections) are not directly in line with the total CO ₂ emissions trends.
Baseline comparison with May 2007 Projections				
Broad changes in emissions	2010 (498 MtCO ₂) 2015 (485 MtCO ₂) 2020 (464 MtCO ₂)	2010 (504MtCO ₂) 2015 (473 MtCO ₂) 2020 (440 MtCO ₂)	2010 (506.4 MtCO ₂) 2015 (471.8 MtCO ₂) 2020 (445.4 MtCO ₂)	Excluding the trading of allowances under EU ETS, emissions of CO ₂ in 2010 are expected to be around 24 Mt lower than the UEP32 projections suggest. Since the majority of this decrease is within the energy supply sector, allowances will be sold up to the value of the cap which means that net emissions including trading are not much different.

UK Air Quality Emission Projections: 2007 to 2020

Section	UEP 30	UEP32	UEP37	Comment
Differences due to		Increased emissions from: power stations, land use change adjustment, increased emissions from traded sector, Reduced emissions from refinery emissions, tightening of EU ETS cap, impact of higher prices	Based on the actual projected emissions (excluding trading) emissions from energy supply, business and industrial processes are expected to be lower than projected in UEP32, due to the economic downturn and higher price of carbon. Emissions from the residential sector are expected to be higher due to the inclusion of revised policy appraisals.	
Composition of the generation fuels for electricity demand (TWh)		Increase in generation of electricity by coal - due to relative prices of gas and coal. Renewable generation is lower in 2015 due to adjustment to build profiles and lower electricity demand. Percentage share of renewables is a little higher in 2020 than in 2007 projections. [Renewables projections do not include the implications from Renewable Energy Consultation]	Overall electricity demand is down. A slightly higher lower proportion of total generation is coal – the high price of carbon makes this more expensive. Nuclear generation makes up a slightly higher proportion of the total, and renewable generation is also a slightly smaller proportion of the total.	
Impact of carbon price for EU ETS sectors and Energy White Paper Measures				
EU ETS	Made no assumptions regarding expansion of traded sectors within EU ETS beyond Phase 1. Assumed 45% of industrial sector emissions included within the EU ETS beyond 2008.	Impact of revised EU ETS, assumptions of an expanded traded sector in Phase 2, and implications of revision to the cap. 76% of industrial sector emissions included within EU ETS beyond 2008	Similar assumptions to UEP32. Higher carbon price has affected fuel mix, but not overall net CO ₂ emissions	
Emissions under central, high, and low policy scenarios		Variation in % change from 1990 baseline - 2010 (1%), 2020 (2%), 2025 (2%)	Only central scenario considered.	
Sector emissions -variant by fuel prices		Variation in % change from 1990 baseline - 2010 (2%), 2020 (3%), 2025 (3%)	Fuel prices unchanged	
Final Energy Demand Results				
Energy demand by final user updated projection with central fossil fuel prices and central policy		Residential and Transport - higher energy demand than UEP30 Industry and Services - Lower energy demanded than UEP30 - overall slightly higher	Higher fuel demand in the residential and services sector (based on revised policy appraisals), lower fuel demand across other sectors.	

UK Air Quality Emission Projections: 2007 to 2020

Section	UEP 30	UEP32	UEP37	Comment
Final energy demand by fuel for central fossil fuel prices and central policy		Gas, electricity and oil demand lower. Solid Fuel and renewables higher		
Electricity Generation				
Changes to modelling approach		Development of seasonal modelling, renewables modelling has been updated allowing the incorporation of ROC prices and maximum build rates for particular renewable types		
Key Power Station Assumptions		<p>Gas, electricity and oil demand lower. Solid Fuel and renewables higher</p> <ul style="list-style-type: none"> •The central case assumes a flat CO2 price of €25/t CO2. •The current Large Combustion Plant Directive applies – the proposed Industrial Emissions Directive is not incorporated¹⁰. • Energy White Paper measures of a banded Renewables Obligation are included but projections do not include any assumptions about targets under the renewables directive as the strategy is still being consulted on. • Some non-opted – out coal – fired capacity closures are assumed. 	<p>Electricity demand is now forecast to be lower in 2010, with reduced fossil fuel demand (for all fuel types) due to economic downturn.</p> <p>The carbon price has been revised up to €34 per tonne of CO₂</p>	
Grid Plants		Projected small increase in electricity demand suggests an increase on grid plants to 2013. Reduces after 2013 due to demand measures and growth in CHP capacity. 2020 call on grid plants is 4% lower compared to UEP30 level.	Total demand is expected to be lower in 2010, 2015 and 2020 than was projected in UEP32.	

UK Air Quality Emission Projections: 2007 to 2020

Section	UEP 30	UEP32	UEP37	Comment
Coal generation	<p>Coal generation in long term predicted to be around 71TWh.</p> <p>Electricity generated by coal:</p> <p>2010 (113 TWh) 2015 (75 TWh) 2020 (71 TWh)</p>	<p>Coal generation remains close to 2008 levels. Significant decline in coal capacity between 2011 and 2015. Small new build coal is projected operating in 2013/14. New coal capacity of 3GW in 2020, rising to around 4GW in 2023, 0.5 GW assumed to have CCS in operation. In long-term coal generation is projected to be 90TWh per year.</p> <p>Electricity Generation from coal:</p> <p>2010 (120 TWh) 2015 (112 TWh) 2020 (87 TWh)</p>	<p>Coal generation is projected to be lower in UEP37 than UEP32 in 2010 and 2015, reaching similar levels to UEP32 in 2020, due to the economic downturn affecting all electricity demand, and the high price of carbon.</p> <p>Electricity Generation from coal:</p> <p>2010 (110 TWh) 2015 (110 TWh) 2020 (87 TWh)</p>	
Gas Generation	<p>Electricity generated by gas:</p> <p>2010 (129 TWh) 2015 (186 TWh) 2020 (195 TWh)</p>	<p>Little change from 2008 levels through to 2014. Suggests new gas build by 2016 then reducing as nuclear and renewables are used for base load.</p> <p>Electricity generation from gas:</p> <p>2010 (132 TWh) 2015 (142 TWh) 2020 (153 TWh)</p>	<p>Gas generation is again slightly lower in 2010 and 2015 than in UEP32, returning to similar levels in 2020.</p> <p>Electricity generation from gas:</p> <p>2010 (119 TWh) 2015 (129 TWh) 2020 (153 TWh)</p>	
Nuclear	<p>Due to consultation new build nuclear only in the high case - small build of 1GW is projected in 2020.</p> <p>Electricity generated from Nuclear:</p> <p>2010 (68 TWh) 2015 (31 TWh) 2020 (25 TWh)</p>	<p>Projected to recover from recent low levels to 63TWh in 2010 before falling due to plant closures. New build nuclear is competitive with other forms of capacity. By 2023 around 5GW of new nuclear capacity is projected to be 10GW.</p> <p>Electricity generated from nuclear:</p> <p>2010 (63TWh) 2015 (45TWh) 2020 (32TWh)</p>	<p>Nuclear generation in 2010 is projected to be slightly higher in UEP37 than was expected in UEP32, then follows a similar decreasing trend due to plant closures.</p> <p>Electricity generated from nuclear:</p> <p>2010 (67TWh) 2015 (44TWh) 2020 (30TWh)</p>	

UK Air Quality Emission Projections: 2007 to 2020

Section	UEP 30	UEP32	UEP37	Comment
Renewables	<p>Electricity generated from renewables:</p> <p>2010 (33 TWh) 2015 (53 TWh) 2020 (57 TWh)</p>	<p>Longer-term generation from renewables expected to meet reach 56TWh/year in 2020 with further smaller increases in following later years. Projection Broadly unchanged from UEP30.</p> <p>Power generated from renewables:</p> <p>2010 (33 TWh) 2015 (50 TWh) 2020 (56 TWh)</p>	<p>Renewable generation is projected to be lower for all years than was projected in UEP32.</p> <p>Power generated from renewables:</p> <p>2010 (26 TWh) 2015 (39 TWh) 2020 (51 TWh)</p>	
Imports of electricity		<p>Short-term projection is for imports of 8.5 TWh/year followed by increased imports from 2010 onwards as a result of new interconnection capacity. Assumed beyond 2014 further interconnection capacity will be added increasing imports to 17 TWh/year.</p>	<p>Imports of electricity have also been revised down. Imports are expected to account for 12.2 TWh in 2010, and then 12.6 in 2015, 2020 and 2025</p>	
Uncertainties in Power Sector Projections		<ul style="list-style-type: none"> • The longevity of existing coal – fired capacity, including ‘opted-in’ plant. • The future CO₂ price. • The evolution of renewables capacity. 		
Oil & Gas E&P Sector emissions (mainly offshore)	<p>Offshore emissions from gas combustion and gas separation:</p> <p>2010 (16.4 MtCO₂) 2015 (12.3 MtCO₂) 2020 (8.2 MtCO₂)</p>	<p>Offshore emissions from gas combustion and gas separation are lower compared to previous projection:</p> <p>2010 (12.5 MtCO₂) 2015 (9.4 MtCO₂) 2020 (6.9 MtCO₂)</p>	<p>Offshore own gas use revised down for 2010, but is expected to be higher than the previous projections indicated in 2015 and 2020.</p>	

UK Air Quality Emission Projections: 2007 to 2020

Section	UEP 30	UEP32	UEP37	Comment
Oil Refineries	<p>Emissions from Refineries:</p> <p>2010 (21.3 MtCO₂e) 2015 (22.0 MtCO₂e) 2020 (22.4 MtCO₂e)</p>	<p>Updated Assumption: Constant throughput to 2010, followed by 0.5% p.a. increase</p> <p>- Average energy consumption of 0.825GWh/kt of throughput (2010-2020)</p> <p>- Fuels consisting of refinery gases, fuel oil, natural gas, petroleum coke¹⁵ and gas oil</p> <p>Emissions from refineries:</p> <p>2010(16.1 MtCO₂e) 2015 (16.5 MtCO₂e) 2020 (17.0 MtCO₂e)</p>	<p>Refinery fuel use is projected to be lower (for all fuels) in 2010, 2015 and 2020.</p>	
Projection Uncertainty				
Uncertainty	<p>Uncertainty margin of 51 MtCO₂e</p>	<p>Plus or minus 43 MtCO₂e by 2020 and 47MtCO₂e by 2025</p>	<p>Emissions are presented in the report as 5 year carbon budgets. A comparable uncertainty range is not quoted.</p>	<p>UEP32 uncertainty is marginally lower than uncertainty in UEP30 - lower due to reduced uncertainty with the estimation of the EU ETS cap.</p>

Appendix 3

This appendix compares the historic and projected emissions by pollutant, illustrating how emission values have changed and whether these have been due to historic changes in the inventory or changes to assumptions used in modelling projections. The emissions data for 2006 (both for the 2006 NAEI and 2007 NAEI inventory) for the four NECD pollutants (SO₂, NO_x, NMVOCs and NH₃) plus PM₁₀ and PM_{2.5} are presented here by NFR code. Also presented are the projected 2010 values based on UEP30, UEP32 and UEP37.

2010 NO_x Comparison

The table below compares the 2006 historic NO_x emissions based on the 2006 and 2007 inventory, there is under a 10% difference in most of the NFR codes. The main changes in the historic inventory have been in the following sectors:

- **1 A 3 a ii** Civil Aviation (Domestic, Cruise)
- **1 A 3 b i** R.T., Passenger cars
- **1 A 4 a** Commercial / Institutional
- **2 C** METAL PRODUCTION

The last three columns of the table compare the projected 2010 values based on UEP30, UEP32 and UEP37. The reasons for change in the UEP32 and UEP37 2010 projections are given in the tables in section 4 of the main report. A comparison of the UEP30 and UEP32 2010 projections was undertaken in the previous projections report (March 2009). This analysis found that the impact of the changes from UEP30 to UEP32 resulted in notable changes in the following:

- Significant decreases in the power sector, road transport and industrial combustion. These sources are among the more significant sources of NO_x emissions.
- Modest increases were expected in a few sectors, most notably petroleum refining and other energy industries, although these sources only make up a small proportion of total emissions

UK Air Quality Emission Projections: 2007 to 2020

Table A3.1 2010 NOx comparison (Emissions in Kilotonnes)

	Historic data			% difference between historic database	Projected data		
	2006 (2006 NAEI)	2006 (2007 NAEI)	2007 (2007 NAEI)		2010 (UEP30)	2010 (UEP 32)	2010 (UEP37)
	2006 NAEI	2007 NAEI			2006 NAEI	2007 NAEI	
1A1a	389.17	391.77	360.47	-1%	558.03	287.37	260.81
1A1b	28.12	27.98	25.96	1%	58.87	33.94	28.68
1A1c	49.12	52.16	51.43	-6%	96.65	60.66	45.20
1A2a	19.78	19.99	18.76	-1%	53.64	20.83	12.97
1A2f	219.60	243.94	229.69	-10%	361.62	177.15	206.44
1A3ai(i)	Memo Item	10.97	10.76		Memo Item	13.12	10.75
1A3aii(i)	1.70	2.21	2.10	-23%	4.23	2.74	2.13
1A3bi	195.30	158.00	137.03	24%	494.52	135.40	112.82
1A3bii	54.42	59.30	54.68	-8%	38.49	38.58	41.50
1A3biii	264.05	259.15	248.35	2%	184.72	185.47	177.57
1A3biv	1.23	1.33	1.28	-7%	1.04	1.05	1.51
1A3c	37.83	37.85	38.70	0%	72.51	28.73	27.81
1A3dii	122.13	122.13	109.27	0%	144.96	61.40	98.46
1A3eii	5.23	5.26	4.85	-1%	9.86	4.93	3.74
1A4a	20.01	24.84	22.44	-19%	34.93	15.84	22.97
1A4bi	103.72	103.66	98.98	0%	193.69	93.03	98.84
1A4bii	0.92	0.92	0.91	0%	1.89	0.95	0.82
1A4ci	0.69	0.69	0.68	0%	1.00	0.38	0.38
1A4cii	45.50	45.50	39.05	0%	53.52	25.27	30.08
1A5b	21.94	21.94	23.45	0%	43.88	23.45	22.70
1B1b	0.26	0.26	0.25	0%	0.54	0.27	0.18
1B2ai	0.51	0.54	0.11	-5%	0.75	0.11	0.11
1B2c	1.84	1.98	2.06	-7%	2.95	1.40	1.89
2B2	0.62	0.62	0.61	0%	1.40	0.61	0.61
2B5	0.37	0.37	0.50	-1%	0.68	0.55	0.36
2C	1.49	1.31	1.41	14%	3.94	1.59	1.04
4F	0.00	0.00	0.00		0.00	0.00	0.00
5B	0.20	0.20	0.18	0%	0.40	0.18	0.18
6C	1.63	1.59	1.55	3%	3.28	1.56	1.49
6D	0.32	0.33	0.33	-2%	0.64	0.33	0.33
Total	1587.70	1596.78	1485.88	-1%	2422.64	1216.86	1212.36

2010 SO₂ Comparison

The table below compares the 2006 historic SO₂ emissions based on the 2006 and 2007 inventory, there is under a 10% difference in most of the NFR codes. The main changes between the historic 2006 and 2007 inventory have been in the following sectors:

- **1 A 1 c** Manufacture of Solid Fuels and Other Energy Industries
- **1 A 3 b ii** R.T., Light duty vehicles
- **1 A 3 b iv** R.T., Mopeds & Motorcycles
- **1 B 2 c** Venting and flaring
- **6 C** WASTE INCINERATION (e)

The last three columns of the table compare the projected 2010 values based on UEP30, UEP32 and UEP37. The reasons for change in the UEP32 and UEP37 2010 projections are given in the tables in Section 4 of the main report. A comparison of the UEP30 and UEP32 2010 projections was undertaken in the previous projections report (March 2009). This analysis found that the impact of the changes from UEP30 to UEP32 resulted in notable changes in the following:

- Decreases were expected in the two largest sources of emissions in 2007: power stations and refineries. These decreases reflect the implementation of FGD, and the requirement to meet the LCPD bubble, respectively.
- Only the iron and steel sector showed an increase of more than 1kt. This sector only makes a small contribution to total emissions

UK Air Quality Emission Projections: 2007 to 2020

Table A3.2 2010 SO₂ comparison (Emissions in Kilotonnes)

	Historic data			% difference between historic database	Projected data		
	2006 (2006 NAEI)	2006 (2007 NAEI)	2007 (2007 NAEI)		2010 (UEP30)	2010 (UEP 32)	2010 (UEP37)
	2006 NAEI	2007 NAEI			2006 NAEI	2007 NAEI	
1A1a	360.01	361.38	285.47	0%	287.89	163.33	135.96
1A1b	75.13	75.13	78.97	0%	138.75	52.90	100.93
1A1c	5.08	4.25	4.74	20%	10.07	4.81	3.38
1A2a	15.79	15.17	15.68	4%	59.23	17.38	10.11
1A2f	86.95	81.24	75.62	7%	145.82	76.16	73.81
1A3ai(i)	Memo Item	0.83	0.73		Memo Item	0.89	0.81
1A3aii(i)	0.21	0.23	0.19	-7%	0.54	0.24	0.21
1A3bi	2.00	2.11	1.83	-5%	3.41	1.83	1.83
1A3bii	0.29	0.21	0.15	39%	0.29	0.15	0.15
1A3biii	0.43	0.39	0.28	9%	0.43	0.28	0.28
1A3biv	0.01	0.01	0.01	-15%	0.01	0.01	0.01
1A3c	1.97	1.97	1.86	0%	2.59	1.03	1.33
1A3dii	50.24	50.24	48.90	0%	41.32	16.94	32.32
1A3eii	0.41	0.41	0.38	0%	0.71	0.35	0.38
1A4a	4.69	4.94	4.66	-5%	9.73	3.25	5.60
1A4bi	21.53	21.51	21.85	0%	26.26	15.49	9.54
1A4bii	0.01	0.01	0.01	0%	0.00	0.00	0.29
1A4ci	0.26	0.26	0.23	0%	0.34	0.23	0.23
1A4cii	3.50	3.50	3.10	0%	4.95	2.34	3.15
1A5b	5.11	5.09	5.09	0%	10.22	5.09	5.09
1B1b	7.42	7.75	9.82	-4%	14.87	9.88	7.25
1B2ai	0.74	0.76	0.19	-2%	1.09	0.11	0.15
1B2c	0.24	0.19	0.18	23%	0.38	0.12	0.16
2A7	18.24	18.39	15.86	-1%	25.50	8.25	8.25
2B5	5.67	5.67	5.80	0%	11.03	6.05	2.27
2C	7.94	7.94	8.14	0%	17.38	8.75	6.34
6C	1.24	0.90	0.91	37%	2.48	0.92	0.91
Total	675.12	670.52	590.67	1%	815.28	396.79	410.76

2010 NMVOC Comparison

The table below compares the 2006 historic NMVOC emissions based on the 2006 and 2007 inventory, there is under a 10% difference in most of the NFR codes. The main changes in the historic inventory have been in the following sectors:

- **1 A 4 b i** Residential plants
- **1 B 2 a i** Exploration Production
- **1 B 2 a v** Distribution of oil products

The last three columns of the table compare the projected 2010 values based on UEP30, UEP32 and UEP37. The reasons for change in the UEP32 and UEP37 2010 projections are given in the tables in Section 4 of the main report. A comparison of the UEP30 and UEP32 2010 projections was undertaken in the previous projections report (March 2009). This analysis found that the impact of the changes from UEP30 to UEP32 resulted in notable changes in the following:

- The reduction was driven mainly by a large reduction in NFR category 3D (which includes sources such as aerosols, household products and industrial adhesives), significant reductions to emissions from oil and gas exploration, and reduction in leakage from the gas distribution system.
- The only projected increase of more than 1kt was from the chemicals industry sector

UK Air Quality Emission Projections: 2007 to 2020

Table A3.3 2010 NMVOC comparison (Emissions in Kilotonnes)

	Historic data			% difference between historic database	Projected data		
	2006 (2006 NAEI)	2006 (2007 NAEI)	2007 (2007 NAEI)		2010 (UEP30)	2010 (UEP 32)	2010 (UEP37)
	2006 NAEI	2007 NAEI			2006 NAEI	2007 NAEI	
1A1a	4.36	4.87	4.61	-11%	4.07	3.61	4.21
1A1b	0.33	0.33	0.31	1%	0.45	0.44	0.29
1A1c	0.55	0.58	0.56	-5%	0.62	0.66	0.49
1A2a	0.75	0.75	0.73	0%	0.88	0.82	0.33
1A2f	24.91	24.71	24.11	1%	24.18	23.73	22.86
1A3ai(i)	Memo Item	1.04	0.96		Memo Item	1.17	1.07
1A3aii(i)	1.03	1.00	0.73	3%	1.36	0.80	0.81
1A3bi	50.55	48.93	41.35	3%	71.10	36.26	36.26
1A3bii	7.37	7.86	7.38	-6%		5.86	5.86
1A3biii	19.61	19.51	18.38	1%		13.61	13.61
1A3biv	7.57	8.18	7.89	-7%		8.28	8.28
1A3bv	17.00	16.44	12.76	3%		12.76	12.76
1A3c	3.66	3.67	3.72	0%	3.91	2.76	2.68
1A3cii	5.91	5.91	5.29	0%	3.68	2.97	4.77
1A3eii	0.70	0.71	0.70	-1%	0.81	0.81	0.69
1A4a	0.92	0.91	0.88	1%	0.91	0.86	0.90
1A4bi	29.71	38.27	42.01	-22%	27.97	39.50	37.16
1A4bii	11.19	11.19	9.91	0%	5.74	5.74	5.02
1A4ci	1.83	1.82	1.82	0%	0.19	0.02	0.02
1A4cii	7.51	7.51	6.96	0%	6.16	5.94	5.78
1A5b	1.50	1.50	1.74	0%	1.50	1.74	1.74
1B1b	0.13	0.13	0.13	0%	0.13	0.13	0.09
1B2ai	49.13	77.52	75.79	-37%	53.74	61.57	71.23
1B2aiv	31.67	31.67	30.90	0%	31.67	30.90	30.90
1B2av	33.19	40.15	36.22	-17%	31.71	23.99	24.20
1B2b	40.80	41.88	39.40	-3%	22.49	22.58	23.13
1B2c	21.13	22.24	25.75	-5%	13.20	17.02	20.19
2A7	3.23	3.24	3.81	0%	2.41	2.07	1.98
2B5	32.79	32.79	32.78	0%	37.19	35.84	24.22
2C	1.64	1.64	1.70	0%	1.95	1.94	0.99
2D1	0.24	0.24	0.15	0%	0.24	0.15	0.13
2D2	78.24	77.70	79.01	1%	78.39	79.17	79.17
3A	117.69	120.20	118.13	-2%	109.74	109.50	108.39
3B	30.13	30.42	30.47	-1%	20.82	21.11	18.63
3C	14.87	14.95	14.94	-1%	12.17	12.30	10.06
3D	239.59	241.44	241.77	-1%	201.23	203.46	219.58
4F	0.00	0.00	0.00		0.00	0.00	0.00
6A	9.26	9.67	9.65	-4%	2.36	9.48	9.50
6C	7.34	6.54	6.43	12%	7.34	6.43	6.40
6D	1.68	1.70	1.70	-1%	1.68	1.70	1.70
Total	909.70	959.80	941.54	-5%	781.97	807.69	816.08

2010 NH₃ Comparison

The table below compares the 2006 NH₃ historic emissions based on the 2006 and 2007 inventory, there is under a 10% difference in most of the NFR codes. The main changes between the 2006 and 2007 historic inventory have been in the following sectors:

- **4 B 8** Swine
- **6 C** WASTE INCINERATION (e)

The last three columns of the table compare the projected 2010 values based on UEP30, UEP32 and UEP37. The reasons for change in the UEP32 and UEP37 2010 projections are given in the tables in Section 4 of the main report. A comparison of the UEP30 and UEP32 2010 projections was undertaken in the previous projections report (March 2009). This analysis found that the impact of the changes from UEP30 to UEP32 resulted in notable changes in the following:

- Significant decreases were projected for a number of sources, most notably non-dairy cattle wastes, road transport and agricultural soils.
- These decreases were largely offset by other increases in the agriculture sector for dairy cattle and poultry wastes.

UK Air Quality Emission Projections: 2007 to 2020

Table A3.4 2010 NH₃ comparison (Emissions in Kilotonnes)

	Historic data			% difference between historic database	Projected data		
	2006 (2006 2006 NAEI)	2006 (2007 2007 NAEI)	2007 (2007)		2010 (UEP30) 2006 NAEI	2010 (UEP 32) 2007 NAEI	2010 (UEP37)
1A1a	0.74	0.74	0.73	0%	1.13	0.19	0.75
1A1c	0.00	0.00	0.00	0%	0.00	0.00	0.00
1A2a	0.00	0.00	0.00		0.00	0.00	0.00
1A2f	0.55	0.55	0.54	0%	0.29	0.28	0.27
1A3bi	8.16	7.27	6.18	12%	8.16	4.37	4.37
1A3bii	0.20	0.19	0.17	2%	0.20	0.19	0.19
1A3biii	0.11	0.11	0.11	0%	0.11	0.11	0.11
1A3biv	0.01	0.01	0.01	0%	0.01	0.01	0.01
1A3eii	0.00	0.00	0.00	0%	0.01	0.01	0.00
1A4a	0.00	0.00	0.00	-2%	0.00	0.00	0.00
1A4bi	1.42	1.54	1.72	-8%	1.10	1.54	1.33
1A4bii	0.00	0.00	0.00	0%	0.00	0.00	0.00
1A4ci	0.00	0.00	0.00	0%	0.00	0.00	0.00
1A4cii	0.04	0.04	0.04	0%	0.04	0.04	0.04
1B1b	0.09	0.09	0.09	0%	0.09	0.09	0.06
1B2aiv	0.06	0.06	0.06	0%	0.06	0.06	0.06
2A7	0.46	0.46	0.49	0%	0.36	0.53	0.38
2B5	3.99	3.99	3.79	0%	3.29	3.79	3.12
2C	0.01	0.01	0.01	0%	0.01	0.01	0.00
2D1	0.01	0.01	0.01	0%	0.01	0.01	0.01
2D2	0.72	0.74	0.75	-3%	0.72	0.75	0.75
3D	1.22	1.22	1.22	0%	1.27	1.28	1.28
4B13	20.38	20.38	17.30	0%	20.38	17.30	17.30
4B1a	85.03	74.60	71.20	14%	84.88	74.65	74.65
4B1b	64.44	62.60	62.70	3%	60.69	58.63	58.63
4B3	11.77	11.30	11.00	4%	12.02	11.54	11.54
4B6	4.94	4.94	4.89	0%	5.11	5.11	5.11
4B8	26.61	22.00	20.90	21%	19.78	19.87	19.87
4B9	37.89	34.57	31.70	10%	29.88	33.84	33.84
4D1	34.79	38.72	42.64	-10%	36.68	41.16	41.16
4F	1.94	7.76	7.76	-75%	1.94	1.94	7.76
6A	3.34	3.33	3.08	0%	3.34	3.08	3.08
6B	5.52	5.50	5.50	0%	5.52	5.50	5.50
6C	0.02	0.02	0.03	-29%	0.02	0.03	0.03
6D	0.04	0.04	0.04	-2%	0.04	0.04	0.04
7	0.27	0.27	0.26	0%	0.27	0.26	0.26
Total	314.75	303.07	294.92	4%	297.37	286.20	291.49

2010 PM₁₀ Comparison

The table below compares the 2006 PM₁₀ historic emissions based on the 2006 and 2007 inventory, there is under a 10% difference in most of the NFR codes. The main changes between the 2006 and 2007 historic inventory have been in the following sectors:

- **1 A 2 a** Iron and Steel
- **1 A 3 b ii** R.T., Light duty vehicles
- **1 A 3 b iv** R.T., Mopeds & Motorcycles
- **1 A 4 b i** Residential plants
- **6 D** OTHER WASTE (f)
- **7** OTHER

The last three columns of the table compare the projected 2010 values based on UEP30, UEP32 and UEP37. The reasons for change in the UEP32 and UEP37 2010 projections are given in the tables in Section 4 of the main report. A comparison of the UEP30 and UEP32 2010 projections was undertaken in the previous projections report (March 2009). This analysis found that the impact of the changes from UEP30 to UEP32 resulted in notable changes in the following:

- Reductions in PM₁₀ emissions were projected to occur in the power stations, national navigation, and minerals industry sectors.
- Increases in emissions of more than 1kt PM₁₀ were forecast to occur in the iron and steel sector, and in road transport (LGVs).

UK Air Quality Emission Projections: 2007 to 2020

Table A3.5 2010 PM₁₀ comparison (Emissions in Kilotonnes)

	Historic data			% difference between historic database	Projected data		
	2006 (2006 NAEI)	2006 (2007 NAEI)	2007 (2007 NAEI)		2010 (UEP30)	2010 (UEP 32)	2010 (UEP37)
	2006 NAEI	2007 NAEI			2006 NAEI	2007 NAEI	
1A1a	11.38	11.43	9.51	0%	21.95	6.36	5.84
1A1b	1.73	1.73	1.52	0%	3.22	1.60	1.35
1A1c	0.33	0.33	0.31	0%	0.63	0.34	0.27
1A2a	2.90	1.32	1.89	119%	6.14	2.97	1.24
1A2f	14.29	13.18	12.22	8%	22.34	11.16	10.74
1A3ai(i)	Memo Item	0.04	0.03		Memo Item	0.04	0.04
1A3aii(i)	0.01	0.01	0.01	-2%	0.02	0.01	0.01
1A3bi	6.01	6.07	5.90	-1%	22.23	5.79	5.61
1A3bii	10.23	4.61	4.41	122%	6.62	6.62	3.25
1A3biii	6.03	5.20	4.62	16%	3.36	3.36	2.68
1A3biv	0.57	0.14	0.14	293%	0.68	0.68	0.07
1A3bvi	9.50	9.52	9.65	0%	20.09	10.04	9.56
1A3c	0.67	0.67	0.69	0%	1.28	0.51	0.49
1A3dii	8.32	8.32	7.93	0%	7.96	3.14	7.14
1A3eii	0.46	0.46	0.43	-1%	0.72	0.36	0.33
1A4a	0.86	0.80	0.69	8%	1.71	0.54	0.80
1A4bi	20.50	16.39	18.29	25%	36.01	16.44	14.51
1A4bii	0.02	0.02	0.02	0%	0.04	0.02	0.02
1A4ci	2.24	2.24	2.23	0%	2.47	0.03	0.03
1A4cii	4.57	4.57	3.85	0%	4.88	2.31	2.94
1A5b	0.84	0.84	0.82	0%	1.69	0.82	0.82
1B1b	0.46	0.46	0.38	0%	0.92	0.38	0.33
1B2c	1.05	1.07	1.16	-2%	1.69	0.78	1.06
2A1	0.19	0.20	0.21	-7%	0.43	0.22	0.16
2A4	0.01	0.01	0.00	0%	0.01	0.00	0.00
2A7	13.67	13.68	13.96	0%	24.12	11.68	9.09
2B5	0.67	0.69	0.55	-3%	1.29	0.57	0.38
2C	6.31	5.54	7.26	14%	13.02	7.53	6.32
2D1	1.17	1.17	0.80	0%	2.34	0.80	0.67
3A	5.18	5.44	5.41	-5%	11.30	5.64	5.47
3C	0.15	0.16	0.16	-3%	0.29	0.17	0.11
4B1	0.65	0.65	0.64	0%	1.30	0.64	0.64
4B8	1.23	1.23	1.20	0%	2.45	1.20	1.20
4B9	9.26	9.26	8.98	0%	18.53	8.98	8.98
4D1	2.32	2.20	2.01	6%	4.64	2.01	2.01
4F	0.00	0.00	0.00		0.00	0.00	0.00
6C	4.42	4.42	4.42	0%	8.84	4.42	4.42
6D	1.41	1.39	1.39	2%	2.83	1.39	1.39
7	1.85	1.85	1.78	0%	3.83	1.92	1.92
Total	151.46	137.30	135.45	10%	261.88	121.47	111.87

UK Air Quality Emission Projections: 2007 to 2020

Table A3.6 2010 PM_{2.5} comparison (Emissions in Kilotonnes)

	Historic data			% difference between historic database	Projected data		
	2006 (2006 NAEI)	2006 (2007 NAEI)	2007 (2007 NAEI)		2010 (UEP30)	2010 (UEP 32)	2010 (UEP37)
	2006 NAEI	2007 NAEI			2006 NAEI	2007 NAEI	
1A1a	6.02	6.09	5.23	-1%		3.72	3.61
1A1b	0.79	0.79	0.72	1%		0.74	0.63
1A1c	0.32	0.32	0.30	0%		0.33	0.26
1A2a	2.17	0.99	1.41	118%		2.22	0.94
1A2f	10.53	9.92	9.17	6%		8.27	8.08
1A3ai(i)	Memo Item	0.03	0.03			0.03	0.03
1A3aii(i)	0.01	0.01	0.01	-9%		0.01	0.01
1A3bi	5.40	5.47	5.32	-1%		5.21	5.05
1A3bii	9.20	4.15	3.97	122%		5.96	2.93
1A3biii	0.63	4.70	4.18	-87%		3.02	2.41
1A3biv	0.45	0.12	0.11	287%		0.61	0.06
1A3bvi	5.20	5.21	5.29	0%		5.53	5.26
1A3c	0.63	0.63	0.64	0%		0.48	0.46
1A3dii	7.82	7.82	7.45	0%		2.95	6.71
1A3eii	0.43	0.43	0.40	-1%		0.34	0.31
1A4a	0.57	0.53	0.46	7%		0.39	0.50
1A4bi	12.67	9.21	10.19	38%		9.49	8.81
1A4bii	0.02	0.02	0.02	0%		0.02	0.02
1A4ci	1.28	1.28	1.28	0%		0.02	0.02
1A4cii	3.52	3.52	2.97	0%	not included in UEP32	1.78	2.26
1A5b	0.79	0.79	0.77	0%		0.77	0.77
1B1b	0.12	0.12	0.10	0%		0.10	0.09
1B2c	1.05	1.07	1.16	-2%		0.78	1.06
2A1	0.07	0.07	0.08	-9%		0.08	0.06
2A4	0.00	0.00	0.00	0%		0.00	0.00
2A7	5.96	5.97	6.25	0%		5.58	4.26
2B5	0.56	0.57	0.45	-3%		0.47	0.31
2C	3.28	2.89	3.42	14%		3.46	2.98
2D1	0.97	0.97	0.66	0%		0.66	0.56
3A	1.81	1.90	1.89	-5%		1.97	1.91
3C	0.05	0.06	0.05	-3%		0.06	0.04
4B1	0.12	0.12	0.12	0%		0.12	0.12
4B8	0.22	0.22	0.22	0%		0.22	0.22
4B9	1.67	1.67	1.62	0%		1.62	1.62
4D1	0.16	0.15	0.13	6%		0.13	0.13
4F	0.00	0.00	0.00			0.00	0.00
6C	4.42	4.42	4.42	0%		4.42	4.42
6D	1.00	0.98	0.98	2%		0.98	0.98
7	0.65	0.65	0.65	0%		1.66	0.65
Total	90.58	83.87	82.09	8%		74.21	68.52