

National Atmospheric Emissions Inventory (NAEI)

UK Emission Mapping Methodology

Introduction

The NAEI annual report gives the estimation pollutant emissions over a time series for 25 pollutants going as far back as 1970 including carbon dioxide, methane and nitrous oxide as greenhouse gases (GHGs). Other GHGs not included in the inventory are HFCs, PFCs and SF₆.

The methodology used in compiling the inventory has and is being improved over time; for an overview of the methods used to compile the annual inventory see:

http://www.airquality.co.uk/reports/cat07/0812151643_NAEIMappingMethodReport2006.pdf

A summary of the methodology for producing 1x1 km resolution emissions maps under the NAEI system is presented below. The maps can be downloaded from:

http://www.naei.org.uk/data_warehouse.php

For large industrial 'point' sources, emissions are compiled from a variety of official UK sources (Environment Agency, Scottish Environmental Protection Agency, Local Authority data). For sources that are distributed more widely across the UK (known as 'area' sources), a distribution map is generated using appropriate surrogate statistics for that sector. The method used for each source sector varies according to the data available.

1. Large Point Source Emissions

Emission estimates from large point sources are obtained from returns under:

- The EU ETS Scheme
- The Large Combustion Plant Directive; and
- IPPC and APC Pollution inventories

It is unlikely that there are any of these sources in the Chew Valley area.

2. Industrial and Commercial Sectors

The industrial sectors in the NAEI are mapped using a combination of the above point source estimates of emissions and area source employment based distributions. The following data sets are used:

- The Office of National Statistics Inter-Departmental Business Register (IDBR) 2007 which provides data on employment at business unit level by Standard Industrial Classification (SIC) code; and
- BERR Energy Consumption in the UK data on industrial and commercial sector fuel usage for 2005.

Sites of employment corresponding to the locations of the highest emissions (as defined by the NAEI point source database in 1. above) have been removed from the distributions to prevent double counting of emissions at these locations.

3. Road Transport

Emissions and the related fuel consumption are calculated within the NAEI using fuel consumption and emission factors for each vehicle type. These are calculated on the basis of the composition of the vehicle fleet (age profile and fuel mix) from the DVLA's national licensing data with the assumption that the fleet mix is the same everywhere on the UK road network. There are currently no regional variations in either the age of the fleet or the fuel mix.

For pollutants such as CO₂, fuel consumption is used to determine emissions in conjunction with speed related fuel consumption factors and estimates of vehicle flow. Traffic flow data for major roads (A roads and motorways) are available on a census count point basis; for minor B and C roads or unclassified roads, regional average flows by vehicle type have been applied (see Table 1). It has been assumed that there are no regional variations in either the age of the fleet or the fuel mix, that 100% of motorcycles are fuelled by petrol and 100% of heavy goods vehicles and buses run on diesel.

Table 1 UK fuel split by vehicle type on minor roads 2006

Vehicle	Fuel type	% of fleet
Cars	Diesel	19.3
Cars	Petrol	80.7
LGVs	Diesel	90.6
LGVs	Petrol	9.4

4. Domestic Fuel Use

The NAEI's approach to modelling domestic fuel use draws on modelling of domestic fuel use within Great Britain for the 2004 Local and Regional CO₂ Emission Estimates. DTI provide high resolution maps of domestic gas use across Great Britain. This dataset characterises the number of gas customers and amounts of gas used per 1km square for 2005, and data on electricity use, specifically type 2 meters (economy 7 type meters).

In addition, data supplied by BRE on behalf of Defra for this work, provided estimates of total energy use by dwelling type and by fuel type and also regional data on the numbers of households using different fuels.

4.1 Domestic House and Garden Machinery

The emissions in the NAEI from domestic house and garden machinery are distributed across the UK using the population density map derived from 2001 Census data.

5. Agriculture

The distributions of methane and N₂O emissions from agricultural sources have been mapped at a 5km resolution by the Centre for Ecology and Hydrology (CEH). Data from the Agricultural Census for

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England, Scotland, Wales and Northern Ireland were combined with emission factors for livestock and fertilizer use and CEH Land Cover Map 2000 data within the AENEID model to calculate emissions maps.

Emissions from agricultural off-road machinery and vehicle are distributed using a combination of arable, pasture and forestry land use data. Incineration of animal carcasses is mapped partly as a point source but mainly across all UK arable land because the location of this source is very uncertain. Land Cover Map 2000 data from CEH is used to map CO₂ emissions from agricultural soils. Agricultural stationary combustion is mapped using IDBR employment data for the agricultural sector.

It is not clear from the data provided whether CO₂ removal by vegetation is included in the NAEI.

6. Aircraft

The NAEI includes national total aircraft emissions occurring below 1000m from the ground during take off and landing. These are calculated from the number of aircraft movements at UK airports on an individual airport basis according to the mix of aircraft types and modelled take off and landing emissions at each airport. For the smaller airports, emissions are distributed across the land area covered by the airport. Emission estimates from airport support vehicles are distributed over the physical airport area based on aircraft arrival statistics for each airport.

Aircraft cruising emissions are not included in the maps because these cannot be assigned to grid squares on the ground.

Use of NAEI by Target 80

The NAEI will enable us to establish baseline estimated tonnes CO₂ emissions on 1 x 1 km grids throughout the project area for 2006. The other green house gas (GHGs) methane and nitrous oxide are only reported as national or sector emissions e.g. from industry, thus data is not available on CO₂ emissions from this source on Bristol Airport.

Emission sources are grouped as follows:

indelec:	Industrial and commercial electricity emissions (including agriculture)
indgas:	Industrial and commercial gas emissions (including agriculture but not including point sources)
indother:	Other industrial and commercial emissions (solid fuels, oils, process gases and non fuel emissions)
indoffrd:	Industrial offroad machinery emissions
agriculture:	Agricultural emissions including stationary combustion (but not electricity or gas), off road machinery and emissions from the breakdown of pesticides
railways:	Emissions from diesel railways
domelec:	Domestic electricity emissions
domgas:	Domestic gas emissions

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domoilsol: Domestic oil and solid fuel emissions

domother: Domestic other emissions (house and garden machinery, household products)

rt: Road transport emissions (petrol, diesel, other)

Bishop Sutton is mainly located within the grid 358500 159500 whereas Denny Island is within the grid 357500 160500 (see Figure 1).

Figure 1 Grid location of Bishop Sutton and Denny Island



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Annual CO₂ emissions for these grids are estimated by NAEI as shown in Table 2

Table 2 Annual CO₂ emissions for Bishop Sutton and Denny Island

Parameter	Bishop Sutton	Denny Island
X	358500	357500
Y	159500	160500
indelec	535	0
indgas	64.6	0
indother	7.1	0
indoffrd	16.4	0
agriculture	32.9	2.13
railways	0	0
domelec	764	110
domgas	954	0
domoilsol	0	156
domother	18	2.67
rt	678	10.3
Total	3070	281.1

It is evident that the NAEI estimates for the Denny Island grid overestimate emissions for domestic electricity and domestic oil and solid fuel emissions and raise some doubts as to the accuracy of the data. Nevertheless, the NAEI estimates provide a relatively easily accessible and comprehensive source of CO₂ emissions for the project area that will enable us to:

- Benchmark the project area with other areas e.g. Bath, Weston, Wells, Exmoor;
- Validate the NAEI estimates against local data;
- Provide detailed statistics e.g. CO₂ emissions for villages within the project area;
- Identify major sources of CO₂ within the project area to assist in determining priorities e.g. buildings and transport;
- Assess the likely percentage reduction in CO₂ emissions through local initiatives; and
- Monitor progress in reducing CO₂ emissions.