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Appendix 1 –Glossary of abbreviations

APEG	Airborne Particles Expert Group
BOF	Basic oxygen furnace
Btu	British Thermal Unit
$CaCO_3$, CaO	Calcium carbonate, calcium oxide
CCGT	Combined Cycle Gas Turbine
CH	Central (GDP growth) High (energy price) energy scenario
CH_4	Methane
CKD	Cement kiln dust
CNG	Compressed natural gas
CO	Carbon monoxide
CO_2	Carbon dioxide
COMEAP	The Department of Health's Committee on the Medical Effects of Air Pollutants
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DTI	Department of Trade and Industry
DTLR	Department for Transport, Local Government and the Regions
EA	Environment Agency
EAF	Electric arc furnace
EC	European Commission
EIPPCB	The European IPPC Bureau in Seville, Spain
EMEP	The UNECE's Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EP68	Energy Paper 68 from the Department of Trade and Industry
EPA90	1990 Environmental Protection Act
EPAQS	Expert Panel on Air Quality Standards
ESI	Electricity Supply Industry
ESP	Electrostatic precipitator
EST	Energy Savings Trust
FCCU	Fluid catalytic cracking unit
FGD	Flue gas desulphurisation
GW	GigaWatt (10^9 Watts)
HARM	Hull Acid Rain Model
HDV	Heavy delivery vehicle
HGV	Heavy goods vehicle
HMIP	Her Majesty's Inspectorate of Pollution
hr	Hour
IGCB	Interdepartmental Group on Costs and Benefits
IIASA	International Institute for Applied Systems Analysis
IPC	Integrated Pollution Control
IPPC	Integrated Pollution Prevention and Control
kt	Kilotonne (000 tonnes)
kWh	KiloWatt hour
LDV	Light delivery vehicle
LPG	Liquefied petroleum gas
m^3	Cubic metre
MAFF	Ministry of Agriculture, Fisheries and Food

mg	Milligramme (10^{-3} grammes)
mm	Millimetres
mmBtu	Million Btu
Mt	Million tonnes
MW	MegaWatt (10^6 Watts) suffix '$_{th}$' denotes thermal input, suffix '$_e$' denotes electrical output
N_2O	Nitrous oxide
NAEI	National Atmospheric Emissions Inventory
NAQS	National Air Quality Strategy
NH_3	Ammonia
Nm^3	Cubic metre of gas at normal temperature and pressure
NO_2	Nitrogen dioxide
NO_X	The sum of nitric oxide and nitrogen dioxide
PAHs	Polycyclic aromatic hydrocarbons
PI	The Environment Agency's Pollution Inventory
$PM_{0.1}$	Particulate matter with a diameter of less than 0.1 micrometers
PM_1	Particulate matter with a diameter of less than 1 micrometer
$PM_{2.5}$	Particulate matter with a diameter of less than 2.5 micrometers
PM_{10}	Particulate matter with a diameter of less than 10 micrometers
ppm	Parts per million
SEPA	Scottish Environmental Protection Agency
SO_2	Sulphur dioxide
SSF	Smokeless sold fuel
STP	Standard Temperature and Pressure
t	Tonne
TEOM	Tapered Element Oscillating Microbalance
Therm	100,000 Btu
TOL	Take off and landing
TSP	Total suspended particulate
UNECE	United Nations Economic Commission for Europe
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
$\mu g/m^3$	Microgrammes (10^{-6} grammes) per cubic meter

Appendix 2– Emission factors

The following table of emission factors is taken from the NAEI (1999). All units are in g/kg for solid & liquid fuel combustion and kg/therm for gaseous fuel combustion.

Source	Fuel	Factor
Agriculture	Burning Oil	0.014
Agriculture	Coal	2.5
Agriculture	Coke	0.2875
Agriculture	Fuel Oil	1.032
Agriculture	Gas Oil	0.25
Agriculture	Natural Gas	0.000604
Agriculture	Straw	11
Agriculture	Vap Oil	1.43
Agriculture Power Units	Gas Oil	1.07
Agriculture Power Units	Petrol	1.006
Aircraft Support	Gas Oil	1.07
Aircraft TOL	Aviation Turbine Fuel	0.204
In-house Electricity Generation	Coal	2.5
In-house Electricity Generation	Natural Gas	0.000108
Cement Production	Non-Fuel Combustion	0.23559
Cement and Concrete Batching	Non Fuel Processes	0.0128
Coastal	Fuel Oil	1.032
Coastal	Gas Oil	1.07
Coke Production	Bf Gas	0.0001
Coke Production	Coke-Oven Gas	0.000135
Coke Production	Coke Made	0.06291
Coke Production	Colliery CH_4	0.000108
Coke Production	Natural Gas	0.000108
Collieries	Coal	2.5
Collieries	Coke-Oven Gas	0.000755
Collieries	Colliery Ch4	0.000604
Collieries	Natural Gas	0.000604
Construction	Construction Value 1990	7.96e-05
Domestic	Anthracite	3.59375
Domestic	Burning Oil	0.014
Domestic	Burning Oil (P)	0.014
Domestic	Coal	10.4
Domestic	Coke	0.2875
Domestic	Fuel Oil	1.032
Domestic	Gas Oil	0.25
Domestic	Lpg	0.000393
Domestic	Natural Gas	0.000482
Domestic	Ssf	5.6
Domestic	Town Gas	0.000602
Domestic House & Garden	Derv	1.21
Domestic House & Garden	Petrol	1.006
Field Burning	Barley Residue	0.1325
Field Burning	Linseed Residue	0.1325
Field Burning	Oats Residue	0.1325
Field Burning	Wheat Residue	0.1325
Fishing	Fuel Oil	1.032
Fishing	Gas Oil	1.07
Gas Production	Colliery Ch4	0.000108

Source	Fuel	Factor
Gas Production	Lpg	0.000295
Gas Production	Natural Gas	0.000108
Gas Production	Opg	0.000295
Gas Production	Town Gas	0.000135
Incineration	Msw	0.027
Incineration	Sewage Sludge Combustion	0.075
Iron And Steel (Basic Oxygen Furnace)	Non-Fuel Combustion	0.030675
Iron And Steel (Blast Furnaces)	Bf Gas	0.0001
Iron And Steel (Blast Furnaces)	Coke-Oven Gas	0.000135
Iron And Steel (Blast Furnaces)	Natural Gas	0.000108
Iron And Steel (Blast Furnaces)	Non-Fuel Combustion	0.19533
Iron And Steel (Combustion)	Bf Gas	0.0001
Iron And Steel (Combustion)	Coal	2.5
Iron And Steel (Combustion)	Coke-Oven Gas	0.000135
Iron And Steel (Combustion)	Fuel Oil	1.032
Iron And Steel (Combustion)	Gas Oil	0.25
Iron And Steel (Combustion)	Lpg	0.000295
Iron And Steel (Combustion)	Natural Gas	0.000108
Iron And Steel (Combustion)	Town Gas	0.000135
Iron And Steel (Electric Arc Furnace)	Non-Fuel Combustion	0.114
Iron And Steel (Flaring)	Bf Gas	0.0001
Iron And Steel (Flaring)	Coke-Oven Gas	0.000135
Iron And Steel (Sinter Plant)	Iron Production	0.1975
Lime Production (Combustion)	Limestone	0.297554
Non-Ferrous Metals (Aluminium Production (General))	Non-Fuel Combustion	2.66
Non-Ferrous Metals (Copper Refining)	Virgin Copper Produced	1.021667
Non-Ferrous Metals (Other Non Ferrous Metals)	Non Fuel Processes	0.229143
Non-Ferrous Metals (Primary Lead Zinc)	Slab Zinc And Lead Bullion Produced	0.0008
Offshore Flaring	Non-Fuel Combustion	0.000604
Offshore Own Gas Use	Natural Gas	0.001901
Other Industry (Asphalt Manufacture)	Asphalt Produced	0.03
Other Industry (Combustion)	Burning Oil	0.014
Other Industry (Combustion)	Coal	2.5
Other Industry (Combustion)	Coke	0.2875
Other Industry (Combustion)	Coke-Oven Gas	0.000135
Other Industry (Combustion)	Colliery Ch4	0.000108
Other Industry (Combustion)	Fuel Oil	1.032
Other Industry (Combustion)	Gas Oil	0.25
Other Industry (Combustion)	Lpg	0.000295
Other Industry (Combustion)	Lubricants	0.25
Other Industry (Combustion)	Natural Gas	0.000108
Other Industry (Combustion)	Opg	0.000295
Other Industry (Combustion)	Ssf	0.23
Other Industry (Combustion)	Town Gas	0.000755
Other Industry (Large Processes)	Non Fuel Processes	1.353986
Other Industry (Small Processes)	Non Fuel Processes	3.438221
Other Industry Offroad	Gas Oil	1.07
Other Industry Offroad	Petrol	1.006
Other Nonindustrial	Fuel Oil	1.032
Other Nonindustrial	Gas Oil	0.25
Other UK Shipping	Fuel Oil	1.032
Other UK Shipping	Gas Oil	1.07
Power Stations	Coal	0.495782
Power Stations	Coke	0.2875

Source	Fuel	Factor
Power Stations	Fuel Oil	0.310685
Power Stations	Gas Oil	0.25
Power Stations	Lpg	0.000295
Power Stations	Msw	0.027
Power Stations	Non-Fuel Landfill Gas	0.000109
Power Stations	Non-Fuel Sewage Gas	0.000109
Power Stations	Opg	0.000295
Power Stations	Orimulsion	0.582418
Power Stations	Slurry	0.074276
Power Stations	Town Gas	0.000135
Public Services	Burning Oil	0.014
Public Services	Coal	2.5
Public Services	Coke	0.2875
Public Services	Natural Gas	0.000514
Public Services	Non-Fuel Sewage Gas	0.000612
Public Services	Town Gas	0.000755
Quarrying	Total Aggregate	0.1
Refineries (Combustion)	Fuel Oil	1.032
Refineries (Combustion)	Gas Oil	1.07
Refineries (Combustion)	Lpg	0.000295
Refineries (Combustion)	Misc	1.07
Refineries (Combustion)	Naphtha	1.07
Refineries (Combustion)	Natural Gas	0.000108
Refineries (Combustion)	Opg	0.000295
Refineries (Combustion)	Petrol	0.204
Refineries (Combustion)	Petroleum Coke	0.462892
Shipping Naval	Gas Oil	1.07
SSF Production	Coke	0.2875
SSF Production	Natural Gas	0.000108
SSF Production	Ssf Made	0.20995

Appendix 3 - Derivation of an emission estimate for PM_{10} from livestock

A report by TNO (Berdowski *et al*., 1997) gives emission factors for livestock, based on measurements of emissions from extract ducts on livestock sheds.

The emission factors are:

Pigs: 2.2 kg PM_{10} per year per animal.

Poultry: 0.086 kg PM_{10} per year per animal.

A report by MAFF (1999) gives the pig and poultry population of England and Wales in June 1998 as follows:

Sows for breeding	631,370
Boars for service	34,333
Gilts not yet in pig	85,849
Sows for fattening	7,857
All other pigs	6,021,929
Total Pigs	**6,781,338**

Total Fowls	**120,208,104**

Multiplying the emission factors by the respective livestock populations gives the following emission estimates:

Pigs	14.92 kt/yr
Fowls	10.34 kt/yr
Pigs plus fowls	**25.26 kt/yr**

Appendix 4
NAEI emissions of PM_{10} in the 1990s

											1998	% of PM_{10} which is:		
SOURCECODE	**FUELCODE**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**% of Total PM_{10}**	**$PM_{2.5}$**	**PM_{1}**	**$PM_{0.1}$**
POWER_STATIONS	COAL	68.7	68.2	64.1	53.3	47.2	35.9	33.0	22.2	23.1	14%	44%	19%	8%
POWER_STATIONS	COKE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
POWER_STATIONS	FUEL_OIL	1.3	1.1	0.8	0.7	0.5	0.3	0.4	0.1	0.2	0%	73%	56%	10%
POWER_STATIONS	GAS_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	43%	18%	15%
POWER_STATIONS	LPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
POWER_STATIONS	MSW	0.8	0.8	1.2	1.2	2.1	0.4	0.3	0.1	0.1	0%	82%	73%	15%
POWER_STATIONS	NON-FUEL_LANDFILL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
POWER_STATIONS	NON-FUEL_SEWAGE_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
POWER_STATIONS	OPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
POWER_STATIONS	ORIMULSION	0.1	0.2	0.6	0.6	0.6	0.6	0.5	0.1	0.0	0%	37%	23%	6%
POWER_STATIONS	SLURRY					0.2	0.2	0.2	0.1	0.0	0%	44%	19%	8%
Refineries_(Combustion)	FUEL_OIL	2.1	2.3	2.3	2.4	2.5	2.4	2.4	2.4	2.5	2%	65%	42%	15%
Refineries_(Combustion)	GAS_OIL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0%	25%	17%	15%
Refineries_(Combustion)	LPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
Refineries_(Combustion)	MISC	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0%	57%	29%	15%
Refineries_(Combustion)	NAPHTHA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	57%	29%	15%
Refineries_(Combustion)	NATURAL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
Refineries_(Combustion)	OPG	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.4	0%	100%	100%	50%
Refineries_(Combustion)	PETROL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
Refineries_(Combustion)	PETROLEUM_COKE	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.6	0%	26%	4%	2%
COKE_PRODUCTION	BF_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
COKE_PRODUCTION	COKE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
COKE_PRODUCTION	COKE-OVEN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
COKE_PRODUCTION	COLLIERY_CH4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
COKE_PRODUCTION	NATURAL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
COLLIERIES	COAL	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0%	38%	32%	8%
COLLIERIES	COKE-OVEN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
COLLIERIES	COLLIERY_CH4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
COLLIERIES	NATURAL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%

											1998	% of PM_{10} which is:		
SOURCECODE	**FUELCODE**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**% of Total PM_{10}**	**$PM_{2.5}$**	**PM_{1}**	**$PM_{0.1}$**
GAS_PRODUCTION	COLLIERY_CH4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
GAS_PRODUCTION	LPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
GAS_PRODUCTION	NATURAL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
GAS_PRODUCTION	OPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
GAS_PRODUCTION	TOWN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
NUCLEAR_FUEL_PROD	NATURAL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
OFFSHORE_OWN_GAS_USE	NATURAL_GAS	2.3	2.3	2.5	2.6	3.1	3.2	3.6	3.8	4.2	3%	100%	100%	50%
SSF_PRODUCTION	COKE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	26%	4%	2%
SSF_PRODUCTION	NATURAL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
TOWN_GAS_PRODUCTION	BURNING_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
TOWN_GAS_PRODUCTION	COAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
TOWN_GAS_PRODUCTION	COKE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
TOWN_GAS_PRODUCTION	COKE-OVEN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
TOWN_GAS_PRODUCTION	LPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
TOWN_GAS_PRODUCTION	NATURAL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
DOMESTIC	ANTHRACITE	4.3	5.9	4.7	6.9	7.2	5.2	4.9	4.6	3.0	2%	26%	4%	2%
DOMESTIC	BURNING_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0%	76%	67%	10%
DOMESTIC	BURNING_OIL_(P)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	76%	67%	10%
DOMESTIC	COAL	31.7	32.8	29.7	28.2	19.9	12.9	13.9	13.6	13.9	9%	38%	32%	2%
DOMESTIC	COKE	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0%	26%	4%	2%
DOMESTIC	FUEL_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	37%	23%	15%
DOMESTIC	GAS_OIL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0%	94%	85%	10%
DOMESTIC	LPG	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	100%	100%	10%
DOMESTIC	NATURAL_GAS	4.9	5.5	5.4	5.6	5.4	5.4	6.2	5.7	5.9	4%	100%	100%	10%
DOMESTIC	SSF	6.4	6.6	6.0	6.3	5.1	4.0	4.6	3.8	3.4	2%	26%	4%	2%
DOMESTIC	TOWN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	10%
AGRICULTURE	BURNING_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	75%	67%	8%
AGRICULTURE	COAL	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	71%	29%	8%
AGRICULTURE	COKE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
AGRICULTURE	FUEL_OIL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	37%	23%	15%
AGRICULTURE	GAS_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	77%	69%	15%

											1998	% of PM_{10} which is:		
SOURCECODE	**FUELCODE**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**% of Total PM_{10}**	**$PM_{2.5}$**	**PM_{1}**	**$PM_{0.1}$**
AGRICULTURE	NATURAL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
AGRICULTURE	STRAW	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	1%	57%	29%	15%
AGRICULTURE	VAP_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
MISCELLANEOUS	COAL	0.8	0.7	0.5	0.5	0.5	0.4	0.4	0.5	0.2	0%	38%	32%	8%
MISCELLANEOUS	COKE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
MISCELLANEOUS	NATURAL_GAS	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0%	100%	100%	50%
MISCELLANEOUS	NON-FUEL_LANDFILL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
MISCELLANEOUS	SSF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
MISCELLANEOUS	TOWN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
OTHER_NONINDUSTRIAL	FUEL_OIL	0.9	0.9	1.0	1.0	1.0	0.9	0.8	0.6	0.5	0%	37%	23%	15%
OTHER_NONINDUSTRIAL	GAS_OIL	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0%	77%	69%	15%
PUBLIC_SERVICES	BURNING_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	75%	67%	8%
PUBLIC_SERVICES	COAL	2.2	2.1	1.9	1.5	1.3	0.9	1.0	1.1	0.8	0%	38%	32%	8%
PUBLIC_SERVICES	COKE	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	26%	4%	2%
PUBLIC_SERVICES	NATURAL_GAS	0.6	0.7	0.8	0.7	0.7	0.8	0.9	0.9	0.9	1%	100%	100%	50%
PUBLIC_SERVICES	NON-FUEL_SEWAGE_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
PUBLIC_SERVICES	TOWN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
Railways_(Stationary_sources)	BURNING_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	75%	67%	8%
Railways_(Stationary_sources)	COAL	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
Railways_(Stationary_sources)	COKE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
Railways_(Stationary_sources)	FUEL_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
Iron_and_Steel_(Combustion)	BF_GAS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0%	100%	100%	50%
Iron_and_Steel_(Combustion)	COAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	52%	10%	8%
Iron_and_Steel_(Combustion)	COKE-OVEN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
Iron_and_Steel_(Combustion)	FUEL_OIL	0.6	0.7	0.6	0.8	0.8	0.8	0.6	0.6	0.4	0%	65%	42%	15%
Iron_and_Steel_(Combustion)	GAS_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	77%	69%	15%
Iron_and_Steel_(Combustion)	LPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
Iron_and_Steel_(Combustion)	NATURAL_GAS	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	100%	100%	50%
Iron_and_Steel_(Combustion)	TOWN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
AUTOGENERATORS	COAL	3.6	3.8	3.7	5.0	4.4	4.1	3.7	4.3	4.1	3%	52%	10%	8%
AUTOGENERATORS	NATURAL_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0%	100%	100%	48%

											1998	% of PM_{10} which is:		
SOURCECODE	**FUELCODE**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**% of Total PM_{10}**	**$PM_{2.5}$**	**PM_{1}**	**$PM_{0.1}$**
Cement_(Non-decarbonising)	NON-FUEL_COMBUSTION	4.1	3.4	3.1	3.1	3.6	3.5	3.6	3.8	2.9	2%	54%	22%	10%
Iron_and_Steel_(Sinter_Plant)	Iron_Production	2.5	2.4	2.3	2.3	2.4	2.4	2.5	2.6	2.5	2%	75%	50%	34%
LIME_PRODUCTION_(Combustion)	LIMESTONE	0.8	0.7	0.7	0.7	0.7	0.8	1.6	1.2	1.1	1%	54%	22%	10%
Other_industry_(Combustion)	BURNING_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	76%	67%	15%
Other_industry_(Combustion)	COAL	9.2	10.7	12.7	10.2	9.4	8.3	6.3	4.6	2.8	2%	71%	29%	8%
Other_industry_(Combustion)	COKE	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0%	26%	4%	2%
Other_industry_(Combustion)	COKE-OVEN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
Other_industry_(Combustion)	COLLIERY_CH4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	49%
Other_industry_(Combustion)	FUEL_OIL	3.9	4.3	4.3	4.1	3.7	2.6	2.2	1.5	1.3	1%	65%	42%	15%
Other_industry_(Combustion)	GAS_OIL	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0%	25%	17%	15%
Other_industry_(Combustion)	LPG	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	100%	100%	50%
Other_industry_(Combustion)	LUBRICANTS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	65%	42%	15%
Other_industry_(Combustion)	NATURAL_GAS	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0%	100%	100%	50%
Other_industry_(Combustion)	OPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
Other_industry_(Combustion)	SSF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	26%	4%	2%
Other_industry_(Combustion)	TOWN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
BASIC_OXYGEN_FURNACE	NON-FUEL_COMBUSTION	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0%	50%	20%	3%
COKE_PRODUCTION	COKE_MADE	1.2	1.1	1.0	1.0	1.0	1.0	1.0	1.0	0.4	0%	26%	4%	2%
Iron_and_Steel_(Blast_Furnaces)	NON-FUEL_COMBUSTION	2.4	2.4	2.3	2.3	2.3	2.4	2.5	2.5	2.5	2%	50%	20%	5%
Iron_and_Steel_(Electric_arc_Furnace)	NON-FUEL_COMBUSTION	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0%	57%	23%	3%
Iron_and_Steel_(Flaring)	BF_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
Iron_and_Steel_(Flaring)	COKE-OVEN_GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	50%
Other_Industry_(Asphalt_manufacture)	Asphalt_produced	0.8	0.8	0.8	0.8	0.9	0.9	0.8	0.7	0.7	0%	100%	100%	15%
Other_Industry_(Large_Processes)	NON_FUEL_PROCESSES	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	1.4	1%	100%	100%	15%
Other_Industry_(Small_Processes)	NON_FUEL_PROCESSES	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	3.4	2%	100%	100%	15%
SSF_PRODUCTION	SSF_MADE	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0%	26%	4%	2%
QUARRYING	TOTAL_AGGREGATE	27.8	24.6	23.3	23.9	25.9	24.0	21.5	21.8	23.3	14%	29%	8%	0%
CONSTRUCTION	CONSTRUCTION_VALUE_1990	4.4	3.8	3.4	3.3	3.5	3.6	3.6	3.7	3.8	2%	31%	11%	0%

											1998	% of PM_{10} which is:		
SOURCECODE	**FUELCODE**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**% of Total PM_{10}**	**$PM_{2.5}$**	**PM_{1}**	**$PM_{0.1}$**
ROAD_TRANSPORT	DERV	46.3	47.0	45.7	44.8	44.3	41.4	38.2	33.2	26.3	16%	90%	85%	50%
ROAD_TRANSPORT	PETROL	17.5	16.4	15.2	13.9	12.9	11.8	10.9	10.0	8.9	5%	90%	85%	50%
ROAD_TRANSPORT	BRAKE_WEAR	3.6	3.6	3.6	3.7	3.8	3.9	4.0	4.1	4.1	3%	40%	10%	8%
ROAD_TRANSPORT	TYRE_WEAR	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0%	71%	10%	8%
AGRICULTURE_POWER_UNITS	GAS_OIL	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0%	77%	69%	15%
AGRICULTURE_POWER_UNITS	PETROL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	93%	84%	25%
AIRCRAFT_SUPPORT	GAS_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	94%	85%	15%
DOMESTIC_HOUSE&GARDEN	DERV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	94%	85%	50%
DOMESTIC_HOUSE&GARDEN	PETROL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	94%	85%	25%
OTHER_INDUSTRY_OFFROAD	GAS_OIL	1.2	1.3	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1%	77%	69%	15%
OTHER_INDUSTRY_OFFROAD	PETROL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	94%	85%	25%
SHIPPING_NAVAL	GAS_OIL	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0%	94%	85%	15%
Railways_(Freight)	GAS_OIL	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0%	94%	85%	15%
Railways_(intercity)	GAS_OIL	0.7	0.7	0.5	0.5	0.6	0.6	0.7	0.7	0.6	0%	94%	85%	15%
Railways_(Regional)	GAS_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	94%	85%	15%
COASTAL	FUEL_OIL	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0%	94%	85%	15%
COASTAL	GAS_OIL	1.1	1.1	1.1	1.0	0.9	0.8	1.0	1.0	0.9	1%	94%	85%	15%
FISHING	FUEL_OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
FISHING	GAS_OIL	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	94%	85%	15%
Aircraft_TOL_(Domestic)	AVIATION_TURBINE_FUEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	76%	67%	15%
Aircraft_TOL_(international)	AVIATION_TURBINE_FUEL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0%	76%	67%	15%
INCINERATION	MSW	3.8	3.8	3.4	3.3	2.5	0.5	0.3	0.0	0.0	0%	82%	73%	15%

SOURCECODE	FUELCODE	1990	1991	1992	1993	1994	1995	1996	1997	1998	1998 % of Total PM_{10}	% of PM_{10} which is: $PM_{2.5}$	PM_1	$PM_{0.1}$
INCINERATION	Sewage_Sludge_Combustion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	100%	100%	14%
OFFSHORE_FLARING	NON-FUEL_COMBUSTION	1.7	1.5	1.5	1.5	2.0	1.4	1.5	1.3	1.3	1%	100%	100%	15%
FIELD_BURNING	BARLEY_RESIDUE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
FIELD_BURNING	LINSEED_RESIDUE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
FIELD_BURNING	OATS_RESIDUE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%			
FIELD_BURNING	WHEAT_RESIDUE	0.5	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0%			
TOTALS		**290**	**290**	**277**	**264**	**249**	**215**	**207**	**184**	**162**	**100%**	**64%**	**49%**	**19%**

Appendix 5 - Ranked emissions of PM_{10} in 1998

Source	Emission (kt/y)	Cumulative emission (kt/y)	%	Typical stack height and likely contribution to ambient concentrations of primary particles
ROAD_TRANSPORT Total	39.90	39.90	24.7%	0m. Large in all urban areas
DOMESTIC Total	26.38	66.28	41.0%	7.5m. Large in some urban areas with significant solid fuel use
POWER_STATIONS Total	23.45	89.73	55.5%	70m. Small. Maximum impact between 5 and 10 km from power station stacks
QUARRYING Total	23.30	113.03	69.9%	0m. Large but only close to quarries, mostly coarse particles
Iron and Steel Industry (incl Coke Production) Total	6.87	119.89	74.2%	25m. Potentially large but only close to plant
Other_industry_(Combustion) Total	5.33	125.23	77.5%	15m. Potentially large but only close to plant
OFFSHORE_OWN_GAS_USE Total	4.25	129.47	80.1%	0m. None
AUTOGENERATORS Total	4.14	133.61	82.7%	50m. Small
CONSTRUCTION Total	3.83	137.44	85.0%	0m. Potentially large but only close to sites, mostly coarse particles
Refineries_(Combustion) Total	3.71	141.14	87.3%	50m. Small
Other_Industry_(Small_Processes) Total	3.44	144.58	89.4%	10m. Potentially large but only close to plant
Cement_(Non-decarbonising) Total	2.86	147.44	91.2%	30m. Potentially large but only close to plant
AGRICULTURE Total	2.38	149.82	92.7%	10m. Small
PUBLIC_SERVICES Total	1.70	151.52	93.7%	10m. Small
Other_Industry_(Large_Processes) Total	1.35	152.87	94.6%	20m. Potentially large but only close to plant
OFFSHORE_FLARING Total	1.27	154.14	95.4%	0m. None
OTHER_INDUSTRY_OFFROAD Total	1.22	155.36	96.1%	0m.
LIME_PRODUCTION_(Combustion) Total	1.09	156.45	96.8%	30m.
COASTAL Total	1.02	157.47	97.4%	0m.
OTHER_NONINDUSTRIAL Total	0.87	158.34	98.0%	10m.
Other_Industry_(Asphalt_manufacture) Total	0.72	159.05	98.4%	5m.
AGRICULTURE_POWER_UNITS Total	0.59	159.65	98.8%	0m.
Railways_(intercity) Total	0.58	160.23	99.1%	0m.
MISCELLANEOUS Total	0.39	160.62	99.4%	0m.
SHIPPING_NAVAL Total	0.31	160.93	99.6%	0m.
FISHING Total	0.14	161.07	99.6%	0m.
SSF_PRODUCTION Total	0.14	161.21	99.7%	30m.
Railways_(Freight) Total	0.13	161.34	99.8%	0m.
Aircraft_TOL_(international) Total	0.11	161.45	99.9%	0m.
Aircraft_TOL_(Domestic) Total	0.05	161.50	99.9%	0m.
DOMESTIC_HOUSE&GARDEN	0.05	161.55	99.9%	0m.

Source	Emission (kt/y)	Cumulative emission (kt/y)	%	Typical stack height and likely contribution to ambient concentrations of primary particles
Total				
COLLIERIES Total	0.03	161.58	100.0%	0m.
GAS_PRODUCTION Total	0.03	161.61	100.0%	0m.
AIRCRAFT_SUPPORT Total	0.02	161.62	100.0%	0m.
Railways_(Regional) Total	0.01	161.63	100.0%	0m.
INCINERATION Total	0.01	161.64	100.0%	70m.
Railways_(Stationary_sources) Total	0.00	161.64	100.0%	0m.
NUCLEAR_FUEL_PROD Total	0.00	161.64	100.0%	0m.
TOTAL	**161.64**			

Appendix 6 - Emission forecasts for PM_{10}

Digest sub sectors	NAEI sourcecode	NAEI FUELCODE	1998	2000	2005	2010	2015	2020
Public Power	POWER_STATIONS	COKE	-	-	-	-	-	-
Public Power	POWER_STATIONS	LPG	-	-	-	-	-	-
Public Power	POWER_STATIONS	OPG	-	-	-	-	-	-
Public Power	POWER_STATIONS	MSW	0.07	0.10	0.33	0.47	0.48	0.48
Public Power	POWER_STATIONS	NON-FUEL_LANDFILL_GAS	0.02	0.01	0.01	0.01	0.01	0.01
Public Power	POWER_STATIONS	NON-FUEL_SEWAGE_GAS	0.01	0.01	0.01	0.01	0.00	0.00
Public Power	POWER_STATIONS	COAL	23.12	9.30	10.66	6.69	4.57	3.87
Public Power	POWER_STATIONS	FUEL_OIL	0.22	0.06	0.04	0.03	0.02	0.02
Public Power	POWER_STATIONS	GAS_OIL	0.01	0.02	0.02	0.03	0.03	0.03
Public Power	POWER_STATIONS	SLURRY	0.012					
Petroleum Refining Plants	Refineries_(Combustion)	FUEL_OIL	2.52	2.33	2.33	2.43	2.61	2.71
Petroleum Refining Plants	Refineries_(Combustion)	GAS_OIL	0.17	0.09	0.09	0.09	0.09	0.09
Petroleum Refining Plants	Refineries_(Combustion)	MISC	-	0.05	0.05	0.06	0.06	0.06
Petroleum Refining Plants	Refineries_(Combustion)	NAPHTHA	0.02	0.02	0.02	0.02	0.02	0.02
Petroleum Refining Plants	Refineries_(Combustion)	NATURAL_GAS	0.01	0.04	0.11	0.11	0.11	0.11
Petroleum Refining Plants	Refineries_(Combustion)	PETROLEUM_COKE	0.55	0.55	0.55	0.55	0.55	0.55
Petroleum Refining Plants	Refineries_(Combustion)	LPG	0.00	0.07	0.09	0.09	0.09	0.10
Petroleum Refining Plants	Refineries_(Combustion)	OPG	0.43	0.46	0.47	0.49	0.51	0.54
Petroleum Refining Plants	Refineries_(Combustion)	PETROL	-	-	-	-	-	-
Other Comb. & Trans.	GAS_PRODUCTION	TOWN_GAS	-	-	-	-	-	-
Other Comb. & Trans.	TOWN_GAS_PRODUCTION	BURNING_OIL	-	-	-	-	-	-
Other Comb. & Trans.	TOWN_GAS_PRODUCTION	COAL	-	-	-	-	-	-
Other Comb. & Trans.	TOWN_GAS_PRODUCTION	COKE	-	-	-	-	-	-
Other Comb. & Trans.	TOWN_GAS_PRODUCTION	COKE-OVEN_GAS	-	-	-	-	-	-
Other Comb. & Trans.	TOWN_GAS_PRODUCTION	LPG	-	-	-	-	-	-
Other Comb. & Trans.	TOWN_GAS_PRODUCTION	NATURAL_GAS	-	-	-	-	-	-
Other Comb. & Trans.	GAS_PRODUCTION	COLLIERY_CH4	-	-	-	-	-	-

Digest sub sectors	NAEI sourcecode	NAEI FUELCODE	1998	2000	2005	2010	2015	2020
Other Comb. & Trans.	OFFSHORE_OWN_GAS_USE	NATURAL_GAS	4.25	3.16	3.50	3.84	4.19	4.56
Other Comb. & Trans.	COKE_PRODUCTION	BF_GAS	0.00	0.00	0.00	0.00	0.00	0.00
Other Comb. & Trans.	COLLIERIES	COAL	0.03	0.02	0.02	0.02	0.02	0.02
Other Comb. & Trans.	COKE_PRODUCTION	COLLIERY_CH4	-	-	-	-	-	-
Other Comb. & Trans.	COKE_PRODUCTION	NATURAL_GAS	0.00	0.00	0.00	0.00	0.00	0.00
Other Comb. & Trans.	COLLIERIES	COLLIERY_CH4	0.01	0.01	0.01	0.01	0.01	0.01
Other Comb. & Trans.	COLLIERIES	NATURAL_GAS	0.00	0.00	0.00	0.00	0.00	0.00
Other Comb. & Trans.	GAS_PRODUCTION	NATURAL_GAS	0.02	0.02	0.02	0.02	0.02	0.02
Other Comb. & Trans.	NUCLEAR_FUEL_PROD	NATURAL_GAS	-	0.00	0.00	0.00	0.00	0.00
Other Comb. & Trans.	COLLIERIES	COKE-OVEN_GAS	-	-	-	-	-	-
Other Comb. & Trans.	GAS_PRODUCTION	LPG	0.01	0.01	0.01	0.01	0.01	0.01
Other Comb. & Trans.	GAS_PRODUCTION	OPG	-	-	-	-	-	-
Other Comb. & Trans.	COKE_PRODUCTION	COKE-OVEN_GAS	0.03	0.02	0.02	0.02	0.02	0.02
Other Comb. & Trans.	SSF_PRODUCTION	COKE	0.01	0.01	0.00	0.00	0.00	0.00
Other Comb. & Trans.	SSF_PRODUCTION	NATURAL_GAS	-	-	-	-	-	-
Residential_Plant	DOMESTIC	TOWN_GAS	0.00	0.00	0.00	0.00	0.00	0.00
Residential_Plant	DOMESTIC	ANTHRACITE	3.04	2.27	1.44	1.01	0.74	0.55
Residential_Plant	DOMESTIC	COAL	13.92	6.74	4.27	3.00	2.19	1.62
Residential_Plant	DOMESTIC	COKE	0.05	0.03	0.02	0.01	0.01	0.01
Residential_Plant	DOMESTIC	SSF	3.38	2.53	1.60	1.13	0.82	0.61
Residential_Plant	DOMESTIC	NATURAL_GAS	5.86	5.79	5.97	6.04	6.17	6.31
Residential_Plant	DOMESTIC	FUEL_OIL	0.00	0.01	0.01	0.01	0.02	0.02
Residential_Plant	DOMESTIC	BURNING_OIL	0.04	0.03	0.03	0.04	0.04	0.04
Residential_Plant	DOMESTIC	BURNING_OIL_(P)	0.00	0.00	0.00	0.00	0.00	0.00
Residential_Plant	DOMESTIC	GAS_OIL	0.05	0.07	0.07	0.08	0.08	0.09
Residential_Plant	DOMESTIC	LPG	0.06	0.08	0.08	0.09	0.09	0.10
Comm., Public & Agri. Comb	MISCELLANEOUS	NON-FUEL_LANDFILL_GAS	0.00	0.00	0.00	0.00	0.00	0.00
Comm., Public & Agri. Comb	MISCELLANEOUS	TOWN_GAS	-	-	-	-	-	-

Digest sub sectors	NAEI sourcecode	NAEI FUELCODE	1998	2000	2005	2010	2015	2020
Comm., Public & Agri. Comb	PUBLIC_SERVICES	NON-FUEL_SEWAGE_GAS	0.01	0.01	0.01	0.01	0.01	0.01
Comm., Public & Agri. Comb	PUBLIC_SERVICES	TOWN_GAS	-	-	-	-	-	-
Comm., Public & Agri. Comb	AGRICULTURE	STRAW	2.21	2.25	2.28	2.32	2.36	2.40
Comm., Public & Agri. Comb	MISCELLANEOUS	COAL	0.15	0.33	0.25	0.22	0.19	0.14
Comm., Public & Agri. Comb	PUBLIC_SERVICES	COAL	0.77	0.79	0.61	0.54	0.46	0.35
Comm., Public & Agri. Comb	Railways_(Stationary_sources)	COAL	-	-	-	-	-	-
Comm., Public & Agri. Comb	MISCELLANEOUS	COKE	-	-	-	-	-	-
Comm., Public & Agri. Comb	PUBLIC_SERVICES	COKE	-	-	-	-	-	-
Comm., Public & Agri. Comb	Railways_(Stationary_sources)	COKE	-	-	-	-	-	-
Comm., Public & Agri. Comb	MISCELLANEOUS	SSF	-	-	-	-	-	-
Comm., Public & Agri. Comb	MISCELLANEOUS	NATURAL_GAS	0.24	0.26	0.28	0.29	0.31	0.33
Comm., Public & Agri. Comb	PUBLIC_SERVICES	NATURAL_GAS	0.92	1.05	1.11	1.16	1.23	1.31
Comm., Public & Agri. Comb	OTHER_NONINDUSTRIAL	FUEL_OIL	0.45	0.68	0.58	0.54	0.49	0.42
Comm., Public & Agri. Comb	Railways_(Stationary_sources)	FUEL_OIL	-	-	-	-	-	-
Comm., Public & Agri. Comb	PUBLIC_SERVICES	BURNING_OIL	0.00	0.00	0.00	0.00	0.00	0.00
Comm., Public & Agri. Comb	Railways_(Stationary_sources)	BURNING_OIL	0.00	0.00	0.00	0.00	0.00	0.00
Comm., Public & Agri. Comb	OTHER_NONINDUSTRIAL	GAS_OIL	0.42	0.41	0.35	0.32	0.29	0.25
Comm., Public & Agri. Comb	AGRICULTURE	COAL	0.02	0.03	0.03	0.03	0.03	0.03
Comm., Public & Agri. Comb	AGRICULTURE	NATURAL_GAS	0.03	0.06	0.08	0.11	0.12	0.12
Comm., Public & Agri. Comb	AGRICULTURE	FUEL_OIL	0.08	0.11	0.09	0.07	0.07	0.07
Comm., Public & Agri. Comb	AGRICULTURE	BURNING_OIL	0.00	0.00	0.00	0.00	0.00	0.00
Comm., Public & Agri. Comb	AGRICULTURE	VAP_OIL	-	-	-	-	-	-
Comm., Public & Agri. Comb	AGRICULTURE	GAS_OIL	0.04	0.03	0.02	0.02	0.02	0.02
Iron_&_Steel Combustion	Iron_and_Steel_(Combustion)	TOWN_GAS	-	-	-	-	-	-
Iron_&_Steel Combustion	Iron_and_Steel_(Blast_Furnaces)	BF_GAS	0.02	0.02	0.02	0.02	0.02	0.02
Iron_&_Steel Combustion	Iron_and_Steel_(Blast_Furnaces)	COKE-OVEN_GAS	0.01	0.00	0.00	0.00	0.00	0.00
Iron_&_Steel Combustion	Iron_and_Steel_(Blast_Furnaces)	NATURAL_GAS	0.00	0.00	0.00	0.00	0.00	0.00
Iron_&_Steel Combustion	Iron_and_Steel_(Combustion)	COAL	0.02	0.39	0.76	1.24	1.61	1.89

Digest sub sectors	NAEI sourcecode	NAEI FUELCODE	1998	2000	2005	2010	2015	2020
Iron_&_Steel Combustion	Iron_and_Steel_(Combustion)	NATURAL_GAS	0.08	0.06	0.07	0.07	0.07	0.08
Iron_&_Steel Combustion	Iron_and_Steel_(Combustion)	COKE-OVEN_GAS	0.03	0.03	0.03	0.03	0.03	0.03
Iron_&_Steel Combustion	Iron_and_Steel_(Combustion)	BF_GAS	0.04	0.05	0.05	0.05	0.05	0.05
Iron_&_Steel Combustion	Iron_and_Steel_(Combustion)	FUEL_OIL	0.37	0.50	0.47	0.43	0.40	0.38
Iron_&_Steel Combustion	Iron_and_Steel_(Combustion)	GAS_OIL	0.04	0.03	0.03	0.03	0.02	0.02
Iron_&_Steel Combustion	Iron_and_Steel_(Combustion)	LPG	0.00	0.00	0.00	0.00	0.00	0.00
Other Comb. in Industry	Non-Ferrous_Metals_ (Copper_Refining)	Virgin_Copper_Produced	0.06	0.06	0.06	0.06	0.06	0.06
Other Comb. in Industry	Other_industry_(Combustion)	TOWN_GAS	-	-	-	-	-	-
Other Comb. in Industry	LIME_PRODUCTION_ (Combustion)	LIMESTONE	1.09	0.85	0.92	1.00	1.08	1.15
Other Comb. in Industry	Non-Ferrous_Metals_(PRIMARY_ LEAD_ZINC)	Slab_zinc_and_lead_bullion_produced	0.12	0.13	0.14	0.14	0.15	0.15
Other Comb. in Industry	Cement_(Non-decarbonising)	NON-FUEL_COMBUSTION	2.86	2.86	2.86	2.86	2.86	2.86
Other Comb. in Industry	Iron_and_Steel_(Sinter_Plant)	Iron_Production	2.52	2.26	2.26	2.27	2.30	2.34
Other Comb. in Industry	Other_industry_(Combustion)	COAL	2.77	1.65	1.40	1.35	1.32	1.31
Other Comb. in Industry	Other_industry_(Combustion)	COKE	0.06	0.06	0.04	0.04	0.04	0.04
Other Comb. in Industry	Other_industry_(Combustion)	SSF	0.01	0.02	0.01	0.01	0.01	0.01
Other Comb. in Industry	Other_industry_(Combustion)	COLLIERY_CH4	0.00	0.00	0.00	0.00	0.00	0.00
Other Comb. in Industry	Other_industry_(Combustion)	NATURAL_GAS	0.55	0.57	0.57	0.57	0.57	0.59
Other Comb. in Industry	Other_industry_(Combustion)	COKE-OVEN_GAS	0.00	0.00	0.00	0.00	0.00	0.00
Other Comb. in Industry	Other_industry_(Combustion)	FUEL_OIL	1.27	1.33	1.27	1.32	1.37	1.40
Other Comb. in Industry	Other_industry_(Combustion)	BURNING_OIL	0.01	0.01	0.01	0.01	0.01	0.01
Other Comb. in Industry	Other_industry_(Combustion)	GAS_OIL	0.46	0.39	0.37	0.38	0.40	0.41
Other Comb. in Industry	Other_industry_(Combustion)	LUBRICANTS	0.08	0.08	0.07	0.08	0.08	0.08
Other Comb. in Industry	Other_industry_(Combustion)	LPG	0.11	0.10	0.09	0.10	0.10	0.10
Other Comb. in Industry	Other_industry_(Combustion)	OPG	0.01	0.01	0.01	0.01	0.01	0.01
Other Comb. in Industry	AUTOGENERATORS	NATURAL_GAS	0.07	0.07	0.10	0.13	0.17	0.19
Other Comb. in Industry	AUTOGENERATORS	COAL	4.07	1.44	0.98	0.91	0.88	0.85

Digest sub sectors	NAEI sourcecode	NAEI FUELCODE	1998	2000	2005	2010	2015	2020
Processes in Industry	Non-Ferrous_Metals_(other_non_ ferrous_metals)	NON_FUEL_PROCESSES	0.23	0.23	0.23	0.23	0.23	0.23
Processes in Industry	Other_Industry_(Asphalt_ manufacture)	Asphalt_produced	0.72	0.72	0.72	0.72	0.72	0.72
Processes in Industry	Iron_and_Steel_(Electric_Arc_ Furnace)	NON-FUEL_COMBUSTION	0.43	0.24	0.25	0.26	0.26	0.27
Processes in Industry	Iron_and_Steel_(Basic_Oxygen_ Furnace)	NON-FUEL_COMBUSTION	0.43	0.38	0.40	0.41	0.42	0.43
Processes in Industry	Non-Ferrous_Metals_ (ALUMINIUM_PRODUCTION_ (General))	NON-FUEL_COMBUSTION	0.69	0.69	0.72	0.76	0.79	0.83
Processes in Industry	Other_Industry_(Large_Processes)	NON_FUEL_PROCESSES	1.35	1.43	1.58	1.73	1.90	2.07
Processes in Industry	Other_Industry_(Small_Processes)	NON_FUEL_PROCESSES	3.44	3.63	4.02	4.38	4.81	5.25
Processes in Industry	Cement_and_Concrete_batching	NON_FUEL_PROCESSES	0.25	0.25	0.28	0.30	0.33	0.36
Processes in Industry	Iron_and_Steel_(Blast_Furnaces)	NON-FUEL_COMBUSTION	2.49	2.34	2.33	2.25	2.18	2.11
Processes in Industry	Iron_and_Steel_(Flaring)	COKE-OVEN_GAS	0.00	0.00	0.00	0.00	0.00	0.00
Processes in Industry	Iron_and_Steel_(Flaring)	BF_GAS	0.01	0.01	0.01	0.01	0.01	0.01
Processes in Industry	COKE_PRODUCTION	COKE_MADE	0.39	0.36	0.35	0.34	0.33	0.31
Processes in Industry	SSF_PRODUCTION	SSF_MADE	0.13	0.19	0.15	0.13	0.13	0.10
Quarrying	QUARRYING	TOTAL_AGGREGATE	23.30	18.30	14.90	12.12	10.07	8.78
Construction	CONSTRUCTION	CONSTRUCTION_VALUE_ 1990	3.83	3.81	4.23	4.61	5.03	5.48
Road Transport Combustion	ROAD_TRANSPORT	DERV	26.29	25.95	17.79	10.38	6.39	5.76
Road Transport Combustion	ROAD_TRANSPORT	PETROL	8.89	5.10	4.39	4.53	4.83	5.11
Brake & Tyre Wear	ROAD_TRANSPORT	BRAKE_WEAR	4.10	4.28	4.66	5.05	5.45	5.82
Brake & Tyre Wear	ROAD_TRANSPORT	TYRE_WEAR	0.62	0.65	0.70	0.76	0.82	0.88
Off-Road Sources	OTHER_INDUSTRY_OFFROAD	GAS_OIL	1.11	1.22	1.35	1.48	1.62	1.76
Off-Road Sources	OTHER_INDUSTRY_OFFROAD	PETROL	0.10	0.11	0.13	0.14	0.15	0.17
Off-Road Sources	AGRICULTURE_POWER_ UNITS	PETROL	0.00	0.00	0.00	0.00	0.00	0.00

Digest sub sectors	NAEI sourcecode	NAEI FUELCODE	1998	2000	2005	2010	2015	2020
Off-Road Sources	AIRCRAFT_SUPPORT	GAS_OIL	0.02	0.02	0.02	0.02	0.03	0.03
Off-Road Sources	AGRICULTURE_POWER_ UNITS	GAS_OIL	0.59	0.47	0.38	0.31	0.30	0.30
Off-Road Sources	DOMESTIC_HOUSE&GARDEN	DERV	0.01	0.01	0.01	0.01	0.01	0.01
Off-Road Sources	DOMESTIC_HOUSE&GARDEN	PETROL	0.04	0.04	0.04	0.05	0.05	0.05
Military	SHIPPING_NAVAL	GAS_OIL	0.31	0.35	0.33	0.33	0.32	0.31
Railways	Railways_(Freight)	GAS_OIL	0.13	0.13	0.08	0.06	0.05	0.05
Railways	Railways_(intercity)	GAS_OIL	0.58	0.56	0.36	0.26	0.22	0.20
Railways	Railways_(Regional)	GAS_OIL	0.01	0.01	0.01	0.01	0.00	0.00
Shipping	COASTAL	FUEL_OIL	0.11	0.11	0.11	0.10	0.09	0.09
Shipping	FISHING	FUEL_OIL	-	-	-	-	-	-
Shipping	COASTAL	GAS_OIL	0.91	0.94	0.94	0.94	0.94	0.94
Shipping	FISHING	GAS_OIL	0.14	0.13	0.13	0.13	0.13	0.13
Civil Aircraft	Aircraft_TOL_(Domestic)	AVIATION_TURBINE_FUEL	0.05	0.05	0.06	0.07	0.08	0.09
Civil Aircraft	Aircraft_TOL_(international)	AVIATION_TURBINE_FUEL	0.11	0.12	0.14	0.16	0.19	0.21
Non Landfill Waste Treat. & Disp.	OFFSHORE_FLARING	NON-FUEL_COMBUSTION	1.27	1.43	1.58	1.74	1.90	2.06
Non Landfill Waste Treat. & Disp.	INCINERATION	Sewage_Sludge_Combustion	0.01	0.01	0.01	0.01	0.01	0.01
Non Landfill Waste Treat. & Disp.	INCINERATION	MSW	-	-	-	-	-	-
Non Livestock Agricult.	FIELD_BURNING	BARLEY_RESIDUE	-	-	-	-	-	-
Non Livestock Agricult.	FIELD_BURNING	LINSEED_RESIDUE	-	-	-	-	-	-
Non Livestock Agricult.	FIELD_BURNING	OATS_RESIDUE	-	-	-	-	-	-
Non Livestock Agricult.	FIELD_BURNING	WHEAT_RESIDUE	-	-	-	-	-	-
Total			**163**	**127**	**114**	**100**	**94**	**93**

Appendix 7 - Regional inventories for PM_{10} in 1997

GLASGOW

Area sources

Sector	PM_{10} emission in 1997 (tonnes)
Power stations	0.11
Industrial combustion	7.03
Residential combustion	95.10
Industrial processes	69.07
Petrol road transport	239.22
Diesel road transport	295.65
Diesel off-road	6.95
Other road transport	176.69
Other	0.70
Total	***890.51***

Point sources

Site details	PM_{10} emission in 1997 (tonnes)	Sector
Dewarment Ltd, Glasgow	0.03	Industrial furnaces
Total - Glasgow	**0.03**	

GREATER LONDON

Area sources

Sector	PM_{10} emission in 1997 (tonnes)
Power stations	0.85
Industrial combustion	160.84
Residential combustion	1126.42
Industrial processes	689.09
Petrol road transport	2132.19
Diesel road transport	2628.72
Diesel off-road	54.75
Other road transport	1520.77
Other	75.31
Total	***8388.95***

Point sources

Site details	PM_{10} emission in 1997 (tonnes)	Sector
Ford Motor Co Ltd, Dagenham	70.36	Industrial boilers
Guinness Brewing Worldwide Ltd, Brent	50.68	Industrial boilers
North London Waste Authority, Edmonton	15.28	Power stations
North London Waste Authority, Edmonton	15.28	Other
SE London Combined Heat And Power Ltd, SELCHP	8.60	Power stations
SE London Combined Heat And Power Ltd, SELCHP	8.60	Other
Nestle (UK) Ltd, Hillingdon	6.45	Industrial boilers
Northwick Park Hospital NHS Trust	4.77	Industrial boilers
Blagden Packaging Ltd, Barking	4.40	Industrial boilers
Johnson Matthey Plc, Enfield	4.34	Industrial processes
London Underground Ltd, Kensington	3.03	Industrial boilers
Delta Enfield Metals Ltd, Enfield	2.29	Industrial processes
A Cohen and Co (GB) Ltd, London	1.08	Industrial processes
Kodak Ltd, Harrow	1.06	Industrial boilers
Citigen (London) Ltd	0.60	Industrial boilers
Clinical Energy Ltd, The Hillingdon Hospital Trust	0.50	Industrial boilers
Tate And Lyle Plc, Thames Refinery	0.50	Industrial boilers
Blue Circle Industries, Beddingham Landfill	0.33	Power stations
Blue Circle Industries, Beddingham Landfill	0.33	Industrial boilers
Wolstenholme International, Belvedere	0.27	Industrial processes
GE Lighting Ltd, Enfield	0.19	Industrial processes
S Grundon (Waste) Ltd, Slough	0.11	Industrial boilers
UOP Ltd, Enfield	0.06	Industrial processes
Heathrow Airport Ltd, Hounslow	0.04	Industrial boilers
Mitchanol International Ltd, Mitcham	0.04	Industrial processes
Brent Smelting Works Ltd, London	0.03	Industrial processes
Defence Research Agency, Sunbury-On-Thames	0.02	Industrial processes
Geo W Neale Ltd, London	0.01	Industrial processes
W S Simpson And Co Ltd, London	0.01	Industrial processes
Alpha Fry Ltd, Croydon	0.01	Industrial processes
Delta Encon Ltd, Enfield	0.01	Industrial processes
Jotun Polymer (UK) Ltd, Mitcham	0.00	Industrial processes
Walterisation (UK) Ltd, Croydon	0.00	Industrial processes
Total - Greater London	**199.28**	

GREATER MANCHESTER

Area sources

Sector	PM_{10} emission in 1997 (tonnes)
Power stations	0.44
Industrial combustion	197.29
Residential combustion	528.65
Industrial processes	396.80
Petrol road transport	1352.56
Diesel road transport	1619.50
Diesel off-road	42.35
Other road transport	891.39
Other	36.53
Total	***5065.51***

Point sources

Site details	PM_{10} emission in 1997 (tonnes)	Sector
Powergen PLC, Fiddlers Ferry	1685.00	Power stations
Ppg Industries (UK) Ltd, Wigan	116.80	Industrial processes
Dexter Speciality Materials Ltd, Manchester	38.97	Industrial processes
Crosfield Limited, Warrington	6.03	Industrial processes
Greater Manchester Waste Disposal Authority, Bolton	5.63	Other
Ciba Geigy Plc, Manchester	1.80	Industrial processes
British Aluminium Ltd, Manchester	1.42	Industrial processes
Solvay Interox Ltd, Warrington	1.38	Industrial boilers
H J Heinz Co Ltd, Wigan	1.29	Industrial boilers
Park And Paterson Ltd	0.37	Industrial processes
Akzo Nobel Chemicals Ltd, Littleborough	0.20	Industrial boilers
Shell Chemicals UK Ltd, Manchester	0.03	Industrial boilers
Warrington Metal Services Ltd, Warrington	0.02	Industrial processes
Shakespeare Foundry, Bolton	0.02	Industrial furnaces
Contract Chemicals (Warrington) Ltd, Warrington	0.01	Industrial processes
Scandura Textiles, Bury	0.01	Industrial processes
British Aluminium Ltd, Manchester	0.01	Industrial processes
Contract Chemicals (Warrington) Ltd, Warrington	0.00	Industrial processes
Rhone Poulenc Chemicals Ltd, Manchester	0.00	Industrial processes
Total - Greater Manchester	**1858.99**	

NEATH PORT TALBOT

Area sources

Sector	PM_{10} emission in 1997 (tonnes)
Power stations	0.04
Industrial combustion	19.07
Residential combustion	82.82
Industrial processes	26.59
Petrol road transport	107.76
Diesel road transport	125.61
Diesel off-road	12.76
Other road transport	59.30
Other	1.30
Total	***435.25***

Point sources

Site details	PM_{10} emission in 1997 (tonnes)	Sector
British Steel Strip Products, Port Talbot Works	1337.51	Industrial processes
Bp Chemicals Ltd, Baglan Bay	207.00	Industrial boilers
British Steel Strip Products, Port Talbot Works	144.42	Industrial furnaces
British Steel Strip Products, Port Talbot Works	45.00	Industrial processes
Total - Neath Port Talbot	**1733.93**	

WEST MIDLANDS

Area sources

Sector	PM_{10} emission in 1997 (tonnes)
Power stations	0.40
Industrial combustion	109.34
Residential combustion	426.22
Industrial processes	686.93
Petrol road transport	890.47
Diesel road transport	1146.46
Diesel off-road	38.46
Other road transport	696.42
Other	13.22
Total	***4007.92***

Point sources

Site details	PM_{10} emission in 1997 (tonnes)	Sector
IMI Refiners Ltd, James Bridge Copper Works	61.30	Industrial processes
Elm Energy And Recycling (UK) Ltd, Wolverhampton	25.50	Industrial boilers
Tyseley Waste Disposal Ltd, Tyseley	17.00	Power stations
Tyseley Waste Disposal Ltd, Tyseley	17.00	Other
Coventry City Council, Coventry	10.25	Power stations
Coventry City Council, Coventry	10.25	Other
MES Environmental Ltd, Dudley	8.50	Industrial boilers
Robinson Brothers Ltd, West Bromwich	5.56	Industrial processes
MES Environmental Ltd, Wolverhampton	4.00	Industrial boilers
BIP Limited, Warley	4.00	Industrial processes
Goodyear Great Britain Ltd, Wolverhampton	2.60	Industrial boilers
Britannia Alloys And Chemicals Ltd, Walsall	2.47	Industrial processes
Aldec Ltd, West Bromwich	1.42	Industrial processes
British Steel Plc, Brierley Hill	0.97	Industrial processes
BFI Packington, Old Railway Cutting	0.84	Industrial boilers
BFI Packington, Old Railway Cutting	0.84	Power stations
Leigh Environmental Ltd; Peart	0.63	Industrial boilers
Halesowen Metal Refiners, Halesowen	0.37	Industrial processes
Biogeneration, Himley Wood	0.33	Power stations
Biogeneration, Himley Wood	0.33	Industrial boilers
Robinson Brothers Ltd, West Bromwich	0.22	Industrial processes
Morton International Ltd, Dewsbury	0.15	Industrial processes
Albright And Wilson UK Ltd, Warley	0.06	Industrial processes
Armalloy Ltd, Cradley Heath	0.03	Industrial furnaces
Gabriel & Co, Birmingham	0.03	Industrial furnaces
Albright And Wilson UK Ltd, Warley	0.01	Industrial processes
Total - West Midlands	**174.66**	

WEST YORKSHIRE

Area sources

Sector	PM_{10} emission in 1997 (tonnes)
Power stations	0.40
Industrial combustion	157.01
Residential combustion	373.68
Industrial processes	233.26
Petrol road transport	708.49
Diesel road transport	876.22
Diesel off-road	27.36
Other road transport	493.98
Other	4.05
Total	***2874.45***

Point sources

Site details	PM_{10} emission in 1997 (tonnes)	Sector
AHS Emstar Plc, Huddersfield	31.90	Industrial boilers
Alenoy Ltd, Bradford	4.22	Industrial processes
Allied Colloids Ltd, Bradford	3.61	Industrial processes
Zeneca Ltd, Huddersfield	3.26	Industrial processes
Britannia Recycling Ltd, Wakefield	2.40	Industrial processes
Hopkinsons Ltd, Huddersfield	1.51	Industrial furnaces
Yorkshire Water Services Ltd, Brighouse Sewage Works	0.96	Industrial boilers
Holliday Dyes And Chemicals Ltd, Huddersfield	0.72	Industrial processes
Yorkshire Water Services Ltd, Knostrop Treatment Works	0.51	Industrial boilers
Yorkshire Water Services Ltd, Esholt Treatment Works	0.36	Industrial boilers
Biogeneration, Howden Clough Road	0.33	Power stations
Biogeneration, Howden Clough Road	0.33	Industrial boilers
Yorkshire Chemicals Plc, Leeds	0.17	Industrial processes
Yorkshire Water Services Ltd, Knostrop Treatment Works	0.17	Industrial boilers
Westcroft Castings, Bradford	0.08	Industrial furnaces
Zeneca Ltd, Huddersfield	0.05	Industrial processes
James Robinson Ltd, Huddersfield	0.01	Industrial processes
Croda Colours Ltd, Huddersfield	0.00	Industrial processes
James Robinson Ltd, Huddersfield	0.00	Industrial processes
James Robinson Ltd, Huddersfield	0.00	Industrial processes
Crompton Lighting, Leeds	0.00	Industrial processes
Lambson Fine Chemicals Ltd, Castleford	0.00	Industrial processes
Hickson And Welch Ltd, Leeds	0.00	Industrial processes
Total - West Yorkshire	**50.59**	

Appendix 8 - Definition of case study regions

The case study regions are defined in terms of Local Authority boundaries. This appendix lists the District Councils whose areas comprise the case study regions.

Glasgow
City of Glasgow

Greater London

Barking and Dagenham	Barnet	Bexley
Brent	Bromley	Camden
City of London	City of Westminster	Croydon
Ealing	Enfield	Greenwich
Hackney	Hammersmith and Fulham	Haringey
Harrow	Havering	Hillingdon
Hounslow	Islington	Kensington and Chelsea
Kingston upon Thames	Lambeth	Lewisham
Merton	Newham	Redbridge
Richmond upon Thames	Southwark	Sutton
Tower Hamlets	Waltham Forest	Wandsworth

Greater Manchester

Bolton	Bury	Manchester	Oldham
Rochdale	Salford	Stockport	Tameside
Trafford	Warrington	Wigan	

Neath Port Talbot
Neath Port Talbot

West Midlands

Birmingham	Coventry	Dudley
Sandwell	Solihull	Walsall
Wolverhampton		

West Yorkshire
Bradford
Kirklees
Leeds

Appendix 9 - Modelling emissions from point sources

All point sources with an annual PM_{10} emission greater than 20 tonnes a year and within 100km of the respective regions have been modelled explicitly using the dispersion model ADMS 3. Figure 1 indicates the location of these sources. The sources are identified for each region in Tables 1 to 6.

The following parameters were required to model the emission

- emission rate;
- stack height;
- stack diameter;
- discharge velocity;
- discharge temperature.

Details were obtained from Environment Agency public registers and from previous studies carried out by NETCEN. Where no information was available within the timescale of the project concerning discharge conditions, estimates were derived from best engineering judgement. This included using the calorific value of the fuel to estimate discharge velocities and the heat content of the discharging plume. HMIP's Technical Guidance Note D1 will be used to estimate stack heights.

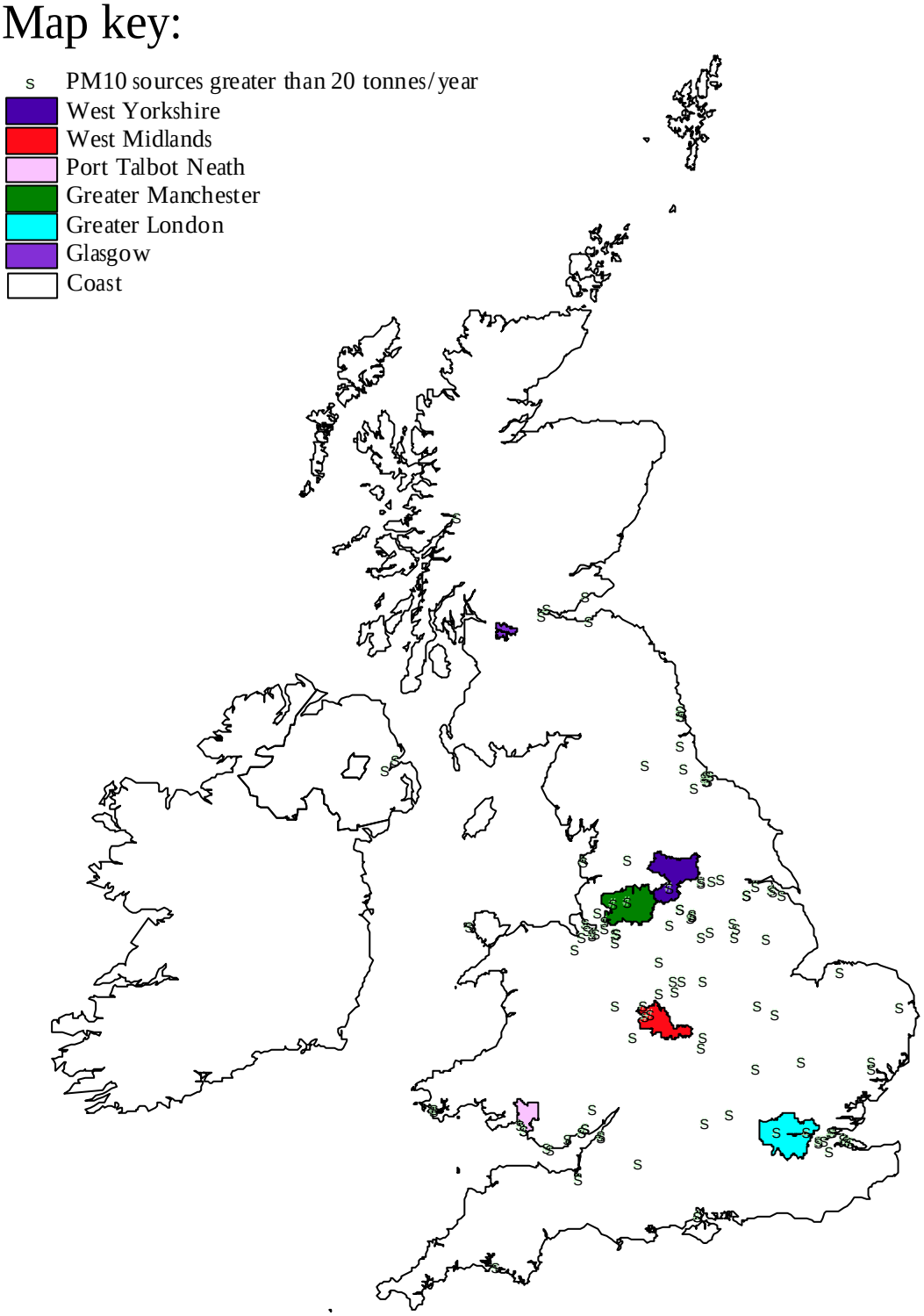

Figure 1 - Location of modelled point sources

Table 1 - Sources contained within, and within 100km of the West Yorkshire region

Sector	Emiss. t/y	Operating Company	Site name
Power stations	2753	POWERGEN PLC	Ferrybridge C
Power stations	1975	POWERGEN PLC	Cottam
Power stations	1932	NATIONAL POWER PLC	West Burton
Industrial processes	1887	BRITISH STEEL PLC	Scunthorpe
Power stations	1807	NATIONAL POWER PLC	Eggborough
Power stations	1685	POWERGEN PLC	Fiddlers ferry
Industrial processes	1152	BRITISH STEEL PLC	redcar
Power stations	1135	NATIONAL POWER PLC	Drax
Industrial boilers	680	ICI CHEMICALS AND POLYMERS PLC	Wilton
Industrial boilers	653	BRUNNER MOND (UK) LTD	Winnington
Industrial processes	553	REDLAND AGGREGATES LTD	FERRYHILL
Power stations	543	POWERGEN PLC	Drakelow C
Conversion	461	SHELL CHEMICALS UK LTD	Stanlow
Power stations	408	NATIONAL POWER PLC	Rugeley B
Industrial processes	357	KEMIRA AGRO UK LTD	CHESTER
Conversion	332	CONOCO LTD	South Killingholme
Industrial processes	320	BLUE CIRCLE INDUSTRIES	BISHOP AUCKLAND
Industrial processes	305	CASTLE CEMENT LTD	CLITHEROE
Power stations	290	POWERGEN PLC	High Marnham
Industrial processes	199	BLUE CIRCLE INDUSTRIES	SHEFFIELD
Industrial furnaces	176	BRITISH STEEL PLC	Scunthorpe
Industrial processes	150	RUGBY GROUP PLC	BARTON-UPON-HUMBER
Industrial furnaces	142	BRITISH STEEL PLC	teeside
Conversion	138	LINDSEY OIL REFINERY LTD	Killingholme
Industrial processes	119	REDLAND AGGREGATES LTD	WORKSOP
Industrial boilers	117	BRIDGEWATER PAPER CO LTD	Ellesmere Port & Neston
Industrial processes	117	PPG INDUSTRIES (UK) LTD	WIGAN
Industrial boilers	114	BRITISH SUGAR PLC	Bardney
Power stations	106	POWERGEN PLC	Ince B
Industrial processes	104	BRITISH STEEL PLC	teeside
Industrial processes	99	BRITISH STEEL PLC	redcar
Industrial processes	97	BRITISH STEEL PLC	teeside
Power stations	92	NATIONAL POWER	Willington B
Industrial processes	86	ROTHERHAM ENGINEERING STEELS	UES STEELS ALDWARKE ROTHERHAM
Power stations	83	POWERGEN PLC	Ratcliffe on Soar
Industrial boilers	79	BASF PLC	Middlesborough
Industrial boilers	76	ICI CHEMICALS AND POLYMERS PLC	Lostock
Industrial processes	73	UNITED ENGINEERING STEELS LTD	STOCKSBRIDGE WORKS SHEFFIELD
Industrial processes	71	CASTLE CEMENT LTD	MOLD
Industrial processes	68	ICI CHEMICALS AND POLYMERS PLC	Lostock
Industrial processes	67	OWENS-CORNING BUILDING PRODUCTS	ST HELENS
Industrial processes	54	BRITISH STEEL PLC	Scunthorpe
Industrial processes	51	BRUNNER MOND (UK) LTD	Winnington
Industrial processes	51	GYPROC INSULATION LTD	RUNCORN
Industrial boilers	49	UNICHEMA CHEMICAL LTD	Wirral
Industrial processes	47	BRITISH CHROME AND CHEMICALS	STOCKTON-ON-TEES
Industrial boilers	46	SHOTTON PAPER COMPANY PLC	Alyn & Deeside
Industrial processes	46	BLUE CIRCLE INDUSTRIES	STOKE-ON-TRENT
Industrial processes	43	FORGEMASTERS STEELS LTD	Sheffield
Industrial processes	43	AVESTA SHEFFIELD LTD	SHEFFIELD SHEPCOTE LANE
Industrial processes	39	TIOXIDE EUROPE LTD	Grimsby
Industrial processes	39	DEXTER SPECIALITY MATERIALS LTD	MANCHESTER
Industrial processes	38	EUROPEAN VINYLS CORP. (UK) LTD	THORNTON-CLEVELEYS
Industrial boilers	33	COALITE PRODUCTS	CHESTERFIELD
Industrial boilers	32	AHS EMSTAR PLC	HUDDERSFIELD
Industrial boilers	30	INTERNATIONAL SPECIALITY CHEMICALS	WOLVERHAMPTON
Industrial furnaces	30	ROTHERHAM ENGINEERING STEELS	UES STEELS ALDWARKE ROTHERHAM
Industrial boilers	29	INTERNATIONAL SPECIALITY CHEMICALS	KNOTTINGLEY
Industrial boilers	28	NESTLE (UK) LTD	NESTLE GROCERY DIV MARSTON LANE BURTON
Industrial processes	27	ZENECA LTD	NORTHWICH
Industrial processes	25	TIOXIDE UK LTD	Hartlepool
Industrial furnaces	25	UNITED ENGINEERING STEELS LTD	STOCKSBRIDGE WORKS SHEFFIELD

Table 2 - Sources contained within, and within 100km of the West Midlands region

Sector	Emission tonnes yr^{-1}	Operating Company	Site name
Power stations	1685	POWERGEN PLC	Fiddlers ferry
Power stations	790	NATIONAL POWER PLC	Didcot A
Industrial boilers	653	BRUNNER MOND (UK) LTD	Winnington
Power stations	580	NATIONAL POWER PLC	Ironbridge
Power stations	543	POWERGEN PLC	Drakelow C
Conversion	461	SHELL CHEMICALS UK LTD	Stanlow
Power stations	408	NATIONAL POWER PLC	Rugeley B
Industrial processes	370	CASTLE CEMENT LTD	STAMFORD
Industrial processes	357	KEMIRA AGRO UK LTD	CHESTER
Power stations	290	POWERGEN PLC	High Marnham
Industrial boilers	241	LONDON BRICK CO LTD	BEDFORD
Industrial processes	199	BLUE CIRCLE INDUSTRIES	SHEFFIELD
Industrial processes	190	RUGBY CEMENT	RUGBY
Industrial processes	130	RUGBY CEMENT	RUGBY
Industrial processes	119	REDLAND AGGREGATES LTD	WORKSOP
Industrial boilers	117	BRIDGEWATER PAPER CO LTD	Ellesmere Port & Neston
Industrial boilers	116	BRITISH SUGAR PLC	Kidderminster
Power stations	106	POWERGEN PLC	Ince B
Industrial boilers	100	LONDON BRICK CO LTD	PETERBOROUGH
Power stations	92	NATIONAL POWER	Willington B
Industrial processes	86	ROTHERHAM ENGINEERING STEELS	UES STEELS ALDWARKE ROTHERHAM
Power stations	83	POWERGEN PLC	Ratcliffe on Soar
Industrial boilers	76	ICI CHEMICALS AND POLYMERS PLC	Lostock
Industrial processes	73	UNITED ENGINEERING STEELS LTD	STOCKSBRIDGE WORKS SHEFFIELD
Industrial processes	71	CASTLE CEMENT LTD	MOLD
Industrial processes	68	ICI CHEMICALS AND POLYMERS PLC	Lostock
Industrial processes	67	OWENS-CORNING BUILDING PRODUCTS	ST HELENS
Industrial processes	61	IMI REFINERS LTD	JAMES BRIDGE COPPER WORKS;
Industrial processes	51	BRUNNER MOND (UK) LTD	Winnington
Industrial processes	51	GYPROC INSULATION LTD	RUNCORN
Industrial boilers	49	UNICHEMA CHEMICAL LTD	Wirral
Industrial boilers	46	SHOTTON PAPER COMPANY PLC	Alyn & Deeside
Industrial processes	46	BLUE CIRCLE INDUSTRIES	STOKE-ON-TRENT
Industrial processes	43	FORGEMASTERS STEELS LTD	Sheffield
Industrial processes	43	AVESTA SHEFFIELD LTD	SHEFFIELD SHEPCOTE LANE
Industrial processes	34	RUGBY GROUP PLC	OXFORD
Industrial boilers	33	COALITE PRODUCTS T/A COALITE	CHESTERFIELD
Industrial boilers	30	INTERNATIONAL SPECIALITY CHEMICALS	WOLVERHAMPTON
Industrial furnaces	30	ROTHERHAM ENGINEERING STEELS	UES STEELS ALDWARKE ROTHERHAM
Industrial boilers	28	NESTLE (UK) LTD	NESTLE GROCERY DIVISION; MARSTON LANE
Industrial processes	27	ZENECA LTD	NORTHWICH
Industrial boilers	27	ENICHEM ELASTOMERS LTD	New Forest
Industrial boilers	26	ELM ENERGY AND RECYCLING (UK) LTD	Wolverhampton
Industrial furnaces	25	UNITED ENGINEERING STEELS LTD	STOCKSBRIDGE WORKS SHEFFIELD

Table 3 - Sources contained within, and within 100km of Port Talbot and Neath

Sector	Emission tonnes yr^{-1}	Operating Company	Site name
Industrial processes	1338	BRITISH STEEL STRIP PRODUCTS	Port Talbot Works
Power stations	1301	NATIONAL POWER PLC	Aberthaw b
Industrial processes	1082	BRITISH STEEL PLC	Llanwern Works
Conversion	225	TEXACO LTD	Pembroke
Industrial boilers	207	BP CHEMICALS LTD	Baglan Bay
Industrial processes	184	BRITANNIA ZINC LTD	BRISTOL
Industrial processes	178	PREMDOR CROSBY LTD	BRIDGWATER
Industrial furnaces	144	BRITISH STEEL STRIP PRODUCTS	Port Talbot Works
Conversion	121	ELF OIL LTD	Milford Haven elf
Industrial furnaces	120	BRITISH STEEL PLC	Llanwern Works
Industrial processes	103	BRITISH STEEL PLC	Llanwern Works
Industrial processes	92	ALPHASTEEL LTD	NEWPORT
Industrial processes	46	ALLIED STEEL AND WIRE LTD	TREMORFA WORKS
Industrial processes	45	BRITISH STEEL STRIP PRODUCTS	Port Talbot Works
Industrial furnaces	33	ALPHASTEEL LTD	NEWPORT
Industrial processes	29	BLUE CIRCLE INDUSTRIES	BARRY
Industrial boilers	28	BLAGDEN PACKAGING LTD	AVONMOUTH WAY BRISTOL
Industrial boilers	27	ENICHEM ELASTOMERS LTD	New Forest

Table 4 - Sources contained within, and within 100km of Greater Manchester

Sector	Emission tonnes yr^{-1}	Operating Company	Site name
Power stations	2753	POWERGEN PLC	Ferrybridge C
Power stations	1975	POWERGEN PLC	Cottam
Power stations	1932	NATIONAL POWER PLC	West Burton
Industrial processes	1887	BRITISH STEEL PLC	Scunthorpe
Power stations	1807	NATIONAL POWER PLC	Eggborough
Power stations	1685	POWERGEN PLC	Fiddlers ferry
Power stations	1135	NATIONAL POWER PLC	Drax
Industrial boilers	653	BRUNNER MOND (UK) LTD	Winnington
Power stations	580	NATIONAL POWER PLC	Ironbridge
Power stations	543	POWERGEN PLC	Drakelow C
Conversion	461	SHELL CHEMICALS UK LTD	Stanlow
Power stations	408	NATIONAL POWER PLC	Rugeley B
Industrial processes	357	KEMIRA AGRO UK LTD	CHESTER
Industrial processes	305	CASTLE CEMENT LTD	CLITHEROE
Power stations	290	POWERGEN PLC	High Marnham
Industrial processes	199	BLUE CIRCLE INDUSTRIES	SHEFFIELD
Industrial furnaces	176	BRITISH STEEL PLC	Scunthorpe
Industrial processes	150	RUGBY GROUP PLC	BARTON-UPON-HUMBER
Industrial processes	119	REDLAND AGGREGATES LTD	WORKSOP
Industrial boilers	117	BRIDGEWATER PAPER CO LTD	Ellesmere Port & Neston
Industrial processes	117	PPG INDUSTRIES (UK) LTD	WIGAN
Power stations	106	POWERGEN PLC	Ince B
Power stations	92	NATIONAL POWER	Willington B
Industrial processes	86	ROTHERHAM ENGINEERING STEELS	UES STEELS ALDWARKE ROTHERHAM
Power stations	83	POWERGEN PLC	Ratcliffe on Soar
Industrial boilers	76	ICI CHEMICALS AND POLYMERS PLC	Lostock
Industrial processes	73	UNITED ENGINEERING STEELS LTD	STOCKSBRIDGE WORKS SHEFFIELD
Industrial processes	71	CASTLE CEMENT LTD	MOLD
Industrial processes	68	ICI CHEMICALS AND POLYMERS PLC	Lostock
Industrial processes	67	OWENS-CORNING BUILDING PRODUCTS (	ST HELENS
Industrial processes	61	IMI REFINERS LTD	JAMES BRIDGE COPPER WORKS
Industrial processes	54	BRITISH STEEL PLC	Scunthorpe
Industrial processes	51	BRUNNER MOND (UK) LTD	Winnington
Industrial processes	51	GYPROC INSULATION LTD	RUNCORN
Industrial boilers	49	UNICHEMA CHEMICAL LTD	Wirral
Industrial boilers	46	SHOTTON PAPER COMPANY PLC	Alyn & Deeside
Industrial processes	46	BLUE CIRCLE INDUSTRIES	STOKE-ON-TRENT
Industrial processes	43	AVESTA SHEFFIELD LTD	SHEFFIELD SHEPCOTE LANE
Industrial processes	43	FORGEMASTERS STEELS LTD	Sheffield
Industrial processes	39	DEXTER SPECIALITY MATERIALS LTD	MANCHESTER
Industrial processes	38	EUROPEAN VINYLS	THORNTON-CLEVELEYS
Industrial boilers	33	COALITE PRODUCTS T/A COALITE C	CHESTERFIELD
Industrial boilers	32	AHS EMSTAR PLC	HUDDERSFIELD
Industrial boilers	30	INTERNATIONAL SPECIALITY CHEMICALS	WOLVERHAMPTON
Industrial furnaces	30	ROTHERHAM ENGINEERING STEELS	UES STEELS ALDWARKE ROTHERHAM
Industrial boilers	29	INTERNATIONAL SPECIALITY CHEMICALS	KNOTTINGLEY
Industrial boilers	28	NESTLE (UK) LTD	MARSTON LANE BURTON-ON-TR
Industrial processes	27	ZENECA LTD	NORTHWICH
Industrial boilers	26	ELM ENERGY AND RECYCLING (UK) LTD	Wolverhampton
Industrial furnaces	25	UNITED ENGINEERING STEELS LTD	STOCKSBRIDGE WORKS SHEFFIELD

Table 5 - Sources contained within, and within 100km of Greater London

Sector	Emission tonnes yr^{-1}	Operating Company	Site name
Power stations	2237	POWERGEN PLC	Kingsnorth
Power stations	790	NATIONAL POWER PLC	Didcot A
Conversion	321	ESSO PETROLEUM CO LTD	Fawley
Industrial boilers	241	LONDON BRICK CO LTD	BEDFORD
Industrial processes	209	BLUE CIRCLE INDUSTRIES LTD	GRAVESEND
Industrial processes	190	RUGBY CEMENT	RUGBY
Industrial processes	150	RUGBY GROUP PLC	ROCHESTER
Power stations	146	NATIONAL POWER PLC	Tilbury
Conversion	139	MOBIL POWER	Coryton
Industrial processes	130	RUGBY CEMENT	RUGBY
Conversion	127	SHELL UK LTD	Shellhaven
Conversion	105	ESSO PETROLEUM CO LTD	Fawley
Industrial boilers	100	LONDON BRICK CO LTD	PETERBOROUGH
Industrial processes	90	CO STEEL SHEERNESS PLC	SHEERNESS SITE SHEERNESS
Industrial boilers	70	FORD MOTOR CO LTD	Dagenham
Conversion	65	SHELL UK LTD	Shellhaven
Industrial boilers	51	GUINNESS BREWING WORLDWIDE LTD	Brent
Industrial processes	45	BLUE CIRCLE INDUSTRIES PLC	IPSWICH
Industrial boilers	35	BRITISH SUGAR PLC	Ipswich
Industrial processes	34	RUGBY GROUP PLC	OXFORD
Industrial furnaces	33	CO STEEL SHEERNESS PLC	SHEERNESS SITE SHEERNESS
Industrial processes	26	RUGBY GROUP PLC	CAMBRIDGE
Industrial processes	23	BRITANNIA REFINED METALS LTD	GRAVESEND
Power stations	21	POWERGEN PLC	Grain

Table 6 - Sources contained within, and within 100km of Glasgow

Sector	Emission tonnes yr^{-1}	Operating Company	Site name
Power stations	2551	SCOTTISH POWER	Longannet
Power stations	715	SCOTTISH POWER	Cockenzie
Conversion	336	BP OIL	Grangemouth
Power stations	100	SCOTTISH POWER	Methil

Appendix 10 – Validation of PM_{10} modelling

PM_{10} concentrations in the UK

Table 1 and Figure 1 show that annual average PM_{10} concentrations have generally decreased over the four year period 1996 to 1999.

Table 1 - Annual average PM_{10} concentrations (TEOM) measured

	1996	1997	1998	1999
Average concentration from all sites ($\mu g\ m^{-3}$)	24.1	21.9	19.3	18.3
Number of operating sites	21	36	45	42

Most sampling sites are in urbanised areas and are hence generally closer to low level sources such as road transport which contribute a significant proportion of the observed annual mean concentration. A value of 1.3 is used to scale the annual PM_{10} concentrations derived by the TEOM instrument to a gravimetric equivalent.

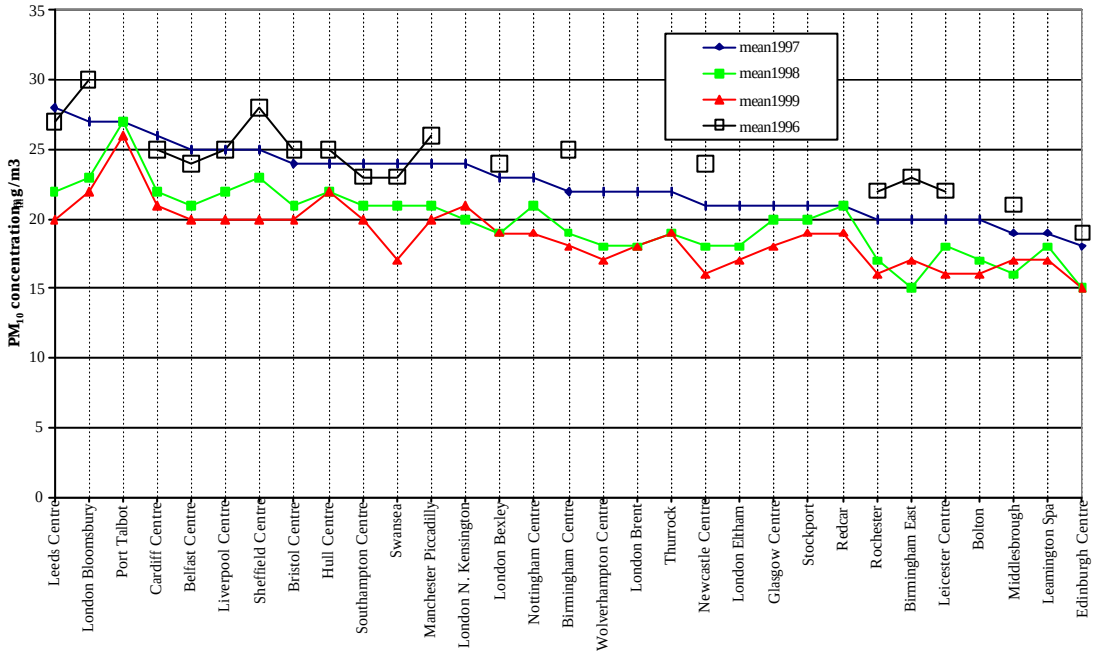

Figure 1 - Measured PM_{10}concentrations in 1996, 1997, 1998 and 1999

The nature of particulate matter has been comprehensively reviewed in the report "Source Apportionment of Airborne Particulates in the United Kingdom" prepared by the Airborne Particulate Expert Group [APEG, 1999]. The prediction of annual mean PM_{10} concentrations is complicated because of differences in the nature of the sources contributing to the particulate matrix. PM_{10} can be considered to consist of three main components:

Total PM_{10}concentration = primary component + secondary component + 'other'

Predicting PM_{10} concentrations

Primary component

Emissions from area sources are modelled using the NETCEN area source model.
The NETCEN area source model has been used previously to predict annual sulphur dioxide concentrations for both the present day and a range of future emission scenarios [Abbott and Vincent, 1999]. The model incorporates results from the dispersion model, ADMS-3 and calculates the annual average contribution from area sources on a 1 km receptor grid covering the country. Contributions at each receptor from sources at distances greater than 15 km in the north-south or east-west directions were ignored. A uniform surface roughness of 1 m, corresponding to typical urban areas was used for the whole country. Wet and dry deposition were ignored.

PM_{10} emissions for each 1 km square in the country were obtained from the National Atmospheric Emission Inventory. Emissions for both 1997 and 1998 were modelled. The emissions from each square were assumed to be uniformly distributed throughout the square at an initial height of 10 m: i.e., each 1 km square was represented by an emitting volume 1 km $\times$ 1 km $\times$ 10 m high. The estimate of 10 m is based on the height of a typical house and assumes that emissions are entrained in the building wake.

Secondary particulate matter concentrations derived from sulphate aerosol concentrations

Estimates of the secondary contribution are based on the sulphate aerosol concentration determined at eight monitoring stations that form part of the acid deposition network. This sampling network was designed such that the sampling sites are distant from local sources and hence reflect the regional pollution climate. The secondary aerosol concentration is derived from the aerosol sulphate by applying a factor 2.45 [APEG, 1999]. Table 2 and Figure 2 show that there is a clear downward trend. 1996 was a usual year due to the prevalence of secondary episodes in that year. Annual mean concentrations were higher in 1996 than in 1995 but lower than concentrations in the early 1990s.

Concentrations are clearly decreasing from the anomalously high concentrations observed in 1996. Concentrations are highest in the southeast and decrease towards the west and north as the influence of sources in other European countries decreases.

Table 2 - Estimates of secondary particulate matter concentrations (TEOM, $\mu g\ m^{-3}$) measured at rural locations in the United Kingdom.

Site	1996	1997	1998	1999
Eskdalemuir	6.6	5.1	4.3	4.0
Stoke Ferry	11.0	8.1	6.7	6.0
Lough Navar	5.9	4.4	3.6	3.0
Barcombe Mills	11.8	9.6	7.3	6.4
Yarner Wood	8.1	6.6	4.8	4.1
High Muffles	8.8	6.6	5.1	4.5
Strathvaich Dam	3.7	2.9	2.6	2.7
Glen Dye	5.9	5.1	3.4	3.3

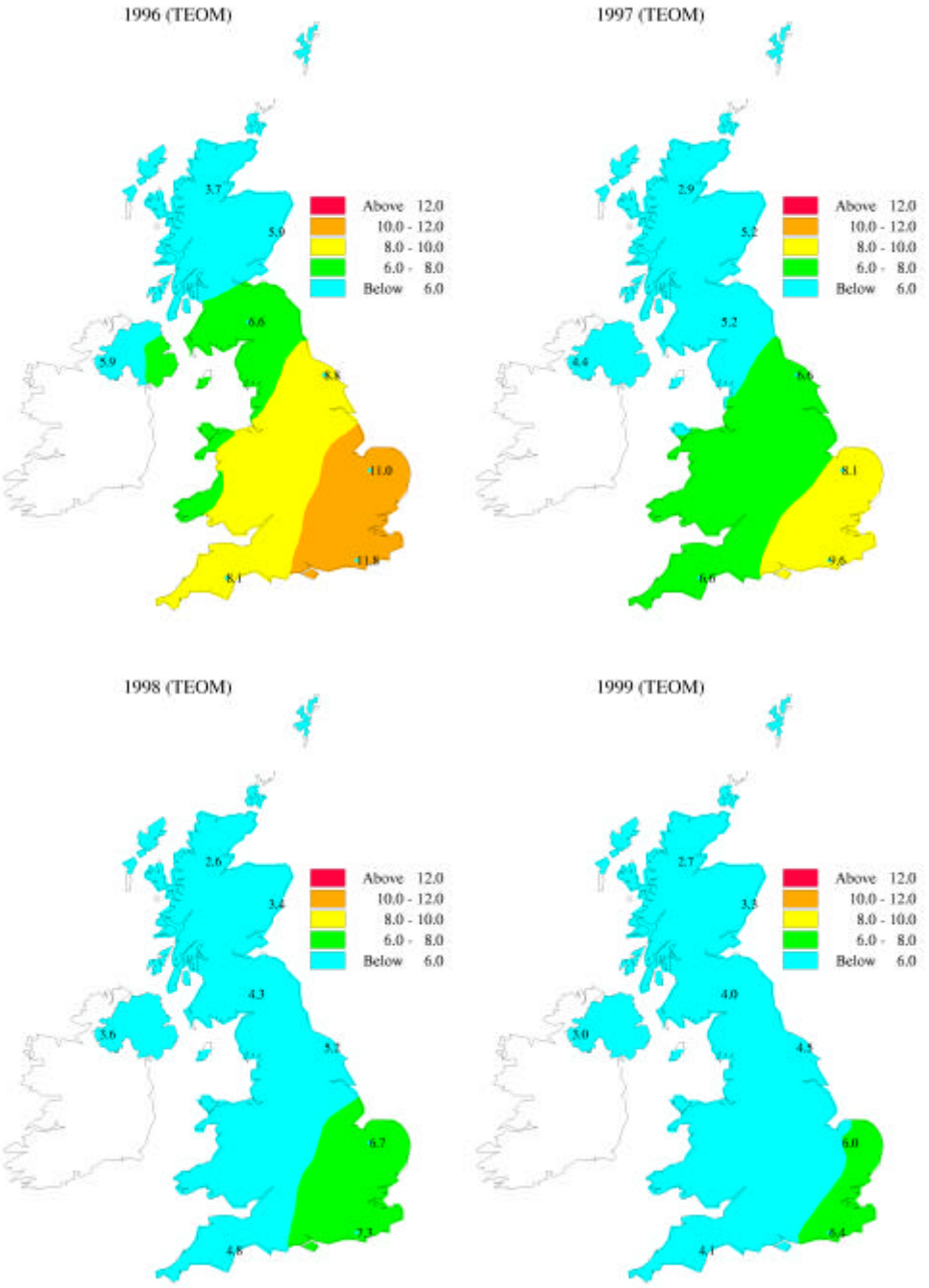

Figure 2: Interpolated secondary particulate concentration (mg m^{-3}, TEOM) 1996 to 1999.

"Other"

The other component was estimated by adding to a constant concentration of 7 µg m^{-3} (TEOM), a component derived from emissions from the construction industry. It was estimated as follows:

0.2 × sum of PM_{10} emission from construction industry in 5 km square around each 1 km square, where 0.2 is a dispersion coefficient derived from previous work.

Model validation for predicted PM_{10} concentrations

The validation of the area source model, of the secondary component methodology and of the estimation of the "other" component has been provided in previous studies by John Stedman and colleagues at NETCEN. Measured annual mean concentrations for 1997 and 1998 were compared to the predicted annual mean concentrations in Figures 3a and 3b, respectively. For about half the sampling sites in each year there is good agreement between measured and predicted concentration. For other sites such as Port Talbot, Leeds Centre, Sheffield Centre, Swansea, Hull Centre, Redcar and Liverpool the predicted concentrations are underestimated due to the influence of other sources not treated by the area model.

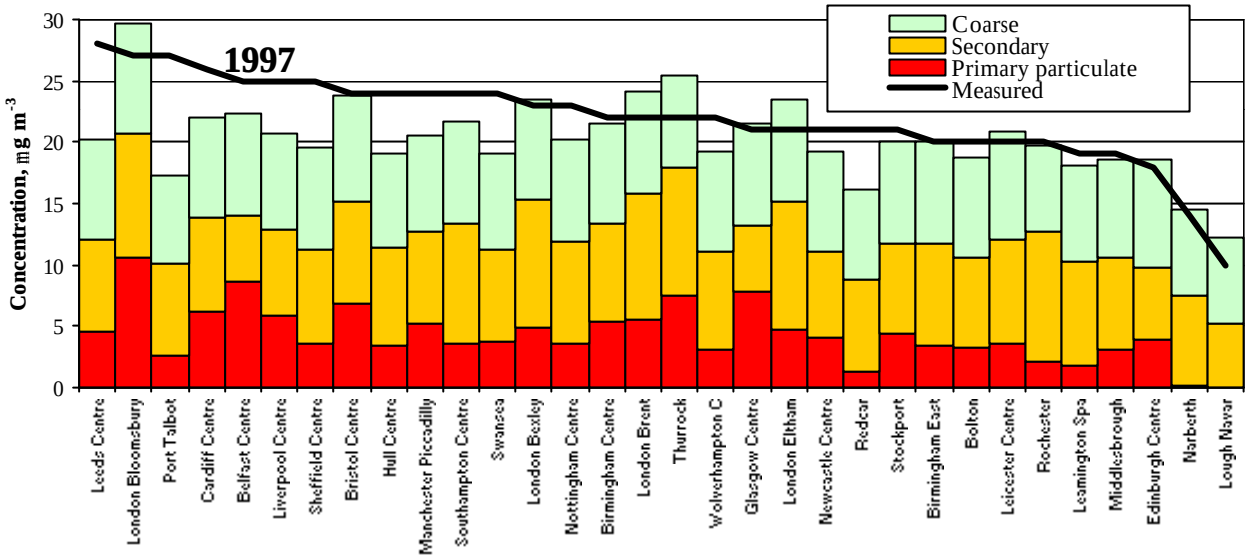

Figure 3a - A comparison of measured and predicted PM_{10} concentration (TEOM) in 1997.

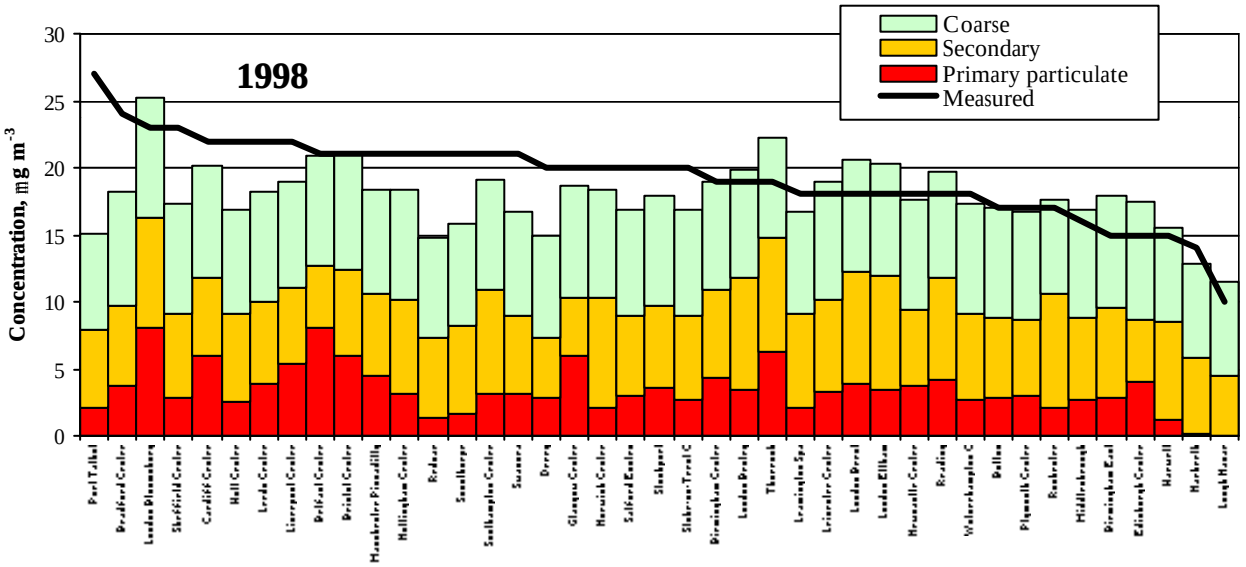

Figure 3b - A comparison of measured and predicted PM_{10} concentration (TEOM) in 1998.

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