Emissions Inventories

4

with increasing distance from evaporative sources.

4.1 INTRODUCTION

An emissions inventory is a compilation of all sources of pollution within an area. It typically includes information from three major types of source:

- *Point sources - emissions from individual points, e.g. a factory chimney, that are significantly large to be worth separate identification;*
- *Line sources - emissions that can only be quantified along a defined line e.g. a road, railway or aircraft flight path;*
- *Area sources - emissions that are assumed to be distributed over an area, generally map grid squares. These consist of emissions which are not sufficiently significant to warrant the extra time and cost to identify individual point and line sources e.g. roads other than major roads and building heating systems.*

Atmospheric emissions inventories are an essential tool in air quality management. They enable examination of the spatial distribution of the emissions of pollutants across a region and the assessment of the relative significance of different sources of emission. Emission estimates are an essential input to dispersion modelling.

Emission inventories had to be compiled for all authorities undertaking dispersion modelling. In addition to these, some local authority groups were specifically asked to compile an emissions inventory as one of their tasks. This chapter summarises the emissions inventory work carried out by the following First Phase authority groups:

- *Aberdeen were asked to construct an emissions inventory for NO_x and PM_{10} covering a 10 x 10 km area of the city centre*
- *Merseyside were asked derive emissions of SO_2, PM_{10} and VOC for modelling purposes and Glasgow were asked to examine different methods of constructing an emissions inventroy*
- *Emission estimates of VOCs were compared by Hampshire and Tyne and Wear*
- *The West Midlands authorities were asked to assess the validation of their local urban inventory compiled by London Research Centre*
- *Belfast and South Yorkshire authorities investigated emissions from domestic solid fuel use.*

The methods used to estimate the emissions from point sources can be classified according the amount of detailed local data that has been collected as follows:

1. *Standard: In this approach, estimates of emissions from Part A and Part B processes were derived using only the information available on the public registers.*

2. *Enhanced: In this approach, companies were approached by telephone or site visits. Where no data on emissions are available, throughput data were collected and default emission factors used to calculate emissions.*

3. *National: The results from methods 1 and 2 above were to be compared with the national inventory which, at the time, was spatially disaggregated on a 10 x 10 km grid square basis*. An analysis of how much additional information is obtained using methods 1 and 2 as compared with the national data set is to be undertaken.*

** Now on a 1 km x 1 km² basis.*

4.2 A NO_X AND PM_{10} EMISSIONS INVENTORY FOR ABERDEEN

Aberdeen was asked to construct an emissions inventory for NO_x and PM_{10} covering a 10 km x 10 km area of the city centre. This proved to be a large and difficult task. However, Aberdeen have succeeded in gathering a wealth of information about local emissions and demonstrated the value of local effort in collating these data. The resulting inventory is far more detailed than the information available at the national level.

Details of the emissions estimates from the source sectors investigated are as follows:

Road Traffic

Information on the number of vehicles using each road within the designated area, vehicle types and

average speeds and a breakdown of road lengths travelled were required. The total quantity of pollutant emitted from each grid square was calculated using appropriate emission factors (g/pollutant/km travelled) for each vehicle type. The local authority Roads Section provided estimates of traffic flows via link and junction counts.

Authorised Part A and Part B processes

There were no Part A processes in the study area. The Scottish Environment Protection Agency supplied information on Part B processes (Table 4.1) with an assessment of the potential for release of NO_x and PM_{10} emissions. Generally the local authority observed that although Part B emission factors should be available from public registers, these data were often incomplete or did not provide the necessary information to compile an inventory. Visits to the industrial premises were required to obtain more data but even then information requested was often unknown.

It was also noted by the local authority that a degree of training in the compilation of emissions is required to undertake this process. Despite receiving assistance and information on use of emission factors from the National Emissions Helpline, local authority staff found the information technically confusing and difficult to interpret and apply.

Non Authorised Point Sources

Boilers of a thermal rating > 2 MW were considered by the local authority sufficiently large to require an estimate of emissions to be calculated. The Council's Property and Technical Services Department was able to assist in the identification of point sources by:

- *providing information on all Council-owned buildings*
- *providing details of a local company which is frequently contracted to service and install boilers within the city of Aberdeen who would be able to advise on individual premises likely to require inclusion, and*
- *offering general advice on types of premises likely to require consideration.*

Ten boilers in the city centre area >2 MW were identified. Questionnaires were sent to these premises to collect the following information: fuel type, annual consumption, burn rate, chimney height

TABLE 4.1. PART B PROCESSES IN THE EMISSIONS INVENTORY AREA IN ABERDEEN.

Premises	*Process*	*Classification*[1]
Blue Circle Cement	Bulk Cement	B
CEBO	Bulk Cement	B
M1 Great Britain Ltd	Bulk Cement	B
Aberdeen Blast Cleaning Services	Coating	C
Ervin Amasteel	Iron and Steel	To close April 1997
M1 Great Britain Ltd	Mineral	B
John Fyfe Ltd	Bulk Cement	B
Cordiners Garage	Vehicle respraying	C
Arnold Clark Automobile Ltd	Vehicle respraying	C
Anderson Cars South	Vehicle respraying	C
Shanks and McEwan Northern Ltd	Waste oil burner < 0.4 MW	C
Castlefield Foods	Animal processing	C
UFP	Animal processing	C
James Conn	Respraying vehicles	C
James Burnett and Son Ltd	Respraying vehicles	C
Halliburton M&S Ltd	Bulk Cement	C
Halliburton M&S Ltd	Coating	C
John Clark Bodyshop	Respraying vehicles	C
Scotoil Services Ltd	Gringing of Barytes	C
BW Mud Ltd	Grinding of Barytes	C
Northern Eastern Farmers	Animal Feed Compound	C

[1]*The classification code is A: high potential for PM_{10} or NO_x emissions; B: medium potential for PM_{10} or NO_x emissions; and C: low potential for PM_{10} or NO_x emissions.*

and diameter, gas exit velocity and temperature (the chimney and gas exit parameters are used in dispersion modelling). Each of the premises were visited by Local Authority staff to ensure receipt of information. While the parameters required for dispersion modelling were not always available or known, all except one were able to provide a throughput of fuel which enabled an emission to be estimated. Emission factors were supplied by the National Emissions Helpline. However, difficulties were experienced by the Local Authorities in computing emissions due to uncertainty as to how to manipulate data into compatible units. A range of units were encountered (e.g. therm, MW, Btu, KJ) and the conversion factors to be applied were not known and so emissions could not be calculated.

Rail Transport

Aberdeen has a railway station located within the designated emission inventory area. The station receives mainly Intercity passenger trains with a limited freight service. The following data were collected for the emission inventory:

- *train movements in and out of the station*
- *number and type of traction engines*
- *rail km travelled within each 1 km² grid*
- *emission factors for each type of traction engine.*

Train details were obtained from the various companies operating from the station and emission factors were obtained from the National Helpline. Emissions were calculated for the three 1 km x 1 km grid squares which contained rail track and are summarised in Table 4.2.

Marine Transport

Emissions from the harbour area are included in the emissions area. Details of shipping movements and activities were obtained from the Aberdeen Harbour Board. Activities included fish landing, loading /offloading operations, repairs, passenger ferry services and refuelling operations. This resulted in 4518 vessels berthed in 1996 with a total gross tonnage of 4,694,481. The following information was necessary to enable calculation of the emission:

- *% harbour area within each 1 km² grid square and vessel distance travelled*
- *tonnes of shipping*
- *energy consumption rate per tonne per km*
- *fuel emission factors*

The average energy consumption rate for UK shipping was taken from the London Research Energy Study and the vessel emission factors were taken from Lloyd's Register of Shipping Exhaust Emission Research Programme.

Total emissions were calculated: NOx totalled

TABLE 4.2. EMISSIONS OF NO_X AND PM_{10} FROM RAIL TRANSPORT IN THE ABERDEEN AREA

Square*	Distance travelled (km)	Train type	No of train journeys/ week	NO_x emissions factor (g/km)	NO_x emissions rate (g/s)	Total NO_x emissions rate for grid square (g/s)	PM_{10} emission factor (g/km)	PM_{10} emissions rate (g/s)	Total PM_{10} emissions rate for grid square (g/s)
B	1	Class 56 locomotive	10	257.5	0.0043	0.0143	8.10	0.0013	0.00138
		Sprinter	196	38.3	0.01		0.24	0.00008	
		Class 57 locomotive	0						
		Intercity 125	0						
F	1	Class 56 locomotive	20	257.5	0.009	0.0451	8.10	0.0003	0.00108
		Sprinter	456	38.3	0.029		0.24	0.0002	
		Class 57 locomotive	12	127.5	0.0013		8.1	0.00008	
		Intercity 125	18	194.8	0.0058		194.8	0.0005	
I	1.3	Class 56 locomotive	20	257.5	0.01	0.0561	8.10	0.0003	0.00306
		Sprinter	456	38.3	0.037		0.24	0.0002	
		Class 57 locomotive	12	127.6	0.0016		8.1	0.0001	
		Intercity 125	18	194.8	0.0058		194.8	0.00066	

* Aberdeen grid square reference

Sprinter and Intercity 125 trains were assumed to have 2 traction units per train. Each Class 56 diesel locomotive (freight trains) was assumed to have made a return journey.

0.44 g/s and PM_{10} totalled 0.039 g/s. The calculations only included vessels leaving and entering the harbour as no information was available for other harbour activities such as loading/unloading or refuelling.

Small Diffuse Sources from the domestic, commercial and service sector

Emissions arising from heating systems in homes and commercial properties were also considered by the local authority. The main fuel used for heating in Aberdeen city centre is from electricity or gas rather than coal or oil. The larger number of suppliers in the UK domestic energy market can make collection of usage data difficult. For example, deregulation of the gas supply industry means a proportion of the commercial and industrial gas market has been distributed to independent suppliers for which there is no central data collation.

4.3 MERSEYSIDE

The Merseyside authorities modelled the dispersion of SO_2, PM_{10} and VOC emissions from industrial sources. Obviously, an emissions inventory had to be compiled first. Annual emissions of sources included in the modelling study are summarised in Table 4.3. In this case, only VOCs that were considered to be "photochemically active" were included in the inventory and organochlorine compounds were excluded. Emissions were either taken from estimates provided by the process operator or the Environment Agency or were calculated using available data. For example, emissions from Pilkington Brothers were calculated from stack monitoring data.

4.4 GLASGOW

This group was asked to assess the value of using different methods of constructing an emissions inventory for CO, NOx, benzene, 1,3-butadiene, PM_{10}, SO_2, lead and volatile organic compounds from Part A and Part B processes.

There are a large number of Part A and Part B processes in an area the size of Glasgow and information was gathered on 80 processes. As Part A and Part B process regulation is the

TABLE 4.3. SIGNIFICANT INDUSTRIAL SOURCES AND 1996 EMISSION RATES ON MERSEYSIDE (TONNES PER ANNUM)

Source	*Process authorisation*	*Process description*	*Sulphur dioxide (tonnes per annum)*	*Particulate Matter (tpa)*	*VOCs (tpa)*
Powergen Ince, Ellesmere Port	Part A	Oil/Orimulsion fired power station	54,739	378	–
Powergen Fiddlers Ferry, Warrington	Part A	Coal fired power station	75,000	1,861	–
Shell Stanlow, Ellesmere Port/Wirral	Part A	Oil refinery	20,236	149	15,300
Shell Tranmere, Wirral	Part A	Oil Storage facility	–	–	209
ICI Merseyside Operations, Runcorn, Halton	Part A	Fluorochemicals manufacture	–	–	525
ICI Weston Point Station, Runcorn, Halton	Part A	Coal fired power station	104	–	–
ICI Sulphuric Acid Plant, Runcorn, Halton	Part A	Sulphuric acid production	440	–	–
Ford Motor Company, Halewood, Knowsley	Part A Part B	Boiler House Paintshop	22.5 –	9 –	– 538
Pilkington Brothers, St. Helens	Part B	Glass manufacture	4827	447	–
Cargills PLC, Bootle, Sefton	Part B	Vegetable oil extraction	–	69	864
Printpack Ltd, St Helens	Part B	Printing process	–	–	1700
Bridgewater Paper, Ellesmere Port	Part A	Paper plant	2129	1072	–

responsibility of the Scottish Environment Protection Agency (SEPA) a local authority officer spent time at the SEPA offices collating data. The collation of data from both Part A and Part B records as part of the 'standard' method required 315 hours of effort. While generally successful, a variety of information was not available from the public register, including specific pollutant information, discharge information, discharge rates, measured emissions, flue gas temperatures, throughput rates and flow rates.

As part of the 'enhanced' method, companies who had incomplete or missing data on the public register were contacted by telephone or visited. However, the usefulness of this exercise was questioned as it was apparent that the majority of the process operators had little or no data on the emissions from their processes. Emissions estimations were not attempted with the collated data. The time required to undertake this task was 50 hours.

4.5 LOCAL EMISSIONS INVENTORIES: CONCLUSIONS

National emissions inventories do not include a detailed "bottom-up" quantification of emissions from individual processes. While those authorities that have access to Central Government-sponsored local emissions inventories should find these sufficient for their needs, there is ample information available for better quantification of emissions at the local level. This is a time consuming task however, and the benefits of improved emissions estimates must be balanced against the staff effort and cost required.

4.6 ESTIMATION OF EMISSIONS OF VOLATILE ORGANIC COMPOUNDS

Two of the first phase local authorities compared emission inventories for volatile organic compounds (VOC) constructed using three different methods: "Standard" and "Enhanced" and "National" (as detailed in Section 4.1).

One of the areas (Hampshire and the Isle of Wight) was tasked with looking at Part B processes only, the other (Tyne and Wear) looked at both Part A and Part B processes.

4.6.1 Tyne and Wear

The enhanced inventory for the Tyne and Wear area is summarised in Table 4.4.

TABLE 4.4 ENHANCED VOC EMISSION INVENTORY FOR PART A AND PART B PROCESSES IN THE TYNE AND WEAR LOCAL AUTHORITY AREA (TONNES PER YEAR)

Area	*Part A*	*Part B*	*Total*
Newcastle	0	60	60
Gateshead	208	14638	14846
South Tyneside	63	655	718
North Tyneside	156	788	944
Sunderland	28	600	628
All areas	455	16741	17196

The Tyne and Wear area has a total of 28 Part A and 101 Part B processes which could be clearly identified as using significant quantities of VOCs. Emissions data for Part A processes were provided by the Environment Agency. In the case of Part B processes, emission estimates could be made on the basis of information available on the public register in less than a third of cases (30 processes). Following contact with process operators and the calculation of default emissions rates for some processes in Newcastle, emissions estimates could be made for almost all processes (97 out of 101). Tyne and Wear have therefore achieved a considerable success in deriving emission estimates for over 95% of Part B processes.

The local authorities involved spent a total of 325 hours developing a VOC inventory, indicating that, although it was possible to develop a local inventory, it can require considerable resources. Most time was spent obtaining information from process operators by direct contact. For example, information provided by four of the five local authorities within the Tyne and Wear area shows that data obtained from the public register took on average 1 hour to collect per process, while data collected through direct contact took on average 2.5 hours to collect. In the case of Newcastle, the calculation of default emission rates took on average 8 hours.

More important, however, is the amount of time taken compared with the significance of the emissions from processes. As an example, the effort expended to obtain emission estimates for

Newcastle and Gateshead is shown below:

	Processes	Hours	VOC emission (tonnes)
Newcastle	17	137	60
Gateshead	24	36	14638
South Tyneside	19	21	655

Clearly there is no obvious relationship between the quantity of emissions and the time taken to collect emissions data as a few processes are responsible for a large proportion of the total emissions. The time taken to construct an inventory could be significantly cut without greatly affecting the accuracy if those processes likely to give rise to most of the emission could be identified and detailed emissions data collected for those processes only. Simpler methods could then be used for other processes. This prioritisation could be done fairly easily on the basis of Process Guidance Notes coupled in some cases with Environmental Health Officer's knowledge of processes regulated within their area.

The enhanced inventory is compared with national data in Table 4.5.

TABLE 4.5 COMPARISON OF ENHANCED AND NATIONAL VOC EMISSION INVENTORIES FOR TYNE AND WEAR (TONNES PER YEAR)

	Part A	*Part B*[1]	*Other*[2]
Enhanced	455	16741	–
National	365	4585	27753

[1] Excluding emissions from 'stage 1' petrol distribution which although now covered by the EP Act, would not yet be authorised.

[2] Other includes road and other transport, domestic sources and industrial processes not regulated under the Environmental Protection Act

Although there is reasonable agreement between the two inventories for Part A processes, this is not true for Part B processes - the national inventory estimate is 27% of the figure given in the enhanced local inventory. This difference is probably a reflection of the fact that the national inventory for Tyne and Wear and other local areas does not identify many large Part B processes. Emissions from Part B processes are instead disaggregated from national totals on the basis of employment or population figures, or process numbers. It is probable that the larger part of the Part B emissions included in the enhanced local inventory are from a few processes.

4.6.2 Hampshire and the Isle of Wight

Emission estimates produced for Hampshire and the Isle of Wight are summarised in Table 4.6.

TABLE 4.6 SUMMARY OF THE RESULTS OF VOC INVENTORY STUDIES FOR HAMPSHIRE AND THE ISLE OF WIGHT

Method	*Emission (tonnes per year)*	*Time spent*
Standard	185	190
Enhanced I	2091	237
Enhanced II	2467	54

Note. Enhanced I involved direct contact with process operators while Enhanced II involved, in addition, one local authority using assumptions/ calculations to complete gaps in information obtained from process operators

It is clear from Table 4.6 that, without the use of the enhanced method, the emission inventory would have significantly underestimated emissions in the area. The time spent on standard and enhanced methods was broadly comparable and, on this evidence, the enhanced method seems to be a more cost effective method of obtaining emissions data than searching the public register. As in Tyne and Wear the first phase authority has been able to produce an inventory, although again, the resources necessary were considerable (481 hours).

In total, 144 Part B processes are regulated in the Hampshire/Isle of Wight area. The emissions data are summarised by process in Table 4.7.

A large proportion of the emission comes from a small proportion of the processes. For example 60% of the emission is from 7% of the processes (the 5 printworks, 3 vehicle manufacturers and 2 film coating processes) and by ignoring the combustion processes, non ferrous metal processes and the vehicle refinishing processes, 95% of the emission could be included whilst only including 30% of the processes. The above analysis only considers broad categories of process, and takes into account only the significance of VOC emissions from the processes but does suggest that prioritisation of effort could dramatically cut the resources necessary to construct a local inventory

without significantly affecting the accuracy.

TABLE 4.7 VOC EMISSIONS BY PROCESS IN HAMPSHIRE AND ISLE OF WIGHT

Process type	*Number of processes*	*Emission (tonnes per year)*
Industrial combustion	45	1
Non ferrous metals	4	6
Di-isocyanate	1	33
Printing	5	517
Vehicle manufacture	3	798
Wood coating	3	258
Vehicle refinishing	52	119
Coating of glass, metal, plastic	23	384
Adhesives	1	21
Film coating	2	177
Textile coating	1	19
Timber processes	1	23
Rubber processes	2	71
Seed oil extraction	1	41

The VOC emission estimates derived using the enhanced method are compared with national inventory estimates in Table 4.8.

TABLE 4.8 COMPARISON OF ENHANCED AND NATIONAL EMISSION INVENTORIES FOR HANTS AND ISLE OF WIGHT (TONNES PER YEAR).

	Part A	*Part B*[1]	*Other*[2]
Enhanced	–	2467	–
National	22949	4876	43631

[1] Excluding emissions from 'stage 1' petrol distribution which although now covered by the Environmental Protection Act, would not yet be authorised.

[2] Other includes road and other transpor, domestic sources and industrial processes not regulated under the Environmental Protection Act.

The local inventory estimate is slightly more than 50% that taken from the national inventory. The reason for the difference is likely to be the same as already given in Section 4.5.1 above - the national inventory assumes that emissions from Part B processes are, in large part, proportional to population or employment within a given area whereas this may not be true.

Emissions from Part A processes were not estimated by the local authority neither were emissions from other sources such as industry not regulated under the Environmental Protection Act, domestic sources, and transport. Emissions from these sources are over 93% of total VOC emissions based on the national emission estimates given in Table 4.8. If the local inventory figure for Part B processes is used instead of the national estimate, then the share of Part A, domestic and mobile sources rises to over 96%.

4.6.3 Conclusions

Both local authority groups were able to derive emission estimates for Part B processes located within their areas but found that the use of the standard methodology alone would have led to the derivation of inaccurate inventories.

The resources necessary were considerable, however analysis for the Hampshire/Isle of Wight inventory suggests that prioritisation of effort could have dramatically cut the resouces necessary to construct a local inventory without significantly affecting the accuracy.

There was poor agreement between emission estimates for Part B processes taken from the local inventories on the one hand and from the national inventory on the other. This is not surprising since the national inventory estimates are based on the assumption that emissions from Part B processes in a given area are proportional to the population or numbers in employment in that area.

4.7 SURVEYS OF SOLID FUEL USE IN BELFAST AND THE DEARNE VALLEY, SOUTH YORKSHIRE

Market Research Northern Ireland Ltd were employed to carry out a survey of current and expected future use of solid fuels in Belfast and the Dearne Valley, South Yorkshire, using standard market research techniques. The main objectives of the project were to:

- *assess the extent of household (not smokeless) coal and other fuels (e.g. petroleum coke) burnt;*
- *predict future fuel usage;*
- *identify barriers to the use of less polluting fuels;*
- *provide data for compilation of emissions inventories.*

TABLE 4.9. USE OF SOLID FUEL IN BELFAST AND THE DEARNE VALLEY

	Number of households burning solid fuel	Number of households burning unauthorised fuels	Winter consumption per household per week (kg)	Total unauthorised fuel consumption per week (tonnes)
Belfast	24,000 (23%)	2,500 (lower estimate)	49 (lower estimate)	180 (lower estimate)
		4,000 (upper estimate)	103 (upper estimate)	280 (upper estimate)
Dearne	8,400 (25%)	1,100	77 (lower estimate)	110
			134 (upper estimate)	

The researchers used a carefully designed sampling plan in which electoral districts (EDs) were classified according to social variables such as distribution of housing type, tenure, social class and age. EDs were then grouped into "high" and "low" risk areas with respect to the likelihood of solid fuel use. The survey team then sought 75% of respondents in "high" risk EDs and 25% in low risk EDs. This gives a more reliable result than a randomly selected sample. Reported results were then weighted to reflect overall households. Around 1,000 completed responses were gathered in each Authority area.

Key results are summarised in Table 4.9. Around a quarter of homes in these areas use solid fuel, mostly authorised "smokeless fuels". A significant proportion of solid fuel users used "unauthorised" fuels, including petroleum coke which have not been assessed for smokiness and sulphur content by the Department of the Environment, Transport and the Regions. These may therefore have a sulphur content higher than the 2% limit set down in the regulations.

4.7.1 Household fuel use

The survey also provided detailed information on the mix of fuels used. These data are summarised in Table 4.10. Although the proportion of homes in each of the two Authorities' areas burning solid fuel are similar, the overall fuel use is very different. Whereas gas is the principal fuel in England, oil is the main fuel in Northern Ireland. Also, where solid fuel is being burnt, different fuel brands are being used in each area. This information is potentially of great use in the compilation of a domestic source emissions inventory. Emission factors have been derived for the burning of various fuel types in the Belfast study. PM_{10} and SO_2 emission factors are given in Table 4.11 and Table 4.12.

Of those household using solid fuels, only a few were planning to change to alternatives in the next five years. In Belfast, only 3% were definitely planning to change while 93% were definitely not planning to change. In Dearne 95% were not planning to change

TABLE 4.10. FUEL USE IN HOUSEHOLDS IN BELFAST AND THE DEARNE VALLEY – Electoral districts were classed as either high or low risk with respect to the likelihood of solid fuel use.

Main Fuel (% of households)				
		high risk	*low risk*	
				Weighted Total
Belfast	Oil	35	73	65
	LPG	1	2	2
	Electricity	7	16	16
	Solid fuel	7	9	17
Dearne	Oil	0	0	0
	Gas	75	69	72
	Electricity	5	3	4
	Solid fuel	20	28	24

Types of solid fuel (% of solid fuel users)				
		high risk	*low risk*	
				Weighted Total
Belfast	Coalite	3	8	6
	Anthracite	11	18	15
	Pet Coke	0	5	3
	Housecoal	5	8	7
	Premium Esse	20	26	23
	Burnglow/Euro Anthracite	35	15	25
	Extracite	6	3	4
	Don't know	14	18	16
Dearne	Coalite	22	19	21
	Anthracite	10	16	13
	Phurnacite	37	37	37
	Pet Coke	14	0	7
	Housecoal	3	1	2
	Don't know	14	18	16

TABLE 4.11 AVERAGE PM_{10} EMISSION FACTORS ON AN OPEN AND CLOSED FIRE APPLIANCE IN mg OF PM_{10} PER kg OF FUEL BURNT.

OPEN	
Fuel Type	*Emission Factor (mg/kg)*
Household Coal	9000
Texan Star Coal	11000
Coalite	1600
Calco	2300
Budget Blend	2800
Redflame	880
CLOSED	
Extracite	1200
Calco	2600
Budget Blend	3200
Burnglow	1000
Premium Esse	1200

TABLE 4.12 SO_2 EMISSION FACTORS FOR EACH FUEL TYPE (g PER kg OF FUEL)

Fuel Type	*Emission Factor (g per kg of fuel)*
Household Coal	10
Texan Star Coal	25
Coalite	21
Calco	58
Budget Blend	32
Redflame	16
Extracite	27
Burnglow	18
Premium Esse	14