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An Air Quality Strategy for Jersey

A report produced for the States of Jersey

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Executive Summary

In 1999 the Planning and Environment's Monitoring Group formed for an Air Quality sub group to produce an Air Quality Strategy for Jersey. This group consisted of representatives from the Environmental Services Unit of the Planning Department, Environmental Health now Health Protection and the Public Services Department.

The Strategy was to address the following objectives:

1. To provide an inventory of significant sources of local pollution and pollutants.

2. To determine appropriate standards to be complied with.

3. To identify those areas where the standards are exceeded.

4. To establish appropriate action plans for improvement, with clear accountabilities for delivery.

5. To design a monitoring programme capable of assessing the efficiency of the above action plans.

6. To provide an estimate of the costs implementing the monitoring programme.

7. To raise public awareness of air quality in Jersey.

The strategy was produced with the assistance of the UK consultants AEA Technology. The strategy is to be submitted to the Environment and Public Services Committee for their endorsement. It is anticipated a steering group chaired by Health Protection will be formed to begin implementation of the action plans and raising public awareness. Health Protection are responsible for protecting and improving the public's health in relation to amongst other things air quality, drinking water and food safety. These areas of work are undertaken by staff with appropriate professional qualifications and training.

In Jersey the principal air pollutant of concern is nitrogen oxides (NOx) where about 68% of the total emissions in Jersey are from road transport sources (NB nitrogen oxides are converted to nitrogen dioxide (NO_2) in the atmosphere). The nitrogen dioxide pollution hot-spots are at Georgetown in St Saviour, Beaumont in St Peter and in St Helier: First Tower, the Bus Station, Broad Street and La Pouquelaye. Other sites also show elevated levels of nitrogen dioxide including Le Bas Centre, Mont Felard, Robin Place, Savile Street/Rouge Bouillon and Bereford Street. Measurements indicate that the European limit value, which has been set for the protection of human health, is currently being exceeded at some of these sites.

Other sources of air pollution have been considered including the power station at La Collette. This station now ceases operation for a significant part of the year over the summer period with a consequent reduction in emissions.

The municipal waste incinerator at Bellozane valley does not comply with EC Directive 89/369/EC and is to be replaced in the next 5 years with a new facility meeting the latest European Union emission standards. The Health and Social Services Crematorium is over 30 years old and does not comply with the UK Environmental Protection Act process guidance note PG5/2(91). There is a proposal to replace the existing cremators in the next 12 months with 2 new units.

In addition to striving to meet EU legislation on air quality, which has been set for the protection of human health, the States of Jersey has international obligations to reduce greenhouse gases under the UN Climate Change Convention.

The most challenging issue for Jersey is the improvement needed in road transport related emissions. Fifteen options have been provisionally assessed in terms of their cost effectiveness at reducing the emissions in the required geographical area. The most cost effective options are listed below:

- Compulsory, periodic testing of vehicle emissions (MOT)
- Park and Ride schemes in St Helier
- Parking (including charges and on street parking restrictions)
- Urban bus schemes
- Vehicle scrapage subsidies
- Vehicle access limits
- Variable tax on engine size and age
- Pedestrianisation
- Alternative fuels
- Walk to school plans
- Traffic management

It is recommended that the States of Jersey carry out a feasibility study into each of these options to determine the cost effectiveness of achieving a measured air quality improvement, and to quantify other potential, socio-economic benefits and impacts.

It is also recommended that the island undertakes continuous monitoring for NO_2 and PM_{10}. For the first year at least, this should be at the highest known pollution "hotspot" (Weighbridge). Once compliance with the Daughter Directive(s) is confirmed at this location, the site could be relocated to an area more representative of general population exposure (eg residential or urban background).

This approach would best be satisfied by purchasing a mobile (or movable) installation. Depending upon the specification, this would involve a capital cost of between £30-40,000, with ongoing costs of approximately £10k per annum (although a lot of this could be offset with skilled/trained local staff). Funding from the Environment fund has already been earmarked for this proposal.

The air quality strategy implementation plan should be managed by Health Protection who would be responsible for communication and integration with other related Island strategies including the Sustainable Transport Strategy, the Island Plan and Sustainability Strategy. Indicators to measure the success of the air quality strategy, and the options chosen to decrease emissions, should be clear from the onset of the implementation. These should include monitoring of air quality, traffic flow reductions, traffic speed increase where there is current congestion and passenger numbers using public transport. Indicators to determine the impact on other environmental and socio-economic issues should also be considered, such as the measurement of noise.

Effective communication of key information will be required to ensure that the suggested transport improvement measures achieve improved air quality and are regarded as socially acceptable for those living and visiting Jersey. Good communication between the stakeholders is also important. Awareness raising campaigns to deliver the messages particularly in relation to the choice of transport mode will be necessary to ensure uptake of policies to deliver air quality targets.

Contents

Glossary

DEFRA	UK Government Department of the Environment, Food and Rural Affairs.
Objectives	are set based on standards, economic efficiency, practicality, technical feasibility and timescale. Typically, an objective will contain a standard, a target date and may be coupled with allowable exceedances.
COMEAP	The Committee on the Medical Effects of Air Pollutantsreports to the Department of Health and discusses health issues.
EPAQS	The Expert Panel on Air Quality Standard reports to the Defra on proposed health based standards for air pollutants.
Standards	are set purely (by EPAQS) on the basis of medical and scientific evidence of how each pollutant affects human health.
NAQS	National Air Quality Strategy - the overarching strategy that UK local authorities must work to comply with the **Environment Act 1995.**
LAQM	Local Air Quality Management, the regime in which UK local authority Environmental Health departments are expected to review and monitor ambient air pollution and ensure it attains Government NAQS standards.
LAPC	Local Authority Pollution Control, the system by which councils regulate the smaller industrial processes.
APEG	Currently disbanded, the Airborne Particle Expert Group has overseen much of the research work and policy formation concerning particles.
QUARG	The Quality of Urban Air Review Group, now defunct, and whose functions were taken over by APEG.
$\mu g\ m^{-3}$	Micrograms per cubic metre. European directives measure pollutants in $\mu g\ m^{-3}$.
µm	One µm, referred to as one micron, is a thousandth of a millimetre. For example, the particle measure PM_{10} refers to particles 10 microns or less in diameter.
PM_{10}	Particles (also known as particulates) of a mean aerodynamic diameter of 10 microns. Particles of sizes $PM_{2.5}$ to PM_{10} are often referred to as the coarse fraction, $PM_{0.1}$ to $PM_{2.5}$ are referred to as

fine particles and those below $PM_{0.1}$ (0.1 microns or 100 nanometres) referred to as superfine particles.

PPC Pollution Prevention and Control legislation originating from a EU Directive, which supersedes IPC (Integrated Pollution Control)

1 IMPORTANCE OF AIR QUALITY

Air is all around us and is essential to life. Polluted air damages health, particularly affecting the most vulnerable in society – the very young and the old. Maintaining good air quality is therefore vital to our long term well being.

Pollutants come from a wide variety of sources including traffic, industry, power generation and domestic activities. Sources of some of the most common pollutants are given in Box 1.

Box 1: Main sources of Air Pollution

Benzene – Motor vehicles account for approximately 90% of emissions in Jersey which includes car refuelling and storage of fuel.

Carbon Monoxide (CO) – Road transport accounts for a significant proportion of emissions

Lead (Pb) – Most airborne lead in the UK arises from motor vehicles. The increasing use of unleaded petrol should cause emissions to fall.

Nitrogen dioxide (NO_2) – Road transport accounts for approximately 40% of total emissions, electricity generation about 19%, shipping about 9% and domestic sources about 4%.

Particulates (PM_{10}) – Road transport contributes a large proportion of the local emissions of particulates. The incinerator and power station on Jersey will also be significant sources. A significant proportion will come from sources outside of Jersey.

Sulphur dioxide (SO_2) – On Jersey the power station and incinerator account for a significant amount of local emissions. Domestic fires make a significant contribution in coal burning areas.

More information on the sources and effects of the main air pollutants affecting Jersey (e.g. NO_2 and PM_{10}) can be found in Appendix A.

In the UK the major air pollutants of concern for the protection of human health are nitrogen oxides and particulate matter. The main contributor to these pollutants is road transport emissions. Industrial emissions of pollution do not, in general, result in exceedence of standards in the UK. This is also true for Jersey.

1.1 Air Quality In Jersey

Jersey is the largest Channel Island at 45 square miles and is only 14 miles from France. It has a population of approximately 87,000 people (Ref: 2000, Census) and at first glance would seem not to have any air quality problems because of the lack of industry and perception by non-islanders that it is possible to walk or cycle everywhere. In reality Jersey has a culture of car dependency, and partly due to its affluence and lack of any Ministry of Transport test (MOT) the number of vehicles has risen to over 94,000 and 83% of households have access to at least one vehicle. Jersey's capital St Helier, unlike many other similar sized towns in the United Kingdom has limited pedestrianisation and vehicles dominate the town centre streets.

Jersey's prevailing wind directions are south westerly, westerly or north westerly. It is accepted that the strength of prevailing winds play a key role in preventing conditions ideal for increased air pollution. As Jersey is an Island it should be less likely to suffer from chronic air pollution episodes than inland UK towns.

Many of the streets in St Helier are canyon type streets which means that air pollution takes longer to disperse and is less affected by wind speed and direction than say an open site.

1.2 The Need For Change

It has already been acknowledged in other Island plans and strategies (Island Plan, 2002 and Sustainability Strategy) that air quality is a matter of concern at certain hot-spots such as the Bellozane Incinerator and certain streets in St Helier due to traffic emissions.

Two important principles, namely the Precautionary Principle and the Polluter Pays Principle have already been endorsed by the States of Jersey in pollution reduction efforts. The Precautionary Principle is important as the major concern of air pollution is the protection of human health. It is well established that prevention is better than cure. Traditional public health approaches have primarily tried to influence individual behaviour. Environmental protection aims at collaborative action to improve a common environment. A key principle of the European Union's environmental policy is that the cost of preventing pollution or of minimising environmental damage due to pollution should be borne by those responsible for the pollution.

The States of Jersey have committed to achieving standards that are as good as or in excess of those applying in the European Union which includes meeting air quality standards within the next 3 to 7 years. In addition, the States of Jersey have international obligations under the Climate Change Convention to reduce emissions of greenhouse gases. It is therefore timely and appropriate that an air quality strategy for Jersey is produced.

The principles of an Air Quality Strategy for Jersey are that:

- It should afford the best practicable protection to human health and the environment taking a precautionary approach where necessary;

- It should take full account and work towards the air quality standards set out in the EU air quality daughter directives, while providing the opportunity for stricter national objectives for some pollution where this is considered appropriate.

- In addition to the health and wider environmental effects of the pollutants, objectives should take account of the practicability of abatement or mitigation measures, their costs and benefits, and other social and economic factors.

- The costs of any pollution abatement should be recovered from those responsible for causing pollution.

- Account should be taken, as far as possible of developments in European legislation, technological and scientific advances.

- Consideration should be given to other Jersey strategies and policies, in particular the Island Plan, Sustainability Strategy and the Island Sustainable Transport Policy to ensure an integrated and consistent approach between Departments.

- Raising public awareness and providing accurate information is vitally important in changing knowledge and attitudes to the importance of air quality.

2 ENVIRONMENTAL IMPACTS OF AIR POLLUTION

Emission estimates were made for a wide variety of pollutants. Each pollutant species is important for one or more impacts- whether it is a toxic compound or contributes to global warming or reduces the ozone layer. Therefore when determining which pollutants are important for Jersey, the importance of the different environmental impacts should first be considered.

In addition, it is important to consider absolute emissions. These place the different environmental impacts in some context. The population of Jersey is approximately 0.1% of the UK, and hence impacts on e.g. global warming are insignificant compared with the UK. Indeed, for Oxides of Nitrogen (NO_x) and Non Methane Volatile Organic Compounds (NMVOC) the emissions from Jersey represent less than 0.3% and 0.2% of the UK total respectively. When the uncertainties associated with the UK total are considered- some 10%, it is clear that the emissions from Jersey are insignificant within the UK or national context. However on a very local level (on particular roads) emissions in Jersey are significant and action should be taken at the local hotspot level. Only local action will bring about an improvement in local air quality in St Helier.

2.1 Greenhouse Gases

Increasing atmospheric concentrations of greenhouse gases (GHGs) originating from anthropogenic(ie man made) activities are leading to enhanced warming of the atmosphere and global climate change. The major greenhouse gases are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) all of which have both natural and anthropogenic sources. In contrast, the three industrial gases: hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6), are potent greenhouse gases but do not occur in nature, and hence only originate from anthropogenic sources.

GHG emission estimates for Jersey were made in 1997. CO_2 emissions arose from a number of sources including electricity generation (36%), transport (23%), other sources (32%) and waste incineration (9%). Jersey is committed to the United Nations Framework Convention on Climate Change (UNFCCC). The Bonn Agreement of the Kyoto Protocol of this Convention requires the UK achieve a 12.5% reduction on 1990 levels of greenhouse gases, within the European Union burden sharing mechanism by 2008. The UK aims to move beyond the Kyoto target and reduce its own CO_2 emissions by 20% below 1990 levels by 2010.

In Jersey approximately one third of greenhouse gas emissions are derived from vehicular sources. It is therefore important to note that any actions to reduce air pollution from road transport in Jersey should also aim to reduce greenhouse gas emissions. Indeed, it will be essential to reduce emissions from road transport for Jersey to meet this obligation.

2.1.1 Ozone Formation (O_3)

It is important to differentiate between stratospheric ozone (15-50 km above the earth), which occurs naturally and filters out much but not all the ultra violet radiation reaching the ground. Stratospheric ozone levels are being depleted by Chlorofluorocarbons (CFCs), along with other chlorine and bromine containing compounds, which is having serious health effects on the health of all living things and world climate.

Chlorofluorocarbons (CFCs), along with other chlorine and bromine containing compounds are used as refrigerants and in the insulation of refrigerators and since approximately 1990 refrigerators have been de-gased in Jersey. They are then shredded and the metals recovered. There is no facility on the island at present to allow separation and incineration of CFC contaminated insulation from waste refrigerators. It is likely that end of life refrigerators will have to be exported to the UK for disposal.

Ozone is also created in the lower atmosphere or troposphere (i.e. ground level to 9 km) as a result of chemical reactions involving vehicle/fossil/industrial emissions and sunlight. These chemical compounds involved in the reactions are called “ozone precursors” e.g. Volatile Organic Compounds (VOCs) and Oxides of Nitrogen (NO_x).

High concentrations of ozone in the troposphere can also have adverse impacts on human health as it is a respiratory irritant. For this reason, pollutants, which are “ozone precursors” are often subject to scrutiny and strategies to ensure reduced emissions. However, ozone impacts at the regional scale, because it takes time for the ozone precursors to react to generate ozone. Given the geographical position of Jersey, ozone formation is not considered a priority issue.

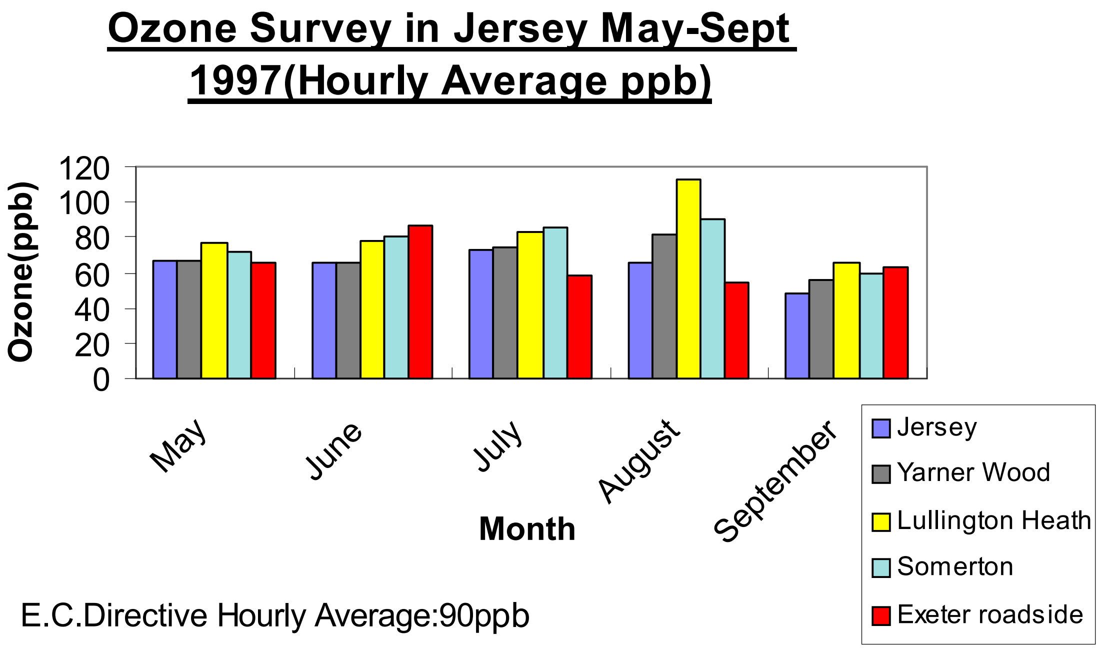
2.1.2 Ozone in Jersey

It should be noted that Jersey is signed up to the NO_x and VOC protocols (both are ozone precursors) as part of the UK. However the reduction targets are applied to the UK and associated territories as a whole, and there are no specific targets for Jersey alone.

The States of Jersey has however monitored ozone at Haut de la Garenne during May to September 1997. Highest concentrations of ozone are expected during the summer months in rural locations. In general concentrations recorded in Jersey were similar to those in the UK mainland. The average ozone for the monitoring period was 37ppb(parts per billion); average background concentrations in rural environments tend to be approximately 35 ppb during the summer months

Photograph 1: The air pollution monitoring equipment housing is shown below.

Figure 2.1



Ozone is formed as a result of chemical reaction between emissions in strong sunlight, a reaction that can take hours to days to occur. As the sources of the ozone pollution in Jersey are often hundreds of miles away, any localised action plan to reduce measured concentrations will have minimal local effect.

2.2 Acidification and Transboundary Pollution

The deposition of acidifying species (eg sulphur dioxide SO_2 and nitrogen dioxide NO_2 which can undergo chemical reactions in the atmosphere to produce acid rain) can have adverse effects on buildings and vegetation, as well as acidifying streams and lakes and damaging the aquatic environment. The transport of acidic species in the atmosphere can be over large distances. However, given the various human activities on Jersey, and the distances to other large land masses, this is not considered to be an issue of highest importance. Nevertheless Jersey must work towards meeting its obligations under the Convention on long-range transboundary air pollution. This protocol is associated with the reduction of emissions of pollutants associated with this environmental impact.

2.3 Local Air Quality

It is the management of local air quality, which is considered to be the priority for the States of Jersey. Although the various anthropogenic activities and geographical situation gives rise to little impact on neighbouring islands, there may be significant impacts on the local population. The extensive use of road transport combined with canyon streeting can trap air emissions in areas frequented by the public. Therefore the focus of the air quality strategy employed by the States must address emissions and public exposure at the local level.

2.3.1 Source Sectors

a) Vehicles

In Jersey in 2001 there were over 94,538 vehicles registered. It is believed a higher proportion of these vehicles are older in Jersey compared to the UK. Approximately 30% are over 10 years old (Ref: Driver and Vehicle Standards Department). The UK Automobile Association has stated that 50% of carbon monoxide emissions are produced by 10% of vehicles with poorly adjusted engines. The lack of an MOT test, generally shorter journeys and high cold start emissions, has lead to high measured concentrations of nitrogen dioxide (NO_2) in St Helier. These emissions from congested traffic in St Helier are not able to readily disperse owing to the nature of the street canyons. Consequently, the current levels measured at certain sites are above the European limit values set for the protection of human health.

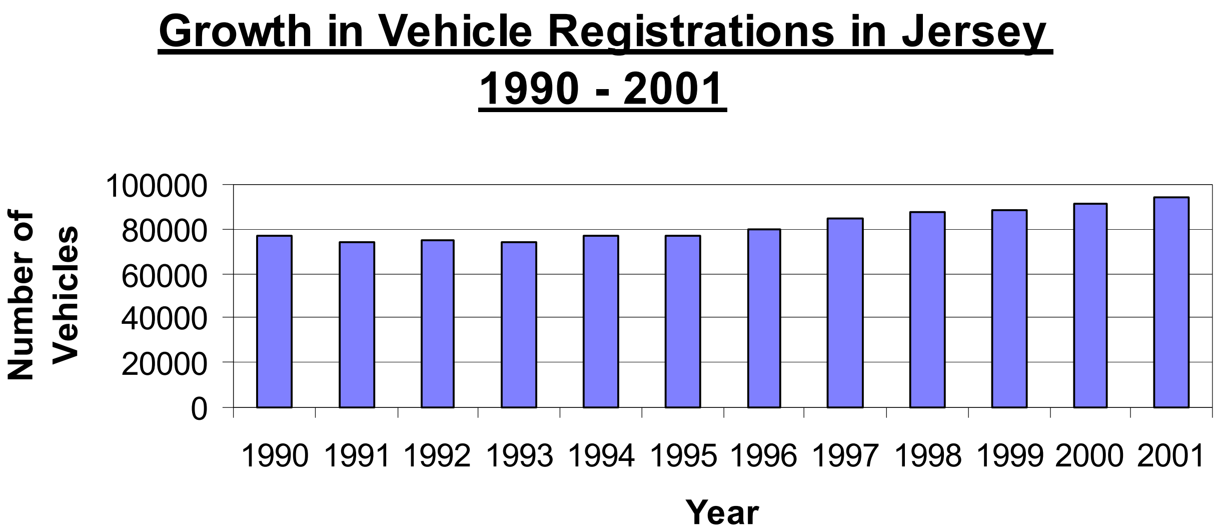
The graph overleaf shows a steady year on year increase in vehicle registrations in Jersey. The true figures are uncertain because the exact numbers of vehicles being scrapped each year is not clear. It is however a concern that the trend continues to rise. Interestingly the number of hire cars, which includes motorcycles and minibuses on the island has fallen from 6102 in 1998 to 4210 in 2000. This is likely to be associated with the downturn in tourists visiting the island.

Jersey is a very car orientated community with one of the highest car ownership levels in the world. Car ownership levels in Jersey compared to other countries are shown below.

Table 2.1 Car ownership levels

Country	Cars/vans per 1000 people
Jersey	620
USA	578
Luxembourg	515
Germany	464
France	419
UK	380
Netherlands	373
Japan	313
Irish Republic	244

Figure 2.2:



As previously mentioned there is virtually no heavy industry in Jersey, and little light industrial activity. This has a significant impact on the relative contribution from different sectors on air emissions. It is also the case that emissions per capita for all types of transport are higher. This is because on a per capita basis, there is increased use of aircraft and shipping as well as motor vehicles. However, there is still some industry in Jersey which causes concern in terms of emission to air.

b) Power station

In Jersey the main emitters of high level sulphur dioxide SO_2 and nitrogen dioxide NO_2 are the JEC oil fired power station and the States of Jersey's municipal waste incinerator. The JEC power station as mentioned earlier shuts down for 6/7 months/year as of March 2002 and when running uses reduced sulphur heavy fuel oil (approximately 1%) . Low nitrogen oxides NO_x burners have also been fitted to the largest boiler thereby reducing levels of NO_2 . In 1999, although the power station was not operating to full capacity emissions were estimated to be 384 tonnes of NO_x

c) Municipal waste incinerator

The States of Jersey's municipal waste incinerator does not comply with EC Directive 89/369/EC and is to be replaced in the next 5 years with a new facility meeting the latest emission standards. The Municipal Waste incinerator emitted 464 tonnes of NO_x in 1999. Emissions from the power station and incinerator will be dispersed seawards during certain wind conditions.

Photograph 2: The Jersey Electricity Company power station.

Photograph 3: The Municipal Waste Incinerator

d) Crematoria
Also, the Health and Social Services Crematorium is 30+ years old and does not comply with current UK Environmental Protection Acts 1990 process guidance note PG5/2(91). Pollutants produced from crematoria could include:- dioxins and furans, mercury, particulates, hydrogen chloride and carbon monoxide. It is probable the Jersey's crematorium is the main source of mercury on the island from fillings in teeth. Odour can also be a problem. (There are approximately 500 - 600 cremations a year). There is a proposal to replace the existing cremators in the next 12 months with two new units. The new cremators will meet the current UK process guidance notes standards.

e) Other Industrial Sources
There are a number of smaller industrial operations which together increase the total emissions on pollutants on the Island. These include printers, dry cleaners and the storage and handling of organic chemicals at the port. In the food industry there are a number of bakeries, and a brewery which will give rise to emissions of pollutants to air. In addition, the three boilers at the general hospital in St Helier gave rise to sulphur emissions from the burning of 765,450 litres of fuel oil during 2001. There is an EC directive requirement that the sulphur content in fuel oil must not exceed 1% by January 2003. Currently, these boilers use Ultra Low Sulphur fuel oil which meets this requirement.

f) Aviation - Shipping

Other major sources of pollution to air on Jersey are aircraft and shipping. In 1999 there were about 80,000 aircraft movements on the Island and there were over 45,000 passengers who arrived in Jersey by sea. (This equates to approximately 549 tonnes NOx, and 47 tonnes of VOCs per year).

g) Agriculture

Although agriculture is an important activity on the island, provisional estimates show that the ammonia (NH_3) emissions arising from the agricultural sector are in fact small when compared with the UK on a per capita basis. This is because emissions of NH_3 are dominated by livestock farming, in particular emissions from cattle. Although the dairy herd on Jersey is expected to be the largest source of NH_3 emissions to air, the animal numbers are relatively small (on a per capita basis). This is presumably due to the restricted amount of land that is available in Jersey for livestock. Although there is extensive arable farming, emissions to air from these activities (e.g. from fertiliser application) are considerably smaller than from livestock.

3 LOCAL AIR QUALITY IN JERSEY

3.1 Targeting Specific Source Sectors

As indicated above, with respect to air emissions, it is considered that “local air quality” is the most immediate environmental issue to address. In effect this relates to the air quality in urban areas. Therefore the following pollutants are considered to be of primary importance: NO_x, SO_2, NMVOC (incorporating benzene and 1,3-butadiene), CO, PM_{10} and Lead (Pb). The most sensible approach to reducing emissions to air first considers which sectors are the primary source of these pollutants.

3.2 Nitrogen Oxides (NOx)

Nitrogen oxides are formed during high temperature combustion processes from the oxidation of nitrogen in the air or fuel. The principal source of nitrogen oxides, nitric oxide (NO) and nitrogen dioxide (NO_2), collectively known as NO_x, is road traffic, which is responsible for approximately half the emissions in Europe. NO and NO_2 concentrations are therefore greatest in urban areas where traffic is heaviest. Other important sources are power stations, heating plant and industrial processes.

Nitrogen oxides are released into the atmosphere mainly in the form of NO, which is then readily oxidised to NO_2 by reaction with ozone. Elevated levels of NO_x occur in urban environments under stable meteorological conditions, when the air mass is unable to disperse.

3.2.1 Health Impact of Nitrogen Oxides

Nitrogen dioxide has a variety of environmental and health impacts. It is a respiratory irritant, may exacerbate asthma and possibly increase susceptibility to infections. In the presence of sunlight, it reacts with hydrocarbons to produce photochemical pollutants such as ozone. In addition, nitrogen oxides have a lifetime of approximately 1 day with respect to conversion to nitric acid. This nitric acid is in turn removed from the atmosphere by direct deposition to the ground, or transfer to aqueous droplets (e.g. cloud or rainwater), thereby contributing to acid deposition. (See also Appendix A)

3.2.2 Asthma Incidents in Jersey

The UK Department of Health hosts the Committee on the Medical Effects of Air Pollutants (Comeap), and it has produced a number of reports, the latest of which asserts that there is no firm evidence that air pollution initiates asthma. It says that the effect of air pollution is ‘small’ and a ‘relatively unimportant’ factor in triggering attacks in existing sufferers.

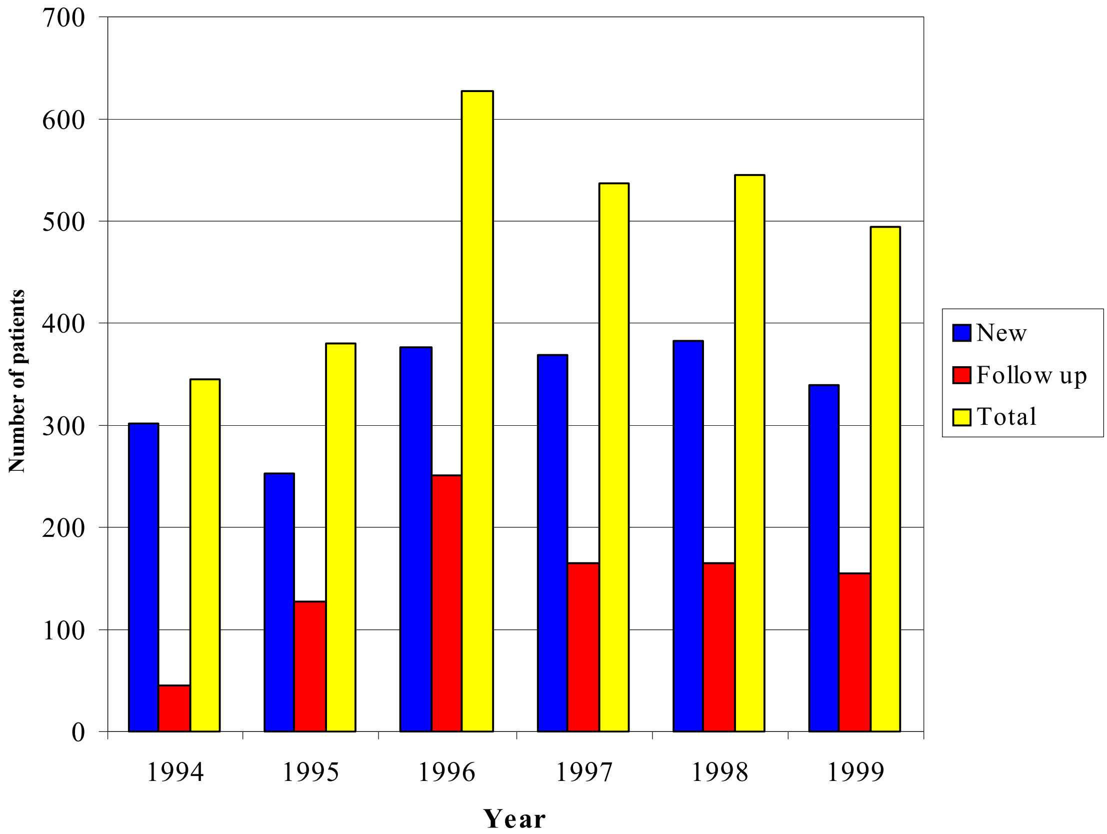
However evidence is available that air pollution and traffic derived pollution in particular, is responsible for triggering attacks in existing sufferers. In 1996 the National Asthma Campaign asked 50,000 of its members about their triggers and 80% of them said traffic pollution affected them. How important that trigger is, relative to other westernised lifestyle factors has yet to be determined.

The situation in Jersey is interesting as asthmatics moving to the Island to live often complain attacks are more regular and more severe. It is unclear why this is but it maybe due to the mix of agricultural, industrial and vehicular sources in such a condensed area of 45 square miles. There is also a significant amount of poor quality housing in Jersey, which results in problems of condensation dampness and associated mould growth, which is a possible factor. Jersey also has a moist maritime climate with periods of high rainfall through the winter period. Figure 3.1 shows the number of asthmatics attending information mornings at Jersey's general hospital. The numbers attending have increased from 1994 – 1996, and then decreases but the significance of air pollution to this increase is uncertain.

Asthma is also very individual with asthmatics often having different triggers and different threshold levels. A recent study found that levels of self reported asthma in children living in the Channel Islands was almost twice as high as those for similar aged children in France only 16 miles from Jersey. It seems that lifestyle factors between the two cultures may contribute towards this. However levels of asthma were broadly similar to the South West of England.

Further information on asthma can be gained through the Asthma Information Mornings at the Clinical Investigation Department, General Hospital on Saturdays 9am – 12 noon. Telephone: 01534 622554.

Figure 3.1: Number of Asthmatics attending the Asthma Information mornings at Jersey's General Hospital 1994-1999



3.2.3 Emissions of Nitrogen Oxides in Jersey

In Jersey emissions of nitrogen oxides are considerably higher per capita from road transport than in the UK (Figure 3.2). This is principally due to the high dependency on the private car. The following plot shows the emissions per capita for NO_x for Jersey and the UK. The data is expressed in this way to allow a direct comparison of the relative contribution from the different sources. It is evident that road transport is the sector which dominates for Jersey, giving considerably larger emissions per capita than observed in the UK for NO_x. However, total emissions of NO_x on Jersey were similar to those estimated for other similarly sized 'islands'.

Figure 3.2 NOx Emissions Per Capita - Jersey and the UK

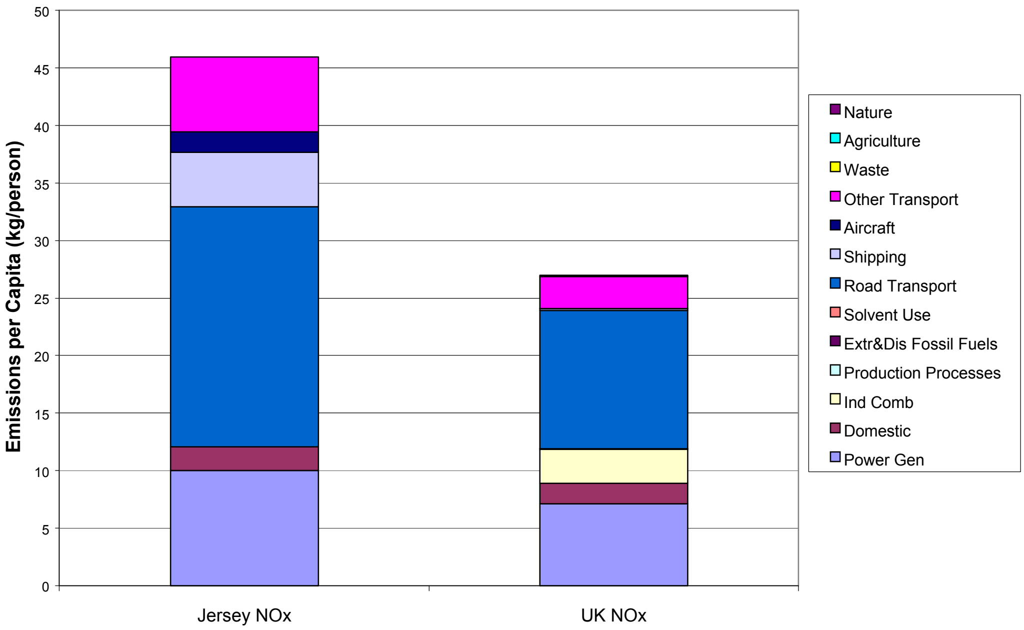


Table 3.1 Emissions of NO_x per capita (kg/person)

Jersey	46
UK	27
Guersney	29
Isle of Man	62
Gibraltar	47

It is clear from the above that the contribution to the total emission per capita from road transport is considerably higher in Jersey than in the UK. NO_x emissions from other transport are also larger indicating the impact from the relatively large number of agricultural vehicles. Emissions from these vehicles are not generally as well controlled as those from road transport vehicles. About 10% of NO_x emissions are from the power station. This will have further decreased as the second power link to France has meant the power station has reduced its operations by over 50%.

3.2.4 Ambient air pollution monitoring

Ambient air pollution monitoring has been carried out by the Environmental Health Department since 1993/4 for Nitrogen Dioxide and in conjunction with the Environmental Services Section of Planning and Building Services this was expanded in 1995/6 to include Sulphur Dioxide and Volatile Organic Compounds (VOCs). Supplementing these were two two-month long studies in February to March 1997 and February to March 2000 to assess levels of air pollution in Halkett Place, St Helier and determine whether there has been any improvement. These surveys were undertaken by AEA Technology.

The February to March 2000 survey in Halkett Place St Helier indicated that vehicle related pollutant concentrations (NOx, CO, PM_{10}) were found to be directly related to traffic density; highest during rush hours and lowest during the night. Concentrations of sulphur dioxide SO_2 which is not emitted from vehicles in large quantities were found to be very low. The results were found to be broadly comparable or slightly lower than those recorded during the 1997 Halkett Place survey.

The data from the Halkett Pace surveys was compared with a number of representative sites in the UK. Average concentrations of CO, SO_2, and PM_{10} at Halkett Place were higher than any of the comparison sites, while levels of NO_2 at the UK roadside sites were higher than at Halkett Place. (Ref: Air Quality Monitoring, St Helier, Jersey, January to February 1997 and Air Quality Monitoring, St Helier, Jersey, February to March 2000, AEA Technology)

The objective of these surveys was to monitor at sites where pollutant concentrations were expected to be highest, and to compliment the ongoing passive diffusion tube surveys for NO_2, VOCs and SO_2.

The dominant source of nitrogen dioxide is road traffic and consequently this pollutant has been measured at 19 sites since 1997 using passive diffusion tubes. There are six areas (mainly road junctions), which currently exceed the annual EU Daughter Directive limit value of 21 ppb (40 $\mu g\ m^{-3}$) as an annual mean, for protection of human health, which is to be achieved by 1 January 2010.

Photograph 4: Diffusion tubes placed on the building façade on the corner of Beresford Street, St Helier

These are the Georgetown road junction in St Saviour, Beaumont filter in turn roundabout in St Peter and First Tower, the Weighbridge area (Bus station), Broad Street and at the junction of Rouge Bouillon and La Pouquelaye in St Helier. An additional four sites exceed the Lower Assessment Threshold including Le Bas Centre, Mont Felard, Robin Place, Savile Street and the Rouge Bouillon junction and a further site at Bereford Street exceeded the Upper Assessment Threshold. Further information on the monitoring programme is available in Appendix B. The results for the diffusion tube surveys 1999 - 2001 are available to download at www.health.gov.je

Photograph 5: Examples of SO_2, VOC (eg Benzene), and NO_2 diffusion tubes.

The diffusion tube methodologies provide data that are accurate to ± 20% for SO_2, ± 25% for NO_2, and ± 20% for BTEX(ie VOCs). BTEX includes benzene, toluene, ethyl benzene, m+p xylene and o-xylene.

Photograph 6: The site of the automatic monitoring trailer at Halkett Place in 2000.

In addition to these measurements of air pollutants an assessment of air quality can be made from sources of emission. In particular the number of vehicles on various roads will provide an indication of the level of pollution. From an initial assessment the following roads have a level of traffic greater than the trigger level (10,000 vehicles per day) as set in the UK for further review and assessment work to be carried out.

- Beaumont
- Weighbridge at Bus Station, St Helier

The air quality impact from road traffic at these junctions was further assessed using a screening model as recommended in UK Government Guidance the Design Manual for Roads and Bridges. Concentrations on annual average nitrogen dioxide were predicted at the roadside for 2005 (Table 3.2).

Table 3.2. Predicted annual average concentrations of nitrogen dioxide for 2005 (µg m^{-3}).

Road Junction	Annual average NO_2 for 2005
Beaumont	34 (18ppb)
Weighbridge at Bus Station, St Helier	43 (23 ppb)

Predicted concentrations are higher than the limit value of 40 μg m^{-3} (21 ppb) at the Weighbridge at the Bus station in St Helier. Emissions from the buses in this vicinity are likely to be giving rise to the elevated concentrations. These estimates are for 2005 and measures need to be introduced to more accurately assess the likely concentrations of NO_2 in 2010 which is the date when the Air Quality daughter directive limit value is to be achieved. These high concentrations of nitrogen dioxide at the bus station is likely to improve upon the upgrade of the bus fleet provided by Connex where 30 new buses and 15 existing buses will meet the Euro III engine emission limits. Also the move to garage of buses at La Collette will help to improve air quality at the Weighbridge.

3.3 NMVOCs (Non Methane Volatile Organic Compounds)

NMVOCs are organic compounds which differ widely in their chemical composition. These organic compounds are often grouped under the NMVOC label as the majority display similar behaviour in the atmosphere. NMVOCs are emitted to air as combustion products, as vapour arising from petrol and solvent use and several other sources. Interest in NMVOC emissions has grown as their role in the photochemical production of ozone has been appreciated. The diversity of processes which emit NMVOCs is huge, covering not only many branches of industry, but also transport, agriculture and natural sources such as for eg certain trees.

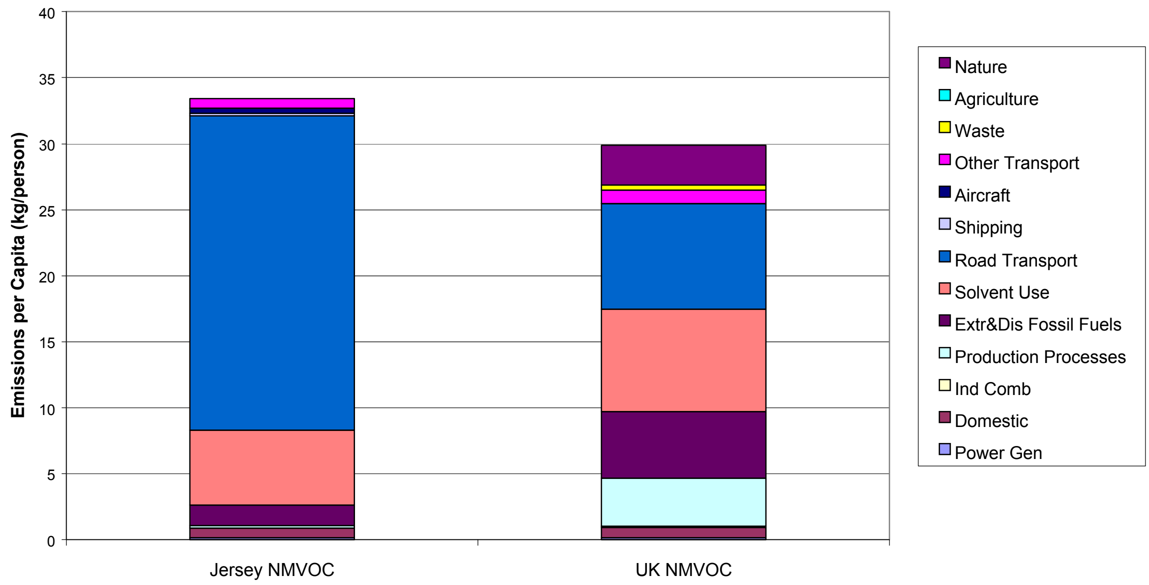
3.3.1 Health Impact of NMVOCs

Some VOCs are quite harmful, including benzene, polycyclic aromatic hydrocarbons (PAHs) and 1,3- butadiene. Benzene may increase susceptibility to leukaemia, if exposure is maintained over a period of time. There are several hundred different forms of PAH, and sources can be both natural and man-made. PAHs can cause cancer. Sources of 1,3-butadiene include the manufacturing of synthetic rubbers, petrol driven vehicles and cigarette smoke. There is an apparent correlation between butadiene exposure and a higher risk of cancer. Environmental tobacco smoke is a significant source of benzene exposure - a UK survey in 1995 indicated that 47% of children between 2 and 15 years of age live in households where at least one person smokes.

3.3.2 Emissions of NMVOCs in Jersey

Emissions of Non-methane Volatile Organic Compounds for both Jersey and the UK are shown below on a per capita basis. Emissions for Jersey are slightly higher than in the UK with a large proportion (69%) resulting from road transport compared to 26% in the UK.

Figure 3.3 NMVOC Emissions Per Capita - Jersey and UK



A comparison of emissions of NMVOC in Jersey with other 'islands' are shown in Table 3.3 which shows lower emissions in Guersney and highest in Gibraltar.

Table 3.3 Emissions of NMVOC per capita (kg/person)

Jersey	33
UK	30
Guersney	21
Isle of Man	27
Gibraltar	40

Some of the emissions of NMVOC on Jersey are derived from loss of volatiles from the petrol storage facility at La Collette and local petrol stations. It has been estimated that up to £11,000 per year has been lost in these evaporative emissions which should decrease with the possible provision of vapour recovery systems.

One of the most important NMVOC is benzene. Road transport is the major source of benzene. It is a known human carcinogen and long-term exposure can cause leukaemia. It is found in petrol
and other liquid fuels, in small concentrations. In urban areas, the major source is vehicle emissions. Benzene concentrations in ambient air are generally between 1 and 5 ppb.

Concentrations of benzene have been reducing at all sites since 1997 with the associated reductions in petrol. (ie Benzene has reduced from 5% to 1% by volume in petrol up to 2000). Currently there are 97 underground fuel storage facilities in Jersey, which will be the main source of benzene on the island (including La Collette and the Airport storage facilities). Most of these will be petrol stations. There are two possible major sources of benzene from evaporative emissions at petrol stations. The first when petrol vapour is displaced when filling underground storage tanks termed stage 1 emissions. The second when petrol vapour is displaced from vehicle petrol tanks during refuelling termed stage 2 emissions.

EU legislation requires all petrol stations with a petrol throughput of greater than $1000m^3$/annum were required to fit Stage 1 vapour recovery before 1 January 2000. Petrol stations with a throughput of less than 1000 m^3/annum are very unlikely to have any significant effect on the local concentrations of benzene. Stage 1 emissions are therefore, unlikely to have any significant influence on concentrations of benzene in the vicinity of petrol stations. Stage 2 of the directive requires recovery of volatiles at the pumps/nozzles to reduce exposure to the public filling up their vehicles. This is to come into force by 2009. It may be that in the future new petrol stations in Jersey will have to comply with Stage 2 as manufacturers of equipment etc will cease producing pre-stage 2 equipment in the next 5 - 10 years.

Concentrations of ambient benzene recorded in 2000 were above the Upper Assessment Threshold (3.5 $\mu g\ m^{-3}$) at two sites Springfields Garage and Stopford Road. Concentrations were above the Lower Assessment Threshold (2 $\mu g\ m^{-3}$) at 3 other sites Beresford Street, Le Bas Centre and Elizabeth Lane. However, there were no exceedences currently of the limit value (5 $\mu g\ m^{-3}$ or 1.5 ppb) and it therefore can be assumed that the limit value should be achieved by the target year of 2010. It is interesting to note that while benzene levels have been reducing m+p xylene levels have increased. This may be due to an increase in the use of m+p xylene as a constituent in petrol.

3.4 Carbon Monoxide

Carbon monoxide (CO) is a colourless, odourless, poisonous gas produced when fuels containing carbon are burned where there is too little oxygen. It also forms as a result of burning fuels at too high a temperature. It burns in air or oxygen with a blue flame and is slightly lighter than air. In the presence of an adequate supply of O_2 most carbon monoxide produced during combustion is immediately oxidised to carbon dioxide (CO_2). However, this is not the case in spark ignition engines in motor cars, especially under idling and deceleration conditions. Thus, the major source of atmospheric carbon monoxide is road transport. In particular, carbon monoxide is usually significant in enclosed trafficked areas such as road tunnels or multi-storey car parks. Smaller contributions come from processes involving the combustion of organic matter, for example in power stations such as at operated by the JEC and waste incineration. Indoor concentrations of carbon monoxide may also be high when there is inefficient combustion of fuels such as coal, wood, oil and gas with limited ventilation. Tobacco smoke is also a significant source indoors.

3.4.1 Health Impact of Carbon Monoxide

Carbon monoxide CO is poisonous when inhaled because it combines with haemoglobin, the oxygen-carrying substance in red blood cells. The haemoglobin then cannot take up oxygen from the air. Lack of oxygen causes cells and tissues to die.

3.4.2 Emissions of Carbon Monoxide in Jersey

Carbon monoxide emissions in the UK are dominated by road transport activities (nearly 70% of the total), and it is expected to be similar in Jersey, with the remaining contribution arising from domestic heating and several other small sources.

Automatic monitoring of carbon monoxide was undertaken in February to March 2000 at Halkett Place, St Helier. During this time no exceedences of the Upper or Lower Assessment Threshold for carbon monoxide were recorded.

Monitoring of Jersey's road tunnel, which runs under the Fort Regent from the 31st October to the 4th November 1994 indicated particularly high levels of carbon monoxide (CO) which exceeded the World Health Organisation standard.

The Public Services Committee recommended (as part of the Sustainable Island Transport Policy) that ventilation be provided for reducing air pollution levels in the tunnel. Although the exposure time is short (eg maximum 5 minutes), the tunnel is used regularly by pedestrians and cyclists. At rush hour periods the public walking or cycling through will be exposed to a cocktail of pollutants. Signage has been provided notifying the public that air quality is 'poor' during rush hour periods.

3.5 Lead

Lead is the most widely used non-ferrous metal and has a large number of industrial applications. Its single largest industrial use world-wide is in the manufacture of batteries (60-70% of total consumption of some 4 million tonnes) and it is also used in paints, glazes, alloys, radiation shielding, tank lining and piping.

As tetraethyl lead, it has been used for many years as an additive in petrol; most airborne emissions of lead in Europe therefore originate from petrol-engined motor vehicles. With the decline in the use of unleaded petrol, however, emissions and concentrations in air have reduced steadily in recent years.

3.5.1 Health Impacts of Lead

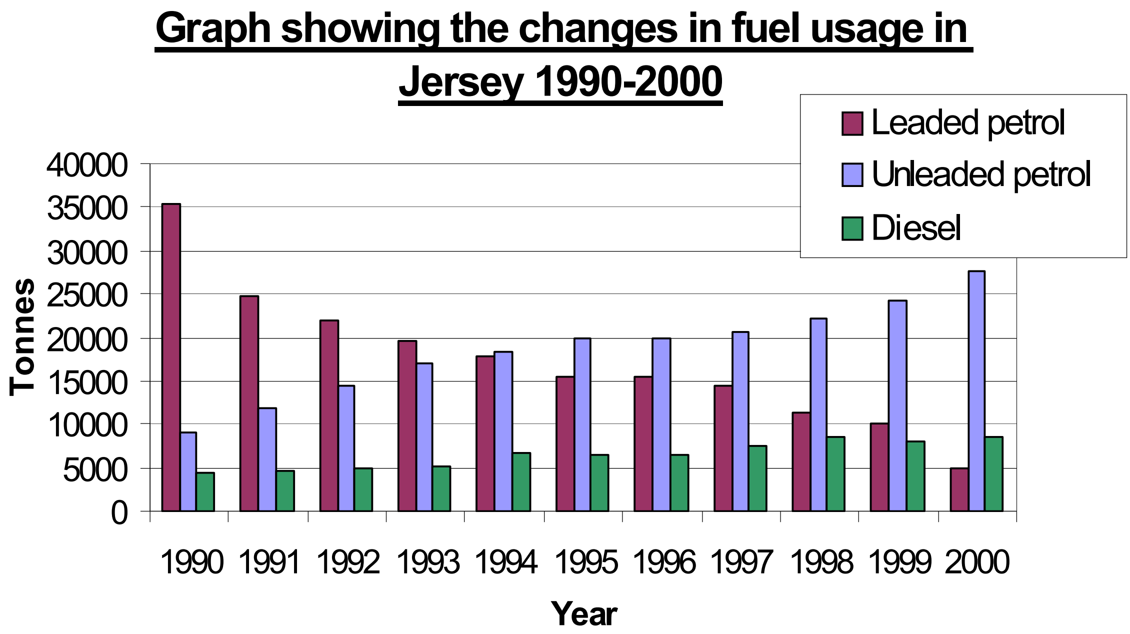
Lead is a cumulative poison to the Central Nervous System, particularly detrimental to the mental development of children.

3.5.2 Emissions of Lead in Jersey

Emissions of lead in Jersey are likely to be dominated by road transport, although emissions have been falling considerably with the gradual phasing out of leaded petrol. From 2000 the sale of leaded petrol was greatly restricted in Jersey. There are no other industrial sector sources of lead, which exist in the UK and therefore in Jersey it is unlikely that emissions of lead will a significant issue. Figure 3.4 shows the changes in vehicle fuel usage in Jersey since 1990 with the associated knock on effects of reduced lead in the environment.

No monitoring has been undertaken of this pollutant in Jersey. However, UK data indicates that concentrations are significantly below the Limit Values. It is likely that this is the case in Jersey as well.

Figure 3.4:



3.6 Sulphur Dioxide (SO_2)

Sulphur dioxide (SO_2) is a colourless, non flammable gas with a penetrating odour that irritates the eyes and air passages. It reacts on the surface of a variety of airborne solid particles, is soluble in water and can be oxidised within airborne water droplets. The most common sources of sulphur dioxide include fossil fuels combustion, smelting, manufacture of sulphuric acid, conversion of wood pulp to paper, incineration of refuse and production of elemental sulphur. Coal burning is the single largest man-made source of sulphur dioxide accounting for about 50% of annual global emissions, with oil burning accounting for a further 25-30%. The most common natural source of sulphur dioxide is volcanoes.

3.6.1 Health Impact of Sulphur Dioxide

The health effects of sulphur dioxide pollution in the UK were exposed graphically during the "Great Smog" of London in 1952. This resulted in approximately 4000 premature deaths through heart disease and bronchitis. Since then, however, emissions have been significantly reduced through legislative controls and the introduction of clean fuel technology. Research has shown that exposure for asthmatics is significantly more damaging than for normal subjects. Even moderate concentrations may result in a fall in lung function in asthmatics. Tightness in the chest and coughing occur at high levels, and lung function of asthmatics may be impaired to the extent that medical help is required. Sulphur dioxide pollution is considered more harmful when particulate and other pollution concentrations are high. This is known as the "cocktail effect."

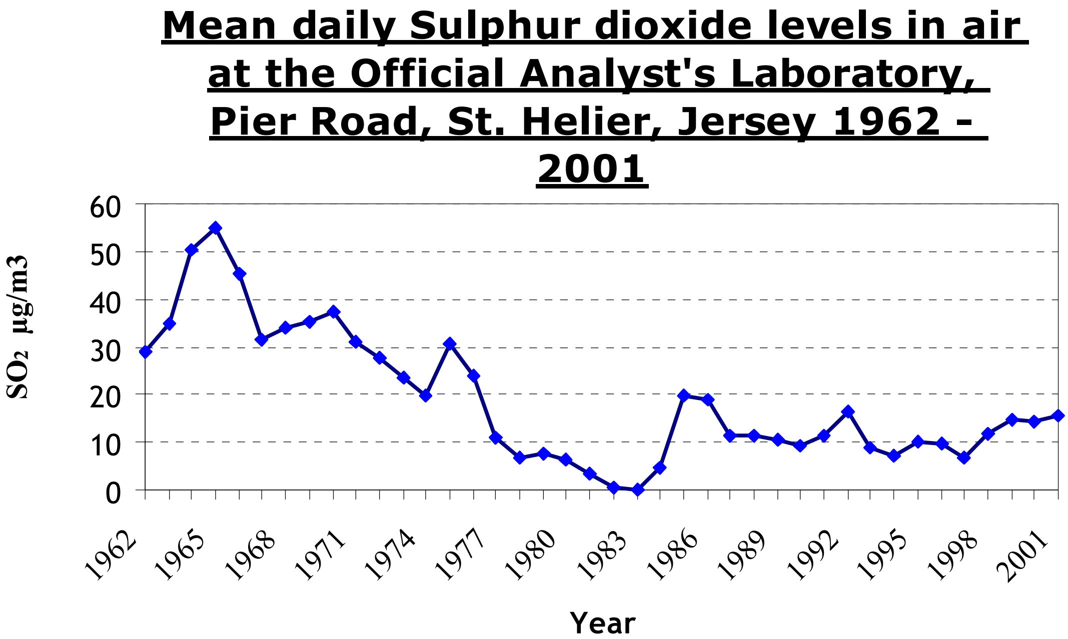
3.6.2 Emissions of Sulphur Dioxide in Jersey

In Jersey SO_2 emissions arise almost exclusively from fuel combustion, and are dependent on the sulphur content of the fuel. Emissions of SO_2 are expected to be dominated by emissions from the power station and domestic heating. Whilst the use of the under sea link with France will reduce the emissions from power generation on the island, the relatively small use of gas on the island for domestic heating is expected to give rise to higher emissions per capita than for the UK.

The amount of domestic coal burned has reduced from 11,033 tonnes in 1990 to 4,774 tonnes in 2000. However the burning of ultra low sulphur (50ppm) oil (ie kerosene) in domestic heating systems has increased from approximately 22,000 in 1990 to approximately 32,000 tonnes in 2000. This is because of the relative cost of oil being less than gas and electricity on the Island.

Levels of SO_2 measured at the States Official Analyst's Laboratory at Pier Road St Helier have been reducing generally since 1965 and are shown in the graph below.

Figure 3.5:



Results from the diffusion tube studies since 1997 have indicated that concentrations of sulphur dioxide measured using diffusion tubes at Clos St Andre, Le Bas Centre, Langley Park and St Brelade (Quennevais School) are all significantly below the annual average Upper and Lower Assessment Thresholds for the protection of vegetation. Levels are either constant or are decreasing from 1997 to 2000. Since 2000, SO_2 monitoring has been carried out at single site, Clos St Andre.

Ambient SO_2 concentrations at Clos St Andre were low during 2001, less than 3ppb during all months except December, when concentrations rose to over 8ppb. The annual mean SO_2 concentration at Clos St Andre was 2.6ppb.

Most of the limits for SO_2 are based on short averaging periods, such as 15-minute or 24-hour means. It is only possible to compare diffusion tube results with limits relating to longer periods, such as the annual mean

The WHO'S 1995 revised guidelines contain a guideline of 17ppb for the annual mean. The 2001 annual mean SO_2 result for Clos St Andre was well within this value.

EC Directive 1999/30/EEC (the first Daughter Directive) contains a limit of 8ppb for the annual (calendar year) and winter (October to March) mean SO_2 concentration, for the protection of ecosystems. This is only applicable in rural areas, and therefore strictly does not apply to Clos St Andre. However, the annual mean of 2.6ppb was well below this limit.

Further automatic monitoring during February to March 2000 in St Helier indicated that for this limited period there were no exceedences of the Upper or Lower Assessment Thresholds for the daily averaging period for the protection of human health. Occasionally there were high concentrations recorded which may have resulted from emissions from the JEC power station during periods of southerly winds.

With the reduction of sulphur in fuel oil and reduced usage of the Jersey Electricity's oil fired power station it is likely that emissions of sulphur dioxide are not significant.

3.7 Particulates

Airborne particulate matter is another important pollutant for the UK as high concentrations are measured. Particles are often classed as either primary (those emitted directly into the atmosphere) or secondary (those formed or modified in the atmosphere from condensation and growth or chemical reactions).

A major source of fine primary particles is combustion processes, in particular diesel combustion, where transport of hot exhaust vapour into a cooler tailpipe or stack can lead to spontaneous nucleation of "carbon" particles before emission.

Secondary particles are typically formed when low volatility products are generated in the atmosphere, for example the oxidation of sulphur dioxide to sulphuric acid. The atmospheric lifetime of particulate matter is strongly related to particle size, but may be as long as 10 days for particles of about 1 μm in diameter. A particle with a mean aerodynamic diameter of 10μm is referred to as **PM_{10}** and likewise a particle with an aerodynamic diameter of 2.5μm is **$PM_{2.5}$.**

Other sources of particulates include agricultural dust, construction sites, incinerators, power generation quarrying, tyre abrasion, pollen, spores, sea salt, domestic coal and oil burning.

3.7.1 Health impacts of Particulates

Particles are associated with a range of health effects. These include effects on the respiratory and cardiovascular systems, asthma and mortality. There is emerging evidence to suggest that the health effects of particles are due principally to fine particles $PM_{2.5}$ and the smaller $PM_{1.0}$ & $PM_{0.1}$.

A percentage of particles below 10 μm will penetrate the upper bronchial tract as far as the trachea and primary bronchi of the lungs. These become attached to the mucus which coats the trachea and bronchi and are removed by the beating cilia (hairs), which move the particles upward and are eventually swallowed. Particles below 2.5 μm will penetrate into the deep lung secondary and terminal bronchi. To penetrate into the alveoli, a particle of less than 1μm is necessary (See Appendix A).

3.7.2 Emissions of Particulates in Jersey

Emissions from mainland Europe may make a significant contribution to secondary particles in Jersey. The UK Airborne Particles Expert Group's findings suggest that in a typical year with typical meteorology, about 15% of the UK's total annual average PM_{10} concentrations (about 50% of secondary particles) are derived from mainland Europe. In years of higher frequency of easterly winds, with large movements of air from mainland Europe, emissions in mainland Europe account for a considerably higher proportion of PM_{10} concentrations, particularly in south and east England. No work has been carried out to try and establish the contribution of secondary particulates originating from Europe affecting Jersey.

Monitoring carried out in 2000 in Halkett Place by Health Protection found a significant proportion of particulates analysed were from natural sources such as sea salt. The monitoring also showed an increased ratio of smaller $PM_{2.5}$ particles to PM_{10} particles, which confirmed the presence of more harmful smaller particles associated with traffic. Road transport is an important source of primary particles and because of the lack of emission controls in Jersey the levels of particulate matter are likely to be high.

Health Protection purchased in 1999 a Turnkey Osiris for monitoring real time levels of particulates (ie total suspended particulates (TSP) , PM_{10} , $PM_{2.5}$, and $PM_{1.0}$). This unit has been used for a number of surveys to assess PM_{10} levels throughout St Helier mainly driven by complaints about traffic:

1) New Street: Levels of PM_{10} in January 2000 varied between 13 to 27μg/m^3 as a running 24 Hour average. These levels do not exceed the EU Daughter directive objective. (ie 50μg/m^3 as a 24 Hour mean to be achieved by 1/01/05)

2) Savile Street: Levels varied in January-February 2001 from 21μg/m3 to 59μg/m3 as a running 24 Hour average. There was one exceedance in the month's monitoring data of the EU Daughter directive objective. The PM_{10} levels follow a characteristic pattern of increasing during morning and evening rush hours and at lunchtimes.

3) A survey was carried out in July 2000 to assess the levels of particulates exposed to whist driving a petrol engined car in Jersey. Levels of PM_{10} particulates within the cabin of the car increased dramatically behind heavy goods vehicles (eg max 190μg/m^3) and through Jersey's road tunnel (eg max 500μg/m^3). The importance of knowing the source was reinforced as high levels of PM_{10} were found close to Jersey's composting site, however the source was non-toxic wind blown dust.

Other survey sites included Wellington hill, Le Bas Centre and Grand Vaux.

A second Turnkey Osiris particulate monitor was purchased in 2002 and was recently situated at the Weighbridge close to the Bus station. This unit can be accessed remotely via a GSM modem. It is also set up to provide wind direction and speed. The unit is fitted with a filter, which allows analysis of the particulates to determine the exact nature, contribution and possible sources.

It is likely that levels of particulates will fall with the introduction of particulate traps and catalytic traps for diesel vehicles assuming total number vehicles do not increase significantly. However there are concerns that the smaller more hazardous particulates will not be reduced by this technology.

The provision of a new bus operator for Jersey in September 2002 and relocation of the parking of buses to La Collette will assist in reducing PM_{10} levels in this area.

Automatic monitoring of particulate matter was also undertaken in February to March 2000 at Halkett Place, St Helier. The Upper and Lower Assessment Thresholds were exceeded for the daily and annual averaging period for particulate matter. A full year of monitoring would be needed to determine compliance with this limit value.

Further information and the reports for the above surveys can be found at www.health.gov.je

Photograph 7: The real time particulate monitor at Weighbridge close to the bus station.

4 LEGISLATION AND PROTOCOLS

4.1 Protocols And Reporting Requirements

The UK is committed to a number of national and international targets, protocols and reduction strategies. This requires emission estimates for the UK to be generated and submitted to various international bodies- including the United Nations Economic Commission for Europe (UNECE) and the United Nations Framework Convention on Climate Change (UNFCCC).

Under the UNFCCC, the UK is committed to developing, publishing and regularly updating national emission inventories of greenhouse gases using reporting guidelines from the Intergovernmental Panel on Climate Change (IPCC). Likewise, emission estimates for nitrogen oxides, carbon monoxide, ammonia, sulphur dioxide, non methane volatile organic compounds NMVOC, persistent organic pollutants and heavy metals are submitted to UNECE under the Convention on Long-Range Transboundary Air Pollution (CLRTAP). The Bonn Agreement of the Kyoto Protocol of this Convention requires the UK achieve a 12.5% reduction on 1990 levels of greenhouse gases, within the European Union burden sharing mechanism by 2012. The UK aims to move beyond the Kyoto target and reduce CO_2 emissions by 20% below 1990 levels by 2010.

Jersey is signed up to specific NO_x and VOC protocols, which come under the UNECE, and therefore emission inventories for these two pollutants have been generated and are included in the UK emission estimates submitted to the UNECE. However, the emissions are expressed as the UK and “other territories”, and therefore emissions arising from Jersey are not quoted individually. This also means that targets are associated with the UK and other territories, hence there are no targets applied specifically to Jersey alone.

Currently the States of Jersey have obligations under the UNFCCC, and include the reduction targets for greenhouse gases in their international commitments

4.2 European Legislation On Air Quality

Currently there is no air pollution legislation in Jersey. However Jersey’s Parliament, the States of Jersey, has agreed to work towards the limits set out in the European Daughter Directive 99/30/EC which deals with particles, sulphur dioxide, nitrogen dioxide and lead.

The EU Directive 96/62/EC on Ambient Air Quality Assessment and Management (The Air Quality Framework Directive) establishes a framework under which the EU will set limit values or target values for concentrations in ambient air of specified pollutants. These will supersede existing EU air quality legislation. The Directive identifies twelve pollutants for which limit or target values will be set in subsequent daughter directives. These pollutants are sulphur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter, lead, carbon monoxide (CO), benzene, ozone, polyaromatic hydrocarbons (PAHs), cadmium (Cd), arsenic (As), nickel (Ni), and mercury (Hg).

Directive 1999/30/EC (the first Air Quality Daughter Directive) establishes legally binding limit values for SO_2, NO_2, particles and lead (Table 1). These limit values are to be achieved by 1 January 2005 and 2010. The Directive was adopted in April 1999 and entered into force in 1999. Member states were required to implement it by July 2001.

The Daughter Directive also sets, for the first time, European limit values for oxides of nitrogen (NO_x) and SO_2 for the protection of vegetation and ecosystems.

Another Daughter Directive, 2000/69/EC, lays down limits for carbon monoxide and benzene. The EC directive 2002/3/EC sets out a target value for ozone. This is set at 120 µg m^{-3} as a maximum daily 8 hour average in a calendar year which should not be exceeded more than 25 days per calendar year averaged over 3 years.

Article 5 of the Framework Directive requires the Member States to undertake a preliminary investigation of ambient air quality prior to implementing the daughter directives for NO_2, SO_2 and particulate matter. The objectives of these assessments are to establish estimates for the overall distribution and levels of pollutants and to identify additional monitoring requirements that may be necessary to fulfil obligations under the Framework and Daughter Directives.

Table 4.1 EU Limit Values and target date for achievement.

	Averaging period	Limit value [µg m^{-3}] *)	Maximum number of exceedences allowed	To be met by
SO_2	Hourly	350	24	1/1/05
SO_2	Daily	125	3	
SO_2	Annual, 6-monthly **)	20	-	
NO_2	Hourly	200	18	
NO_2	Annual	40	-	1/01/10
NO_x	Annual	30	-	19/07/01
PM_{10}	Daily	50	35	1/01/05
PM_{10}	Annual	40	-	1/1/05
Pb	Annual	0.5	-	19/07/01
Benzene	Annual	5	-	1/01/10
CO	Maximum daily 8 hour mean	10 [mg m^{-3}]	-	1/1/05

*) Numerical value of the limit value
**) Calendar year and winter (1 October to 31 March)

In accordance with the Framework Directive on Air Quality Assessment and Management, Member States have to break down their territories into zones. The zones are primary units for the management of air quality. However, the Directive specified requirements concentrating the assessment of individual zones. The Directive 96/62/EC does not stipulate any detailed rules for the definition of such zones and it leaves the decision to the Member States. It is therefore reasonable that Jersey considers itself as one agglomeration and one zone.

The assessment requirements for individual zones, as set out in the directives, are dependent on the levels of pollution encountered in the zones compared with the limit values. The "daughter" directive identified for each pollutant two defined threshold values: the upper assessment threshold (UAT) and the lower assessment threshold (LAT). The assessment threshold values are lower than the limit value and are defined as a percentage of the limit value. The requirements for assessment within the zone depend on whether the assessment limit was exceeded within the zone in the previous years.

Within the first year of effect of the daughter directive, the assessment regime is dependent on the results of the preliminary assessment. In zones where the UAT is exceeded for a specific pollutant very intensive assessment requirement apply. Where the LAT but the UAT is exceeded, less strict requirement apply. This means that the exceedence of limit values does not determine the requirement of the assessment. An exceedence requires that organisation measures are implemented and a reporting process initiated. The Upper and Lower Assessment Thresholds are given in Appendix C.

5 ACTION PLAN FOR JERSEY

5.1 Integration With Other Island Strategies

Many existing initiatives in Jersey which are incorporated within existing Island strategies will have the benefit of improving air quality. To enhance the success of this air quality strategy it is important that these existing initiatives, for example recommendations in the 2002 Jersey Island Plan, are integrated within this Strategy. Such initiatives are included in the *1995 Strategic Policy Review "2000 and Beyond"* which has the following policy statements which relates to traffic pollution:-

1) reduce the detrimental impact of traffic on people's lives;

2) to raise levels of environmental awareness and responsibility.

The *Environmental Charter 1996* has a clear statement with regard to future transport and planning policies:-

"to develop transport and planning policies which encourage the use of public transport and minimise the use of other vehicles. The States will support the provision of facilities for and encourage, cycling and walking, and encourage a policy of fuel efficiency."

The 1995 Strategic Review "2000 and Beyond" and the Environmental Charter committed the States of Jersey's parliament to adopting and developing a sustainable transport policy.

In 1999 the States of Jersey's Public Services Committee produced a *Sustainable Island Transport Strategy* (Ref: www.psd.gov.je). Some of the options presented in this for the improvement of traffic will also result in an improvement in air quality. These, together with additional measures are assessed in terms of how cost effective they are likely to be for the improvement in air quality.

In 2001 the Sustainability strategy report was published "*Jersey into the Millenium: A Sustainable Future*"(Ref: www.planning.gov.je). Consultation during the production of this report identified over 700 policy options for the Island to achieve sustainability. From these over 200 strategic and operational strategic recommendations have been included. The top 10 of these, which includes pollution, provides a focus for strategic development.

In 2002 the *Jersey Island Plan* (Ref: www.planning.gov.je)provided policies for the improvement of traffic and transport on the Island in relation to land use. Its main objective is to achieve sustainable transport for Jersey which minimises the overall need to travel, reduce the use of the private car and encourage more environmental forms of transport such as cycling and walking. This is to be achieved through providing a more efficient use of the existing transport infrastructure including improvements to the existing road network.

Improved safety and security for transport users should be made a priority including reducing accidents and increasing priority
for pedestrians, cyclists, the mobility impaired and public transport user over the car. In particular the Island Plan recognises the need to improve transport in the centre of St Helier where the air quality issues are of greatest concern. This should be achieved by measures, which also ensure a town centre which is a vibrant and attractive place for workers, shoppers, residents and visitors.

The 2002 Island Plan sets out a Strategic Travel Policy, which aims to achieve a more energy efficient and environmentally sustainable transport system in Jersey. The principal modes of achieving this is through:

- A land use strategy and development policies that take account of the access to transport provision
- Promotion of a travel awareness campaign
- Improvements of the existing highway especially for pedestrians and cyclists

Improvements of the existing highway at Colomberie, St Helier are now in progress with the implementation of the St Helier Street Life programme.

5.2 Establishment Of Suitable Monitoring Network

Under the EC Air Quality Framework Directive (96/62/EC), all Member States have to assess their existing air quality and implement a programme of monitoring, dependent upon population, population density, emission sources and proximity of the general public to these sources.
Under the Framework Directive, a Member State must undertake continuous monitoring (using appropriate instrumentation) at at least ONE site.

The subsequent Daughter Directives (1st for NO_2 and SO_2, 2nd for CO and Benzene, and the newly published 3rd for O_3), all prescribe exactly how and where monitoring should be undertaken. However, the mass of monitoring evidence collected strongly suggests that concentrations of CO and SO_2 are likely to be below the lower assessment threshold, and that there is little benefit in measuring O_3, as emissions from the island will have very little impact on island ozone concentrations.

We would recommend, therefore, that the island undertakes continuous monitoring for NO_2 and PM_{10}. For the first year at least, this should be at the highest known pollution "hotspot" (Weighbridge). Once compliance with the Daughter Directive(s) is confirmed at this location, the site could be relocated to an area more representative of general population exposure (eg residential or urban background).

This approach would best be satisfied by purchasing a mobile (or movable) installation. Depending upon the specification, this would involve a capital cost of between £30-40,000, with ongoing costs of approximately £10k per annum (although a lot of this could be offset with skilled/trained local staff).

A number of locations in St Helier have been identified as being at risk of exceeding the EU limit value. Therefore we recommend that the States of Jersey carry out continuous passive diffusion tube monitoring of nitrogen dioxide at a number of these identified areas of high pollution. Together with co-location of these passive monitors with the automatic site this would provide information on the levels of pollution on a widespread basis. If required, short term automatic monitoring at identified hot spots of high pollution can be used to supplement the surveys.

This monitoring strategy will allow an assessment of the long term effectiveness of local actions put in place to meet the limit values.

5.3 Options For Traffic Emission Abatement In Jersey

The States of Jerseys *Sustainable Island Transport Strategy* (1999) suggested a number of options for the improvement of transport, some of which will also improve air quality. These along with other options to be considered are presented.

A very initial indication of the cost-effectiveness of different schemes is presented overleaf. Care must be taken in interpreting the initial conclusions, as more detailed information on baseline conditions are needed, specifically on the types of trips being taken (i.e. the relative split between tourists and inhabitants), and the levels of island registered traffic and non-island registered traffic.

The overall cost-effectiveness relates to how expensive it is likely to be to achieve the emissions reduction required in the main problem areas, i.e. St.Helier, rather than the wider environmental and transport benefits of introducing such schemes. Consideration for other areas (transport impacts, noise, socio-economic effects) should really be made alongside air quality to establish the overall best measures for Jersey. For example, such socio-economic effects includes consideration of issues such as social equity (e.g. congestion charging limits access to drivers who are on lower incomes and cannot afford the congestion charge) or social exclusion (e.g. the promotion of bus services in an area where the catchment and take up is likely to be high may exclude residents in outlying villages from this service). However any improvements in air quality are likely to benefit lower socio-economic groups.

Option	Indication of Costs	Linkage to other Island Strategy/Policy
Legislative MOT test	Expensive to set up, but potentially attractive because of large number of older vehicles in Jersey (>40% of vehicles >10 years old). Costs for scheme could be recovered through road tax or scheme charges. Main benefit will be improvements to vehicle safety, but should lead to emissions improvements and would provide incentive to remove older, more polluting vehicles from fleet. Will not specifically target the air quality 'hot spots 'in St. Helier and so maybe more expensive than targeted measures. *Cost-effectiveness likely to be low for targeted reductions for AQ in St. Helier but will be good for the whole of Jersey. Important other benefits.*	This measure is promoted within the Sustainable Island Transport Strategy
Roadside emissions testing	Only really applicable if a legislative MOT test is in place, as it works by targeting older, high emitting vehicles that exceed emission limits. *Cost-effectiveness linked to above.*	
Park and Ride	Maybe an attractive option for St. Helier. Costs associated with infrastructure for parking, and with purchase and running of bus service, plus signing and promotion of scheme. However, if existing parking is in place, and bus services can be contracted out (e.g. with a charge to recover costs), then financially may be attractive. Higher take-up rates are usually obtained if accompanied by parking restrictions/higher parking charges in central area. Targeted measure, so likely to have higher success at reasonable cost. *Cost-effectiveness medium.*	This measure is promoted within the Sustainable Island Transport Strategy and the Sustainability Strategy promotes a more effective public transport strategy.

Option	Indication of Costs	Linkage to other Island Strategy/Policy
Parking	Actions to reduce number of parking spaces, or to increase parking charges, to encourage public transport or park and ride. Of little use unless public transport options are available. Increases from parking revenue financially attractive, and can be used to offset costs of accompanying schemes (e.g. park and ride). For St. Helier will depend if car parks public or privately run. Most are privately run and consequently are not affected by a charging policy. *Cost-effectiveness medium* Current on street parking should be limited which would decrease the circling of traffic searching for a space, e.g. with 'red' routes that prohibit parking along certain roads or stretches of road. This on street parking should be displaced with cycle routes and improved pedestrian facilities where appropriate. Parking concessions for low emission vehicles *Cost-effectiveness medium high*	Policy TT25 of the Island Plan (2002) requires the Planning and Environment Committee to develop a new parking standards which will assist in redressing the balance between private and public parking provision in town. Support is given for the development of a parking strategy to be developed by the Public Services Committee which will: • Provide adequate short stay parking • Take account of the need for residential parking in St Helier where off street parking is not practical • Ensure adequate parking for the disabled • Develop a parking charging structure that better reflects the real cost of provision • Considers options for improving the efficiency of enforcement The Sustainability Strategy supports these parking policies.
Vehicle scrapage subsidies	Vehicle scrapage schemes have been very effective in a number of European cities. They work by encouraging the replacement of the oldest, and most polluting vehicles, by offering a financial incentive to take these vehicles off the road. In an island like Jersey, such a scheme may be particularly effective by targeting the existing registered vehicle stock. Relatively low subsidy levels are needed to get good	

	take-up. May be most appropriate if targeted at the heavier goods fleet. *Cost-effectiveness medium – medium*	

Option	**Indication of Costs**	**Linkage to other Island Strategy/Policy**
Bus Schemes	Island public transport. The success of bus schemes will depend on the level of existing services on the island and the potential level of patronage. Likely to be expensive to provide level of service needed to see modal switch across the island, and even a good service may not have high take-up as private car use very prevalent. Would require very large subsidies to be able to deliver attractive enough service at low cost. Finally, island wide public transport schemes will not target the main pollution areas in St. Helier, with exception of specific Bus Priority Corridors . *Cost-effectiveness low – medium.* Urban schemes. In addition to park and ride schemes, it would be possible to improve public transport services in St. Helier, servicing the town centre. Need to introduce with measures to try and discourage car transport into city to make effective. This could build upon the Sustainable Island Transport Strategy objective of improving bus services particularly for the School provision and creating a bus priority corridor. Increasing bus provision is likely to	Bus Priority Corridors were identified in the Island Plan (2002) as being required to promote public transport in key radial routes. However, it was recognised that radial routes offer few opportunities for bus priority, there may be opportunities in the town for bus only streets or priority turns are allowed while general traffic is prohibited. Support was given to the investigation of a bus 'showcase' corridor initiative, which would provide an improved frequency and quality of bus service. It was also recognised in the Island Plan that facilities for bus passengers were extremely poor. While a programme of bus shelter provision has been instigated by the Planning and Environment Committee, this needs expansion. This is to be targeted at the pollution hot spot in St Helier, for example by ensuring bus stop provision within 400 m of new residential development outside the St Helier Ring Road. The most effective policy of the Island Plan to have an improve air quality is likely to be the promotion of a new Transport Centre. The highest pollution concentrations are found at the Weighbridge close to the bus station. With the proposal to relocate the bus station and overnight depot to the Island site

	have a detrimental impact on air quality at the Weighbridge bus station area, which is already poor. Consequently it is important that any increase in bus schemes is accompanied with existing proposals in the Jersey Island Plan (2001) to provide a new Transport Centre at the island site. *Cost-effectiveness medium.*	emissions should be significantly reduced at the Weighbridge. The Island site should be able to cater for a range of improved transport services such as Town Hopper buses, cycle hire, road train and an evening taxi rank. In the transfer of buses from the Weighbridge an assessment should be made to determine the likely air pollution concentrations at the proposed Transport Centre Island site.

Option	**Indication of Costs**	**Linkage to other Island Strategy/Policy**
Car sharing schemes/Green Travel Plans	Main costs associated with information programmes to encourage car sharing. Usually implemented with high occupancy lanes, to provide an incentive, which may require some infrastructure costs, plus enforcement. However, take-up is often low and the improvement in emissions is small. Effectiveness will depend on the existing commuting level for St. Helier, and attractiveness of relevant organisations. This measure is promoted within the Sustainable Island Transport Strategy and the Island Plan. *Cost-effectiveness low – medium for existing problem, though very important for future developments.*	Policy TT2 of the Island Plan states that the Planning and Environment Committee will require a Travel Plan to be submitted with major planning applications for new development. Where any submitted Travel Plans are not acceptable, permissions will not normally be granted.
Vehicle access limits	Examples include Low Emission Zones, where vehicles are prohibited entering a zone unless they comply with modern emissions standards are being considered in a number of cities in the UK. However, for a small city such as St. Helier would be costly to implement and enforce. Usually targeted at freight distribution (heavy fleet). *Cost-effectiveness low - medium.*	

Congestion charging	Not suitable for St. Helier.	
Variable tax on engine size and age	Introducing road tax differentials for vehicles, such as to encourage smaller vehicles and also to penalise older, more polluting vehicles. Both approaches have effectively been introduced in the UK. Smaller cars now pay a lower annual road tax. There are also reduced annual road taxes for heavier vehicles which retro-fit older vehicles with new abatement technology. Similar system would be worth considering, and should be low cost provided an existing vehicle registration and road tax scheme is in place. *Cost-effectiveness medium*	A vehicle registration tax is to be introduced on the 1st January 2003.

Option	Indication of Costs	Linkage to other Island Strategy/Policy
Alternative fuels	Alternative fuels are very effective in reducing emissions from any individual vehicle. The main two fuels being implemented are CNG and LPG. The use of alternative fuels may be attractive in Jersey, as normally the take-up of these fuels is restricted by lack of fuelling depots, and the limited range of these vehicles. Currently there are 2 autogas filling stations (Jersey Gas in St. Helier and Freelance in Trinity). On an island the size of Jersey, both of these constraints would not be so relevant for an island specific fleet. The infrastructure costs of installing new alternative fuel depots would be high, but there should be benefits to operators from lower fuel costs, depending on the relative tax levels on different fuels. For example, with LPG a motorist can achieve 80% of the travelling distance with a litre of LPG compared to that of petrol. However, the costs of 1 litre of LPG is currently 31 pence compared to 63 pence for a litre of petrol. The reductions in emissions from use of LPG compared to Ultra Low Sulphur (ULS) Petrol and ULS diesel are shown below: LPG compared to ULS petrol 11-13% less CO_2 15-80% less NO_x 20-40% less Hydrocarbons 30-50% less CO LPG compared to ULS diesel 80-95% less particulates 99-99.8% less ultra fine particulates 90-99% less NO_x	This measure is promoted within the Sustainable Island Transport Strategy The UK Energy Saving's Trust offer to pay 70% of the costs of converting to LPG. It is recommended the States offer a similar type of incentive to promote the uptake of LPG (eg free or reduced parking charges).

	Cost-effectiveness: medium.	
Option	**Indication of Costs**	**Linkage to other Island Strategy/Policy**
Pedestrianisation	Obviously effective in reducing road traffic, but can lead to overall problems from displaced/diverted traffic (that routes around an area). Any larger projects such as this have high costs, as they usually require construction work. There may be additional benefits from such schemes in St. Helier by increasing attractiveness of areas for tourism. Within the Jersey Island Plan six areas have been identified as pedestrian priority areas where full pedestrianisation, reduction in circulating traffic and removal of on street parking would result in improved air quality. *Cost-effectiveness low – high*	This measure is promoted in the Island Plan, the Island Sustainable Transport Policy and Jersey into the Millennium: A Sustainable Future. They recommend that a number of minor lanes are designated as green lanes. However, as many of the main roads on the Island do not have any footpaths which raises an issue of safety to widen this option to an Island –whole viable alternative. However, in St Helier, 8 pedestrian improvement areas have been identified –see Island Plan. Within the Island plan support is given for a central area which is dedicated to the pedestrian. The Sustainability Strategy notes that the pedestrianisation of King Street in St Helier has been very successful for residents, shoppers, retailers and tourists
Walk to School Plans	This could reduce the impact of peak hour congestion during term times especially around school locations. The effectiveness does depend on the uptake which needs to be encouraged through the Education Services and Health Services to improve children's physical fitness. Needs to be	Safe Routes to School is promoted in the 2002 Island Plan and also in the Island Sustainable Transport Strategy.

	implemented in conjunction with road safety measures. *Cost-effectiveness medium*	

Option	Indication of Costs	Linkage to other Island Strategy/Policy
Cycling and walking provision	Improves overall visual amenity in St Helier. However cycling facilities are needed which may be limited in the physical space available in some of the narrow street canyons in St Helier. However in the other parts of Jersey the existing Green Lanes (for the promotion of cycling and walking) and cycle routes needs to be integrated into a route network. May not be desirable in the rural parts of the Island where distances are perceived to be too far. In terms of improvement in air quality the impact is likely to be minimal unless many of the short journeys made by car in St Helier switch mode. *Cost-effectiveness low but important other benefits.*	Currently on the Island there are 8 cycle routes covering 96 miles but most of these are not integrated. However, in the Island Plan (2002) there is support that residential streets are promoted to ensure that pedestrians and cyclists have equal priority to the car. In these streets vehicle speed is not to exceed 20 mph. Appropriate land use planning and road design can ensure that these speeds are adhered to. However with this option lower speeds are likely to increase emissions of air pollutants and therefore to make a positive impact on air quality it must be integrated with a mode switch from car to walking or cycling. However, taking the Island as a whole, most journeys are less than 5 miles therefore making Jersey ideal for cycling. Is it clear that cycling on Jersey and in St Helier in particular, is restricted because of safety issues and congestion on the main road
Planning Strategy	Looking at future planning policy to ensure developments have adequate public transport provision and will not exacerbate transport and air quality problems. *Cost-effectiveness. Low for current problem, but important for future.*	Island Plan 2002

Option	**Indication of Costs**	**Linkage to other Island Strategy/Policy**
Traffic management	Such as one way systems to restrict the flow of traffic into certain areas (e.g. central areas) or improve the flow of traffic along others (e.g. increasing speeds along main roads). Costs will depend on the levels of infrastructure required. Most effective measures can be in relation to speeds. Given the speed restrictions on Jersey – emissions could actually be reduced along major roads by increasing allowable speeds. Other changes to traffic flows in the centre of St. Helier will be very site-specific. The effectiveness of a Ring Road around St. Helier will also be site specific to the proportion of the total traffic which is through traffic. *Cost-effectiveness low – high*	Policy TT7 of the Island Plan (2002) states that the Planning and Environment Committee will support the development of a Town Centre Movement Strategy. This will aim to give priority to pedestrians, mobility impaired, service requirements, public transport, taxis and cyclists. Currently one of the major problems identified in St Helier is that caused by motorists looking for on-street parking. This leads to increased traffic flow, usually at low speed and results in elevated air pollution concentrations. This measure is promoted within the Sustainable Island Transport Strategy
Raising awareness	To enable all sections of the community to fully participate in the process to improve air quality information in Jersey it is essential that people are provided with accurate and meaningful information in a form that is easily understood. Use of the media, leaflets and the internet etc. *Cost-effectiveness low – high*	

5.3.1 Improving Industrial Sources of Air Pollution

The principal source of industrial emissions in Jersey is the incinerator in Bellozanne. This incinerator is of dated technological design and has little pollution abatement technology. However, recently proposals to decommission this incinerator and construct a new one will reduce significantly the pollution issues arising from incineration in Jersey. It is recommended that the States of Jersey ensure the new plant employs Best Available Techniques of abatement. There is now an urgent need for a financial and policy commitment to be made as presently Jersey is in breach of the EC Directive. There is also the related issue to consider of fugitive emission from ash handling and disposal.

The European Community Directive (96/61/EC) on Integrated Pollution Prevention and Control (the “IPPC Directive”) controls releases from industrial plant to all environmental media. The aim of the IPPC regime is to introduce a more integrated approach to achieve a high level of protection of the environment taken as a whole by, in particular preventing, or where that is not practicable, reducing emissions into the air, water and land. Under IPPC plant operators should show that they have applied the Best Available Techniques to ensure emissions are at a minimum.

Currently, the IPPC regime does not apply to Jersey but it does represent good practice and such legislation would assist the States of Jersey to create a more co-ordinated and integrated approach to pollution issues. For example, currently in Jersey there is concern about the effect of the policy decision to charge for the disposal of waste oil. Traditionally waste oil has been used by some growers to heat greenhouses via waste oil burners and approximately 120,000 litres of waste oil per year had been disposed of at the Bellozanne incinerator or shipped off Island. As a result of the new charge for disposal it is likely that there may be an increase in illegal dumping or burning via waste oil burners which may result in increased nuisance type complaints and associated emissions to air. The IPPC regime would encourage a more integrated approach to such pollution issues.

Best Available Techniques is defined as “the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing in principle the basis for emission limits values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environmental as a whole.”

The Best Available Technique (BAT) approach ensures that the cost of applying techniques is not excessive in relation to the environmental protection they provide. It follows that the more environmental damage BAT can prevent, the more the regulator can justify telling the operator to spend on it before the costs are considered excessive.

Jersey has one power station, which is oil fired. The following improvements have been carried out:-

- £7 million has been spent on updating the distribution control system to increase fuel efficiency by closely following demand. This helps reduce emissions including particles from the stack.

- Low Oxides of Nitrogen (NO_x) burners have now been fitted to the largest boiler. The combustion takes place at lower temperatures so reducing formation of NO_x.

- Sulphur in heavy fuel oil has reduced from 3.5% to 2.0% and has reduced further to approximately 1%.

- Cyclonic dust separators have been installed to catch greater than 95% of particles.

A second 80 MW cable link with France has been laid in 2000 (the first was laid in 1985). This may result in local generation being reduced from 12 to 4 months of the year with the subsequent reduction in air pollution including carbon dioxide (CO_2). Consequently the emissions from the power station as a percentage of the total have decreased.

Other fuels available on Jersey include, liquefied petroleum gas (LPG), which is brought into the island by ship and is relatively expensive, generated electricity and coal both standard and smokeless. Since 1990 the use of oil has increased by approximately 50%, while the use of coal has reduced by 42%. LPG and electricity usage has increased by 20% and 8% respectively up to 2000.

Other options available to improve air quality on Jersey include:

1. Improving best practice in industrial paint spray operations which includes the increased use of water based paints; high volume, low pressure spray guns; high efficiency filters to be used in spray booths to aid removal of contaminants and compliance with Policy Guidance note PG6/34(96).

2. Energy efficiency improvements particularly in domestic housing with the wider installation of cavity and loft insulation. Since April 1st 2002 in the UK the revised Building regulation document L (J in Scotland and N Ireland) has been in force. This document focuses on energy savings in all new buildings, the fabric of the building, heating boilers, controls, lighting equipment and ventilation along with energy ratings or SAP ratings (Standard assessment procedure). This is to aid the UK government achieve a reduction in CO_2 emissions by 12.5% below 1990 levels by 2012. (eg certain UK ventilation companies now provide; low watt ventilation units which use 50% - 80% less power, these utilise a DC motor which is quieter and doubles the product motor life, plus; low watt whole-house recovery units which are up to 90% efficient) It is hoped that the Planning and Building Services Department will update the Building byelaws to incorporate Document Part L. It is recommended the States offer an incentive(s) to upgrade and improve thermal insulation in all new premises.

The use of for example gas condensing boilers for heating or hot water which can be up to 90% efficient and result in lower NO_x emissions are recommended. These energy efficiency programmes can often save individuals money on fuel costs and therefore the uptake of these should be encouraged. It is recommended that this is partially achieved through the introduction of a legislative requirement for new proposed commercial building development to include an energy audit as part of the planning application.

3. Within the industrial and commercial sectors the use of combined heat and power boilers (CHP)can result in approximately 35% reduction in primary energy usage compared to that in power stations. Currently there are five CHP boilers in Jersey, which results in a 30 – 50% reduction in carbon dioxide emissions compared to that of coal/oil fired power units.

4. The planned new incinerator would result in improved emissions and provide a continued source of electricity.

5. The cost of oil per litre in Jersey could be aligned with that of gas charges, which would result in decreased pollutant emissions from the domestic sector and encourage the take up of gas. The feasibility of the providing a gas pipeline to France should be investigated to allow access to cleaner cheaper natural gas. The promotion of smokeless fuels should also be encouraged.

5.4 Roles And Responsibilities

The success of improving air quality to meet European limit values hinges on successful implementation in an integrated approach in Jersey. The principal aim of improving air quality is to improve human health and consequently this air quality strategy and action plans needs to be strongly linked to environmental and health impact assessments on the Island. The co-ordinating role to link the implementation of an air quality strategy together with the Island strategy, Transport Strategy and Planning Strategies should lie in the Environmental Health Department now Health Protection.

Indicators to measure the success of the air quality strategy, and in particular, the success of the options adopted to improve air quality should be made at the outset. These should include continuous monitoring of the pollutant concentrations, vehicle flows on specific streets, passenger numbers on public transport. Other indicator s should be considered including the noise levels, socio-economic factors to ensure social exclusion does not develop as a result of measures implemented. Again the co-ordinating role for the measurement of these indicators should lie with the Environmental Health Department now Health Protection who should provide a comprehensive knowledge on air quality across all States Departments. This would include the health impact assessment of air quality.

The mechanism for the implementation of this air quality strategy should be made clear from the outset. It is recommended that the States of Jersey carry out a feasibility study into each of the options to determine the cost effectiveness of achieving a measured air quality improvement, and to quantify other potential, socio-economic benefits and impacts.
Following which, adequate resources should be made available to refine the most cost-effective options for reduction of emission and for their successful implementation and monitoring for indication of success. Consideration of the drafting of local legislation

setting out limit values for pollutants and a pollution reporting system, based on EU requirements, should be made.

5.5 Raising Awareness And Involving The Whole Community

To enable all sections of the community to fully participate in the process to improve air quality information in Jersey it is essential that people are provided with accurate and meaningful information in a form that is easily understood. Informing the public is an important element of compliance with the EC Framework Directive.

The EC Framework Directive requires Member States to make information publicly available when alert thresholds are levels of pollutant concentrations are exceeded. For example when the alert thresholds for nitrogen dioxide and sulphur dioxide have been exceeded the following information package is required, as a minimum:

- date, hour and location where the limits were exceeded and reasons for the exceedence if available;
- any forecast of any change of the concentration (improvement, stabilisation, worsening), together with any information on the reasons for such changes, geographical areas affected and duration of the occurrence;
- the type of population potentially sensitive to the occurrence;
- recommend precautions to be taken by the sensitive population

Member States are also responsible for the notification of respective organisations (e.g. environment agencies, consumer organisations, health care organisations) using the media, leaflets, internet etc. The requirements are as follows:

- Information on the concentration of sulphur dioxide, nitrogen dioxide and particulate matter is to be updated at least once a day, in the case of the hourly concentrations of sulphur dioxide and nitrogen dioxide, if possible, based on a 1 hour interval

- Information on the concentration of lead in the air is to be updated every three months
- Information on the concentration of benzene in the form of average values for the last 12 months is to be updated at least once in three months and, if possible, once a month
- Information on the concentration of carbon monoxide expressed as maximum 8 hours sliding average values is to be updated at least once a day and, if possible, every hour
- Such information is to be clear, understandable and available.

After the date of attainment Member States need:

- to have taken the necessary measures to ensure compliance with the limit values;
- to continue reporting in accordance with the above Directive requirements.

The Commission is in the process of preparing a Commission Decision, which will provide a common format (in the form of a questionnaire) for Member States to fulfill their annual reporting requirements under the Air Quality Directives.

5.5.1 Health and Environmental Impact Assessment

In Jersey it is important that air quality information should be provided to the public on a regular basis. Various mechanisms can be used to deliver this information including the internet, posters

giving daily pollution levels for the previous month, leaflets and information packs that will be regularly updated. Such information packs should be designed specifically for the various Key Stage education levels as well as for general library suitability. Another important element is an "Alert System" which provides information for alerting people whose health may be affected when air pollution levels rise. This should be addressed through press releases via radio, TV, Ceefax/Teletext and newspapers. An information telephone helpline could be operated providing appropriate health information for concerned and sensitive individuals.

Communication of measurements of air pollution should be in a easily understandable format such as the banding system in the UK which is shown in Table 5.1 overleaf. Air pollution levels are publicised as low, moderate, high or very high with a 1-10 numerical index. This type of public information and education programme is vitally important over the longer term (20-30 years) to change people's behaviour and attitude towards various transport modes. To ensure that any attempt by the States of Jersey to improve air quality is met with success the social acceptability of these pollution reduction measures must be attainable.

Table 5.1 Air Pollution Bandings and Index and the Impact on the Health of People who are Sensitive to Air Pollution

Banding	Index	Health Descriptor
Low	**1**	Effects are unlikely to be noticed even by individuals who know they are sensitive to air pollutants
	2	
	3	
Moderate	**4**	Mild effects, unlikely to require action, may be noticed amongst sensitive individuals.
	5	
	6	
High	**7**	Significant effects may be noticed by sensitive individuals and action to avoid or reduce these effects may be needed (e.g. reducing exposure by spending less time in polluted areas outdoors). Asthmatics will find that their 'reliever' inhaler is likely to reverse the effects on the lung.
	8	
	9	
Very High	**10**	The effects on sensitive individuals described for 'High' levels of pollution may worsen.

An Island Air Quality Forum should be established which would provide a working group of all concerned and interested stakeholders including relevant Jersey politicians and States civil servants to bring forward issues and ideas for the improvement of air quality. Such a group or forum should be led by the Environmental Health Department now Health Protection who have a wide understanding of pollution and health issues.

Most improvement in air quality on the longer term is typically achieved through the planning process. The consideration of mitigation measures to reduce emissions should be an integral part of the environmental impact of any planning application. Current and future polices for the improvement of sustainability on the Island should be accompanied with a Health Impact Assessment which provides a focus on the air quality impact of any proposed planning and transport scheme. The existing requirement for Environmental Impact Assessments should incorporate Health Impact Assessments. It is important that air quality issues are included in decision-making criteria for any proposed planning development.

6 SUMMARY

The States of Jersey are committed to attaining European Environmental Legislation. In 1996 the EU set out an Air Quality Framework Directive which set out an approach for each Member State to assess air quality within their national area. In 1999 and 2000 daughter directives were brought into force which set limit values for the protection of human health for a number of air pollutants. These limit values are to be achieved by each Member State by 2010 at the latest. In addition to these limit values the daughter directives set out Upper Assessment Thresholds and Lower Assessment Thresholds which are both lower than the limit values for each pollutant. Should these assessment thresholds be exceeded in any Member State then there is a requirement on that State to carry out further investigation into the causes of the pollution and report to the Commission.

For a number of years the Environmental Health Department now Health Protection of the States of Jersey has been undertaking routine and short term specialised air pollution monitoring. The routine monitoring has been enabled by use of simple passive diffusion tubes for the measurement of nitrogen dioxide and benzene. These have been placed at 28 sites across the Island including 14 in St Helier. In addition several campaigns of monitoring have been made in St Helier using sophisticated monitoring equipment which is more accurate than diffusion tubes. More recently the Environmental Health Department have purchased automatic particulate monitors which have enabled more accurate monitoring of this pollutant as a matter of routine. This monitoring has given a good understanding as to which pollutants are important and enabled a comparison with the EU limit values.

In Jersey the principal pollutant of concern is nitrogen oxides where about 68% of the total emissions in Jersey are from road transport sources. Jersey is a very car orientated society and has a significantly higher car ownership level than in the UK. This has led to high concentrations of nitrogen dioxide particularly in St Helier, which is prone to congestion. Emissions of pollutants from road vehicles are particularly high during low speeds. The congestion problem in St Helier is compounded by narrow streets inhibiting the effective dispersal of the pollution by the wind. The current parking problems also exacerbate the pollution levels, in particular, when motorists circle around seeking on-street parking which is limited in availability. Emissions of pollutants are also comparatively high from Heavy Goods Vehicles including buses. Therefore areas which suffer from a high proportion of slow moving or idling Heavy Goods Vehicles will also show elevated pollution concentrations. Consequently, in Jersey the pollution hot-spots found during monitoring campaigns were Georgetown in St Saviour, Beaumont in St Peter and within St Helier are at First Tower, the Bus Station. Other sites also show elevated levels of nitrogen dioxide include Le Bas Centre. Measurements at some of these sites indicate that the European limit value or the Upper or lower assessment thresholds are currently being exceeded. It is therefore recommended that the States of Jersey implement an action plan to ensure emissions are reduced in these locations.

There are other sources of pollution in Jersey which have been considered. While, there is virtually no heavy industry in Jersey, and little light industrial activity there are still particular plant in Jersey which causes concern in terms of emission to air.

In Jersey the main emitters of high level SO_2 and NO_2 are the JEC oil fired power station and the States of Jersey's municipal waste incinerator. The JEC power station as mentioned earlier shut down for 6/7 months from March 2002 and when running uses reduced sulphur heavy fuel oil (1%). Low NO_x burners have also been fitted to the largest boiler thereby reducing levels of NO_2. The States of Jersey's municipal waste incinerator does not comply with EC Directive 89/369/EC and is to be replaced in the next 5 years with a new facility meeting the latest emission standards.

Also, the Health and Social Services Crematorium is 30+ years old and does not comply with current UK Environmental Protection Acts 1990 process guidance note PG5/2(91). Pollutants produced from crematoria could include:- dioxins and furans, mercury, particulates, hydrogen chloride and carbon monoxide. There is a proposal to replace the existing cremators in the next 12 months with 2 new units. The new cremators will meet the current UK process guidance notes standards.

There are a number of light industrial operations which combined increase the total emissions on pollutants on the Island. These include printers, dry cleaners and the storage and handling of organic chemicals at the port. In the food industry there are a number of bakeries, a brewery and the manufacture of alcohol spirits which will give rise to emissions of pollutants to air.

Other major sources of pollution to air on Jersey is aircraft and shipping. In 1999 there were about 80,000 aircraft movements on the Island and there were over 45,000 passengers who arrived in Jersey by sea.

To assist the States of Jersey improve air quality to protect human health fifteen options have been provisionally assessed in terms of their cost effectiveness at reducing the emissions in the required geographical area. The most cost effectiveness options are the following and it is recommended that the States of Jersey carry out a feasibility study into these options which includes the cost effectiveness of air quality improvement, and other potential, socio-economic benefits and impacts, of each to a higher precision than the current data enabled:

- MOT test
- Park and Ride schemes in St Helier
- Parking (charging and on street parking restrictions)
- Urban bus schemes
- Vehicle scrapage subsidies
- Vehicle access limits
- Variable tax on engine size and age
- Pedestrianisation
- Alternative fuels
- Walk to school plans
- Traffic management

The implementation of an action plan and air quality strategy should be co-ordinated by the Environmental Health Department (now Health Protection) who would be responsible for communication and integration with other important Island strategies including the Traffic

Strategy, Planning and Environment Island Plan and the Sustainable Strategy. Indicators to measure the success of the air quality strategy, and the options chosen to decrease emissions, should be clear from the onset of the implementation. These should include monitoring of air quality, traffic flow reductions, traffic speed increase where there is current congestion, passenger numbers using public transport. Indicators to determine the impact on other environmental and socio-economic issues should be considered.

Currently there is no automatic monitoring of nitrogen dioxide, which complies with the EU directive requirements for accuracy. As the limit value for nitrogen dioxide is over an annual period, monitoring is required for the whole calender year. It is therefore recommended that the island undertakes continuous monitoring for NO_2. For the first year at least, this should be at the highest known pollution "hotspot" (Weighbridge). Once compliance with the Daughter Directive(s) is confirmed at this location, the site could be relocated to an area more representative of general population exposure (eg residential or urban background). These monitors will also indicate the effectiveness of any traffic improvement measures in pollution reduction.

The improvement needed in air quality in Jersey relies on a multi-agency approach and commitment from all stakeholders to keep working on the issues. The problems of local air quality are directly linked to the local transport strategy and the community's attitude towards the use of the private car. Local policies need to target car users in a fair way to ensure acceptability of the approaches to improve air quality.

Good communication between the stakeholders is important. Campaigns to deliver the messages particularly in relation to the choice of transport mode will be necessary to ensure uptake of policies to deliver air quality targets. To enable all sections of the community to fully participate in the process to improve air quality information in Jersey it is essential that people are provided with accurate and meaningful information in a form that is easily understood. Informing the public is an important element of compliance with the EC Framework Directive. Indeed the EC Framework Directive requires Member States to make information publicly available when alert thresholds are levels of pollutant concentrations are exceeded. To enable good communication an Island Air Quality Forum should be established which would provide a working group of all concerned and interested stakeholders.

Most improvement in air quality on the longer term is typically achieved through the planning process. The existing requirement for Environmental Impact Assessments should incorporate Health Impact Assessments which assesses the air quality impact of a proposed development on the health of local residents and visitors. It is important that air quality issues are a stipulated criteria for decision-making on any proposed planning development. The consideration of mitigation measures to reduce emissions should be an integral part of the environmental impact of any planning application.

Appendix A
Sources and Health Effects of Pollutants

CONTENTS

Sources and Health Effects of Particulates (PM_{10}) and NO_2

The pollutants of most concern in Jersey are particulates PM_{10} and nitrogen dioxide NO_2. Further details on the sources and health effects of these are given here:

1. Particles

Particles are also sub divided into several size ranges whose limits reflect the ability of the particles to penetrate into the lungs. The human upper respiratory tract is an efficient filter for PM_{10}, (particles of 10µm or below) but as with all filter systems, it loses its filtering efficiency quite quickly with a decrease in particle diameter. As particles generally have a random shape the term used is its' 'aerodynamic diameter' which measures its effective diameter as being equivalent to a sphere. In reality particles come in all shapes. The emphasis on sub dividing the particle size range is to measure the 'respirable' that is below 10µm or PM_{10} and 'non-respirable' particle that is above 10µm.

Particulates are produced from both petrol and diesel engines. Exhaust emissions are not necessarily higher from diesel vehicles but are more visible than from petrol engines. Diesel is also a more dense fuel containing more carbon/hydrogen bonds resulting in greater carbon particles compared to petrol. For petrol vehicles, mass emissions are undoubtedly lower but their size distribution is unclear. The greatest proportion of particles is in the smaller range of less than PM_{10}, which are less visible than diesel emissions but are potentially more harmful. In ambient air ultra fine particles account for just 1% of the total mass of $PM_{2.5}$, however they constitute almost 75% of the total particle number.

Table A1: Comparison of the emissions from diesel, uncontrolled petrol engines and vehicles fitted with 3 way catalysts.

Pollutant	Uncontrolled Petrol engine	3 way catalyst	Diesel
NOx	Highest	Low	Intermediate
CO	Highest	Intermediate	Lowest
HC	Highest	Low	Intermediate
Particulates	Low	Lowest	Highest

Diesel engines have a tendency to emit smoke/particles when either worked hard or when not properly maintained, or both. They operate at a significantly higher air/fuel ratio than a petrol engine therefore combustion is more efficient. However diesel fuel is less volatile than petrol and must be dispersed effectively and at the right time for it to burn properly. The major particle emissions occur when starting, when the engine is cold, or when fuel injectors are worn.

European diesel contains 10 - 35% by volume of hydrocarbons with aromatic rings. There is believed to be a relationship between the level of aromatics in fuel, and the emission level of particles and polcyclic aromatic hydrocarbons (PAHs). The term polcyclic aromatic
hydrocarbon covers a large group of organic compounds whose molecular structures contain two or more aromatic rings fused together. Some PAHs are present in the atmosphere as gases and are associated with particles because of their low vapour pressures. PAHs are formed in all processes involving combustion of carbon-based fuel.

PAHs are usually emitted in low concentrations in the vapour phase, condensed on to particles. Analysis of diesel exhaust particle emissions has shown that the major PAH components are:

- napthalene
- fluorene
- phenanthrene and their alkyl derivatives
- carbazole and
- dibenzothiophene

Concerns relate to the carcinogenic risk associated with such compounds The International Agency for Research on Cancer has classified diesel engine exhaust as a probable human carcinogen. Evidence suggests that the main source of PAHs is unburnt fuel, although some high molecular weight PAH is formed during combustion of the fuel in the engine. It is also interesting to note that evidence suggests a strong link between air/fuel ratio and PAH emission; higher emissions occur at lower air/fuel ratios when the engine is not working efficiently.

2. Nitrogen dioxide

Nitrogen dioxide is a gas produced by reaction of nitrogen and oxygen in combustion processes. The reaction usually takes place in two stages, the first resulting in the combination of one atom of each of the gases to form nitric oxide, this compound then being oxidised over time to produce nitrogen dioxide. Wherever nitrogen dioxide occurs, nitric oxide is also found, and these oxides of nitrogen are collectively known as NOx. There are several natural sources of oxides of nitrogen in the atmosphere, including lightning and forest fires. Bacterial activity in soils and possibly plant metabolism are responsible for a proportion of the oxides of nitrogen found in the air in the United Kingdom, but by far the largest amount is formed as a consequence of combustion of the fossil fuels petrol, oil, coal and gas, especially by motor transport and non-nuclear power stations.

Once formed, nitrogen dioxide takes part in chemical reactions in the atmosphere that convert it to nitric acid and nitrates, both of which can be removed by rain. However, nitrates can also remain in the air as very small particles, for example as ammonium nitrate, which can be dispersed widely in the atmosphere, contributing to the airborne concentrations of small particles known as PM_{10}. Nitric oxide is a gas that is produced naturally by cells in the lung and respiratory tract, and has no harmful consequences when inhaled by man at the concentrations likely to occur in the ambient atmosphere.

Nitrogen dioxide is an irritant gas which has been known for many years to have serious and sometimes fatal effects on health when inhaled in the very high concentrations associated with accidental exposures, for instance in farm silos and in mines. There is now evidence that it has more subtle effects on health at the much lower concentrations that may occur in the ambient atmosphere, both outdoors and indoors

In very high concentrations, such as have occurred in certain industrial accidents, nitrogen dioxide can cause very severe and sometimes fatal lung damage. However most concern is with the health effects that may be observed at the much lower concentrations that occur during pollution episodes in our towns and cities. It has been suggested that the gas may have both acute, short-term, and chronic, longer-term, effects on health, particularly in people with asthma.

The mechanism by which nitrogen dioxide acts is most probably related to its properties as an oxidising agent which can damage cell membranes and proteins. At relatively high concentrations nitrogen dioxide causes acute inflammation of the airways. In addition, short-term exposure can affect the immune cells of the airways in a manner that might predispose people to an increased risk of respiratory infections.

The health effects of nitrogen dioxide have been assessed in four main ways:

(i) by experimental exposure of volunteers with and without asthma to the gas;
(ii) by assessment of the effects on groups of people of variations in ambient concentrations of nitrogen dioxide, using daily symptoms or lung function measurements;
(iii) by assessing changes in hospital admissions or mortality in a population in relation to changes in ambient concentrations; and
(iv) by comparing the health of groups of people who have had different long-term exposures.

People with healthy lungs, whether at rest or exercising, show little response to experimental inhalation of nitrogen dioxide at concentrations well above those occurring in the ambient air, even during extreme pollution episodes. Very small changes in sensitive tests of lung function have been recorded at exposures between 2500 and 7500 ppb. However, in people with asthma, some studies have shown changes in these tests of lung function to have occurred at exposures of around 300 ppb when the subjects have been exercising, though other studies have shown no changes at higher concentrations. Measurements of the responsiveness of the lung to inhalation of irritant chemicals have shown that the airways of some people with asthma may become more sensitive to such stimuli after exposure to nitrogen dioxide at concentrations down to about 200 ppb. It should be noted that this concentration is only reached in occasional episodes of outdoor air pollution in the United Kingdom.

Other studies have investigated the possibility that inhalation of nitrogen dioxide at moderate concentrations may cause an inflammatory reaction in the lungs or may increase the susceptibility of individuals to subsequent inhalation of allergens, such as those from house dust mite or grass pollen. The inflammatory reaction, if repeated frequently, might act to decrease the resistance of individuals to infection, and is more relevant to repeated exposures to elevated indoor levels than to exposure to the outdoor concentrations typically occurring in the United Kingdom. At present, the evidence from both human and animal studies is equivocal. However, there is some evidence that exposure to nitrogen dioxide can enhance the response of someone with asthma to inhalation of allergen. After exposure of volunteers with asthma to 400 ppb for one hour, inhalation of house dust mite extract has been shown to cause a significantly greater fall in lung function than occurred in a control experiment, suggesting that the gas may have primed the airways to react more readily to the allergen. A

similar finding has been reported following ozone exposure and grass pollen inhalation and it may be that this subtle effect is a more important consequence of irritant gas exposure than the more direct effects on lung function. Nevertheless, to date all these effects have only been demonstrated at concentrations of nitrogen dioxide that occur in the ambient air of the United Kingdom only in the most exceptional circumstances.

The question as to whether exposure to nitrogen dioxide causes long-term damage to the lungs is less well studied and the information is more difficult to interpret. There is less information, what there is contradictory, and the evidence tends to be indirect, relying on surrogate measures of exposure rather than direct measurements. Studies from Switzerland and the United States have suggested that those living in areas with higher exposures to nitrogen dioxide have poorer lung function, but other similar studies have failed to find such an association. The contrast between the former East and West Germany, with higher levels of nitrogen dioxide from traffic pollution and higher levels of hay fever and asthma in the West, led to some speculation that the two might be causally connected. However, although there is, as mentioned above, some experimental evidence that nitrogen dioxide may enhance susceptibility to allergens and some studies have suggested that those living near to busy roads or in areas with heavy traffic pollution may be at greater risk of asthma, a recent study in East London failed to find such an association.

Appendix B
Air Pollution Monitoring Locations

CONTENTS

Nitrogen Dioxide

Monitoring of NO_2 was started in 1993/4 with just 4 sites. This number increased up to a total of 19 sites by 2000. These are shown in Table B1 and Figure B1.

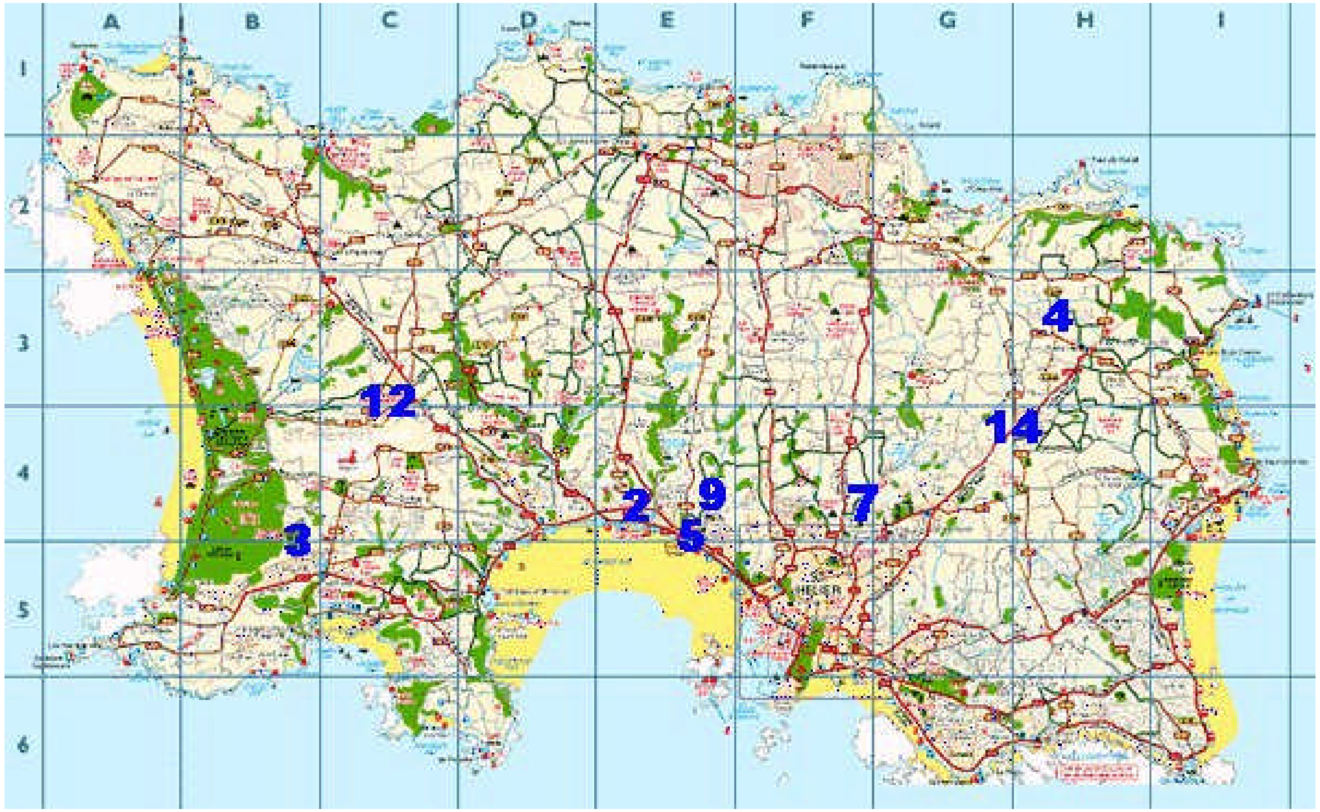
Table B1. NO_2 Monitoring sites

Site number	Site Name	Grid Reference	Description
N1	Le Bas Centre	658 489	Urban Background
N2	Mont Felard	629 501	Residential background, to SW of waste incinerator and 20m from busy road
N3	Les Quennevais	579 496	Residential Background
N4	Rue des Raisies	689 529	Rural Background
N5	First Tower	636 497	Kerbside on major road
N6	Weighbridge	651 483	Roadside at bus station near centre of St Helier
N7	Langley Park	660 501	Residential background
N8	Georgetown	661480	Kerbside on major road
N9	Clos St Andre	638 499	Residential area near Bellozanne Valley refuse Incinerator. Background
N10	L'Avenue et Dolmen	656 490	Urban background close to ring road
N11	Robin Place	656 489	Urban background
N12	Beaumont	597 516	Kerbside
N13	The Parade *	648 489	Roadside site at General Hospital
N14	Maufant	683 512	Background site in Maufant village
N15	Jane Sandeman	652 494	Urban background on housing estate
N16	Saville Street	648 492	Background
N17	Broad Street	652 486	Urban background
N18	Beresford Street	653 486	Urban background
N19	La Pouquelaye	654 496	Kerbside on St Helier ring road.

*The Parade has been moved is now a roadside site.
Kerbside: less than 1m from kerb of a busy road.
Roadside: 1-5m from kerb of a busy road.

Background: > 50m from the kerb of any major road. *Note: all grid references are from OS 1:25000 Leisure Map of Jersey and are given to the nearest 100m.*

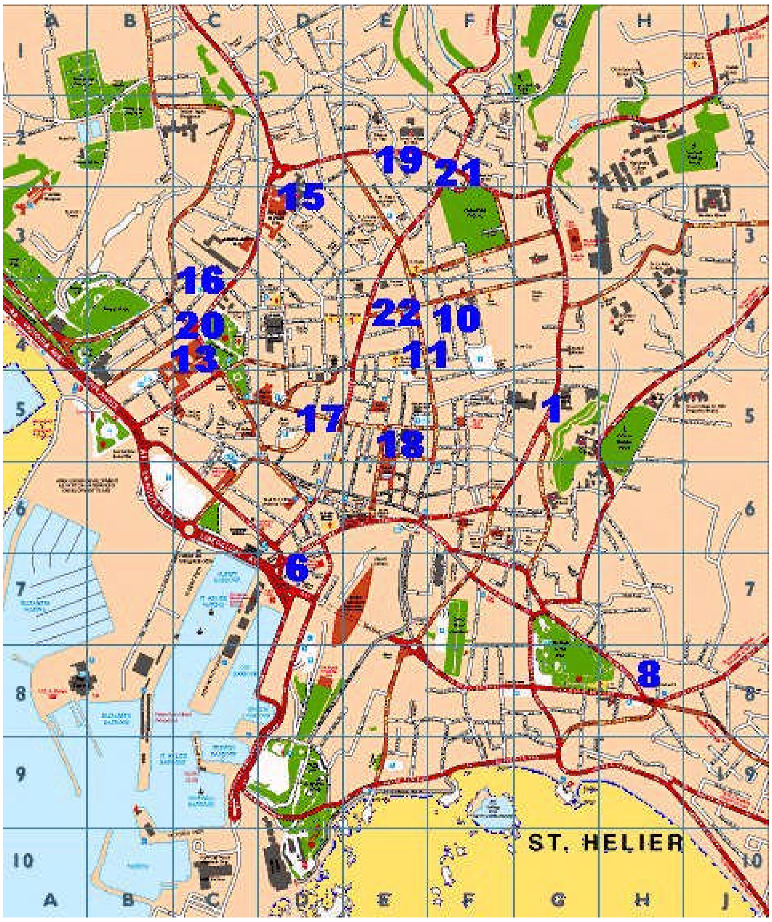
Figure B1 - Site Locations – see also next page



Key:

1. Le Bas Centre
2. Mont Felard
3. Les Quennevais
4. Rue Des Raisies
5. First Tower
6. Weighbridge
7. Langley Park
8. Georgetown
9. Clos St Andre
10. L'Avenue et Dolmen
11. Robin Place
12. Beaumont
13. The Parade
14. Maufant
15. Jane Sandeman
16. Saville Street
17. Broad Street
18. Beresford Street
19. La Pouquelaye
20. Elizabeth Lane
21. Springfields Garage

Figure B1 Continued



Sulphur Dioxide

SO_2 monitoring was carried out at just one site during 2000 and 2001. Results from 1999 and earlier years, based on a total of 13 sites, indicated that SO_2 levels in Jersey were not likely to be high enough to constitute a problem. The single site at Clos St Andre was retained because it is in a residential area near the Bellozanne Valley waste incinerator (a potential source of SO_2).

Table B2 SO_2 Monitoring site

Site number	Site Name	Grid Reference	Description
S13	Clos St Andre	638 499	Residential area near Bellozanne Valley refuse incinerator.

BTEX (VOCs)

The 2001 survey monitored BTEX at six of the same seven BTEX sites used in 1999. These are shown in Table B3. The aim was to investigate sites likely to be affected by different emission sources, and compare these with background sites. The sites at Beresford Street and Le Bas Centre are intended to monitor hydrocarbon concentrations at an urban roadside and urban background location respectively. The Elizabeth Lane site is close to a paint spraying process, and the Springfields Garage site is located by a fuel filling station, both possible sources of hydrocarbon emissions. The Stopford Road site is located at a house between two petrol stations. (During the 1999 survey, this site was actually located inside the house to investigate reports of odours by residents; it has since been moved outside). The Clos St Andre site is located near the Bellozanne Valley waste incinerator.

Table B3. BTEX Monitoring sites

Site number	Site Name	Description
BTEX 1	Beresford Street	Urban roadside
BTEX 2	Le Bas Centre	Urban background
BTEX 3	Elizabeth Lane	Urban background near paint spraying process
BTEX 4	Springfields Garage	Urban background near fuel filling station
BTEX 6*	Stopford Road (outdoors)	Outdoor urban background site, at house between two petrol stations.
BTEX 7	Clos St Andre	Residential area near Bellozanne

		Valley refuse incinerator.

* This BTEX tube has been moved to Jersey airport.

Appendix C

Upper and Lower Assessment Thresholds

CONTENTS

Table C1: Upper and lower assessment thresholds as laid out in the EC directives 1999/30 and 2000/69.for the protection of human health

		24 hour limit value	Annual average limit value
SO_2	Upper Assessment Threshold	60% of the limit value (75 µg m^{-3}) not to be exceeded more than 3 times in any calender year	N/A
	Lower Assessment Threshold	40% of the limit value (50 µg m^{-3}) not to be exceeded more than 3 times in any calender year	N/A
NO_2	Upper Assessment Threshold	70% of the limit value (140 µg m^{-3}) not to be exceeded more than 18 times in any calender year	80% of the limit value (32 µg m^{-3}).
	Lower Assessment Threshold	50% of the limit value (100 µg m^{-3}) not to be exceeded more than 18 times in any calender year	65% of the limit value (26 µg m^{-3})
PM_{10}	Upper Assessment Threshold	60% of the limit value (30 µg m^{-3}) not to be exceeded more than 7 times in any calender year	70% of the limit value (14 µg m^{-3})
	Lower Assessment Threshold	40% of the limit value (20 µg m^{-3}) not to be exceeded more than 7 times in any calender year	50% of the limit value (10 µg m^{-3})
Pb	Upper Assessment Threshold	N/A	70% of the limit value (0.35 µg m^{-3})
	Lower Assessment Threshold	N/A	50% of the limit value (0.25 µg m^{-3})
CO	Upper Assessment Threshold	N/A	70% of the limit value (7 mg m^{-3})
	Lower Assessment Threshold	N/A	50% of the limit value (5 mg m^{-3})
Benzene	Upper	N/A	70% of the limit value

	Assessment Threshold		(3.5 μg m^{-3})
	Lower Assessment Threshold	N/A	50% of the limit value (2 μg m^{-3})

Appendix D
Emissions Estimates for Jersey

CONTENTS

Table D1: Emission Estimates for Jersey by "SNAP" Code

The emission estimates presented below are disaggregated by SNAP code. This is a standard classification used to allow comparison of emissions from different countries across Europe under the CORINAIR framework.

SNAP	CATEGORY NAME	Tonnes per annum **NOx**	Tonnes per annum **VOC**	Tonnes per annum **Benzene**	Tonnes per annum **NH_3**
1	**Combustion in Energy Production &Transformation**	849	13	0.6	NE
2	**Comb. in Commercial Residential & Agriculture**	176	61	3.1	0
3	**Combustion in Industry**[1]				
4	**Production Processes**	0	19	0.0	az
5	**Extraction/Distribution of Fossil Fuels**	0	130	0.7	0
6	**Solvent Use**	0	485	0	1
7	**Road Transport**	1777	2022	118.9	16
8	**Other Transport & Machinery**				
	8.1 Shipping	401	15	0.7	0
	8.2 Aircraft	148	32	0.7	0
	8.3 Other Transport	557	62	3.1	0
9	**Waste Treatment & Disposal**	1	1	0	NE
10	**Agriculture, Forestry & Land Use Change**	0	0	0	113
11	**Nature**[2]	0	0	0	NE
	TOTAL	**3909**	**2840**	**128**	**130**

0 This indicates that emissions are less than 0.5 tonnes (or less than 0.05 for Benzene)
NE "Not Estimated" It has not been possible to make emission estimates for this pollutant & category
az "Assumed Zero" Emissions are assumed to be negligible, but this has not been confirmed

1. Emissions are included in SNAP2- "Combustion. in Commercial Residential & Agriculture"
2. Emissions from "Nature" are not included under emission protocols.

Appendix E
Useful Website addresses

CONTENTS

Useful website addresses

General Websites:

Jersey's Department of Health and Social Services www.health.gov.je
Cabinet Office "regulatory impact" site www.cabinet-office.gov.uk/regulation
Chartered Institute of Environmental Health www.cieh.org.uk
Department of Health's air pollution site www.doh.gov.uk/hef/airpol/airpolh.htm
DEFRA site www.defra.gov.uk
DGXI – Environment, Nuclear Safety & Civil Protection
www.europa.eu.int/comm/dg11/index_en.htm
Don't Choke Britain Campaign www.dcb.org.uk
European Environment Agency www.eea.eu.int
International Institute for Applied Systems Analysis www.iiasa.ac.at
Local Government Association www.lga.gov.uk
National Asthma Campaign www.asthma.org.uk
National Environmental Technology Centre (AEA Technology)
www.aeat.co.uk/netcen/airqual
National Society for Clean Air and Environmental Protection www.nsca.org.uk
Natural Environmental Research Council www.nmw.ac.uk
Scottish Environment Protection Agency www.sepa.org.uk
Scottish Natural Heritage www.snh.org.uk
United Nations Environment Programme www.unep.org
Air Quality Encyclopaedia www.doc.mmu.ac.uk/aric/eae
Health Effects Institute www.healtheffects.org
British Thoracic Society www.brit-thoracic.org.uk
Committee on the Medical Effects of Air Pollutants (COMEAP)
www.doh.gov.uk/comeap/index.htm
World Health Organisation www.who.int/peh/air/airqualitygd.htm

Nitrogen Dioxide:
www.defra.gov.uk/environment/airquality/consult/naqs/6e.htm
www.doh.gov.uk/hef/airpol/airpolh.htm
www.defra.gov.uk/environment/airquality/aqs/no2/index.htm
Sulphur Dioxide
www.defra.gov.uk/environment/airquality/strategy/pdf/section9.pdf
Carbon Monoxide:
www.exnet.iastate.edu/Pages/communications/CO/co1.html
www.nlm.nih.gov/medlineplus/carbonmonoxidepoisoning.html
www.phymac.med.wayne.edu/FacultyProfile/penney/COHQ/co1.htm
Tropospheric Ozone:
www.al.noaa.gov/WWWHD/pubdocs/TropoRural.html
www-gte.larc.nasa.gov/trace/tra_fig1.htm
www.ucar.edu/learn/1_7_1.htm
charlotte.med.nyu.edu/outreach/ozonetropo.html
Ozone:
www.epa.gov/docs/ozone
www.atm.ch.cam.ac.uk/tour
sedac.ciesin.org/ozone
ohioline.osu.edu/cd-fact/0182.html
www.int-ozone-assoc.org/
www.greenpeace.org/~ozone
e-net.awi-bremerhaven.de/MET/Neumayer/ozone_his.html
www.geocities.com/RainForest/Vines/4030
Lead:
www.epa.gov/opptintr/lead/
www.epa.gov/lead/nlic.htm
www.lead.org.au/
www.niehs.nih.gov/oc/factsheets/lyh/lyh.htm
www.nsc.org/ehc/nlic/leadlink.htm
VOCs:
www.epa.gov/iaq/voc.html
www.doc.mmu.ac.uk/aric/eae/Air_Quality/Older/VOCs.html
www.ilpi.com/msds/ref/voc.html
Acid Deposition:
www.epa.gov/airmarkt/acidrain/index.html
www.chesapeakebay.net/info/air_pollution.cfm#impacts
www.aeat.co.uk/netcen/airqual/reports/home.html#acid
Global Warming:
www.ukcip.org.uk/climate_change/climate_change.html
www.defra.gov.uk/environment/climatechange/01.htm

www.ukcip.org.uk/
library.thinkquest.org/C0111401/global_warming.htm