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18 Air Quality

18.1 Introduction

Air quality is an important area of the environment, especially from a human interaction point of view, but equally for all air breathing animals. In Guernsey since 1992 data on NO_2 (Nitrogen Dioxide) has been collected, initially at 5 sites around Guernsey and since 1995 at 9 sites. These include urban and rural areas and roadside and background areas, which are sampled monthly. This information is directly comparable to that available in the UK, and annual averages are published in the “Guernsey Facts and Figures” booklets. Guernsey also has an ‘Air Quality in Guernsey, Screening and Assessment Document’ which was released in March 2010.

18.2 Baseline Environment

Air quality is adjudged based on the concentrations of a number of impurities, mainly the levels of Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ozone (O_3), Carbon Monoxide (CO) and Particulate Matter (PM) in the air that we breathe. The World Health Organisation (WHO) published global air quality guidelines in 2005 which are designed to support the implementation of countries individual targets regarding air quality. However, these guidelines are not enforceable; they are merely to provide advice to countries.

18.2.1 Monitoring in Guernsey

Based upon air quality monitoring data that has been collected on Guernsey by the States of Guernsey Health and Social Services (HSSD) since 1992, air quality in Guernsey is generally very good. There are few significant industrial processes on-Island although road traffic volumes are high. The risk of the air quality objectives for benzene, 1,3-butadiene, carbon monoxide, lead, particulate matter and sulphur dioxide being exceeded are considered negligible. Whilst not currently exceeding the objective levels, there are two air pollutants of local concern; nitrogen dioxide and ozone. The former is associated with road traffic but ozone levels are greatly affected by transboundary airflows and cannot be controlled at a local level.

The sampling undertaken in Guernsey has a variety of sources in both urban and rural areas, including roadside and non roadside areas. Guernsey has four permanent air quality monitoring stations; an urban background site, two urban roadside sites and a rural site. The urban background site is at the Youth Centre site on Brock Road and has equipment to measure PM_{10}, SO_2 and nitrogen oxides (NO_x) levels. The first urban roadside site is on the Grange and has equipment to measure NO_x and CO levels. The second urban roadside site is in Bulwer Avenue in St Sampsons, which was previously run by the Public Services Department and has been run by HSSD since the beginning of 2010. This site has NO_x, SO_2 and PM_{10}

analysers. The rural site is at the Reservoir where ozone (O_3) is measured. There is also a weather station at the rural site. The Brock Road, Grange and Reservoir stations have been operating since 1999. For information about the equipment used for measurements please see "**Air Quality in Guernsey, Screening and Assessment Document, March 2010"**.

Nitrogen dioxide levels are also monitored on a monthly basis using diffusion tubes situated around Guernsey. Additional nitrogen dioxide, nitrogen oxides and sulphur dioxide diffusion tubes were also used at an additional 21 sites across Guernsey, Herm and Lihou as part of the Environmental Impact Assessment for the proposed Suez waste from energy plant although this monitoring has now ceased.

The information that Guernsey collects is directly comparable to the UK. "Guernsey Facts and Figures", an annual report from the States of Guernsey, reports the annual maximum levels of NO_2, SO_2, PM and O_3. In addition to the information reported in "Guernsey Facts and Figures" HSSD undertakes sampling, and reports in various publications, of air quality in Guernsey, and this gives a reasonable assessment of Guernsey's on land air quality.

18.2.2 Air Quality Standards

Air quality standards are set by each country to protect public health. Air quality standards for pollution are concentrations over a given time period that are considered to be acceptable in the light of what is known about the effects of each pollutant on health and on the environment. The standards vary according to a nations approach to balancing the health risks and technological feasibility along with various other political and social factors. They can also be used as a bench mark to see if air quality is getting better or worse. An objective is the target date on which exceedances of a standard must not exceed a specified amount.

As the information is comparable to the UK, the most relevant comparison for Guernsey's air quality levels are the standards and objectives adopted in the UK that are defined in the latest Air Quality Strategy for England, Scotland, Wales and Northern Ireland, published on 17th July 2007. A summary of the current UK Air Quality Standards and Objectives is presented in table 18.2.1. Guernsey currently follows, although does not enforce, the English standards; however there are plans, by the end of 2011, to introduce an air quality management regime which is to be implemented by Ordinance under the Environmental Pollution Law. In implementing this Guernsey is looking to follow how Scotland has implemented standards.

An exceedance of a standard is a period of time (which is defined in each standard) where the concentration of a substance is higher than that set down by the standard. In order to make useful comparisons between pollutants, for which the standards may be expressed in terms of different averaging times, the number of days on which an exceedance has been recorded is often reported. In the UK results are presented as averages over the course of the year for an annual report. There is also information given on hourly samples over the year at specific sites.

Table 18.2.1 – UK Air Quality Standards and Objectives 2007 (Taken from Air Quality in Guernsey Screening and Assessment Document March 2010)

UK Air Quality Objectives for Protection of Human Health, July 2007			
Pollutant	**Air Quality Objective**		**To be achieved by**
	Concentration	**Measured as**	
Benzene All authorities	16.25 µg m^{-3}	Running annual mean	31 December 2003
England and Wales Only	5.00 µg m^{-3}	Annual mean	31 December 2010
Scotland and N. Ireland	3.25 µg m^{-3}	Running annual mean	31 December 2010
1,3-Butadiene	2.25 µg m^{-3}	Running annual mean	31 December 2003
Carbon Monoxide England, Wales and N. Ireland	10.0 mg m^{-3}	Maximum daily running 8-hour mean	31 December 2003
Scotland Only	10.0 mg m^{-3}	Running 8-hour mean	31 December 2003
Lead	0.5 µg m^{-3} 0.25 µg m^{-3}	Annual mean Annual mean	31 December 2004 31 December 2008
Nitrogen Dioxide	200 µg m^{-3} not to be exceeded more than 18 times a year 40 µg m^{-3}	1-hour mean Annual mean	31 December 2005 31 December 2005
Particles (PM10) (gravimetric) All authorities	50 µg m^{-3}, not to be exceeded more than 35 times a year 40 µg m^{-3}	Daily mean Annual mean	31 December 2004 31 December 2004
Scotland Only	50 µg m^{-3}, not to be exceeded more than 7 times a year 18 µg m^{-3}	Daily mean Annual mean	31 December 2010 31 December 2010
Particles (PM2.5) (gravimetric) *	25 µg m^{-3} (target)	Annual mean	2020
All authorities	15% cut in urban background exposure	Annual mean	2010 - 2020
Scotland Only	12 µg m^{-3} (limit)	Annual mean	2010

UK Air Quality Objectives for Protection of Human Health, July 2007			
Pollutant	**Air Quality Objective**		**To be achieved by**
	Concentration	**Measured as**	
Sulphur dioxide	350 µg m^{-3}, not to be exceeded more than 24 times a year	1-hour mean	31 December 2004
	125 µg m^{-3}, not to be exceeded more than 3 times a year	24-hour mean	31 December 2004
	266 µg m^{-3}, not to be exceeded more than 35 times a year	15-minute mean	31 December 2005
PAH *	0.25 ng m^{-3}	Annual mean	31 December 2010
Ozone *	100 µg m^{-3} not to be exceeded more than 10 times a year	8 hourly running or hourly mean*	31 December 2005

*** not included in regulations at present**

Light Blue shaded data shows new objectives

The Air Quality (England) Regulations 2000 specify air quality objectives for benzene, 1,3-butadiene, carbon monoxide (CO), lead, nitrogen dioxide (NO_2), particles (PM_{10}) (gravimetric) and sulphur dioxide (SO_2). Objectives have also been set for polycyclic aromatic hydrocarbons (PAH), ozone and particles ($PM_{2.5}$) (gravimetric) although these are not yet included within the regulations. As previously mentioned Guernsey currently does not need enforce these standards, although they must be considered as good practice benchmarks, especially with the plans to implement standards in the future.

18.2.3 Data for Guernsey

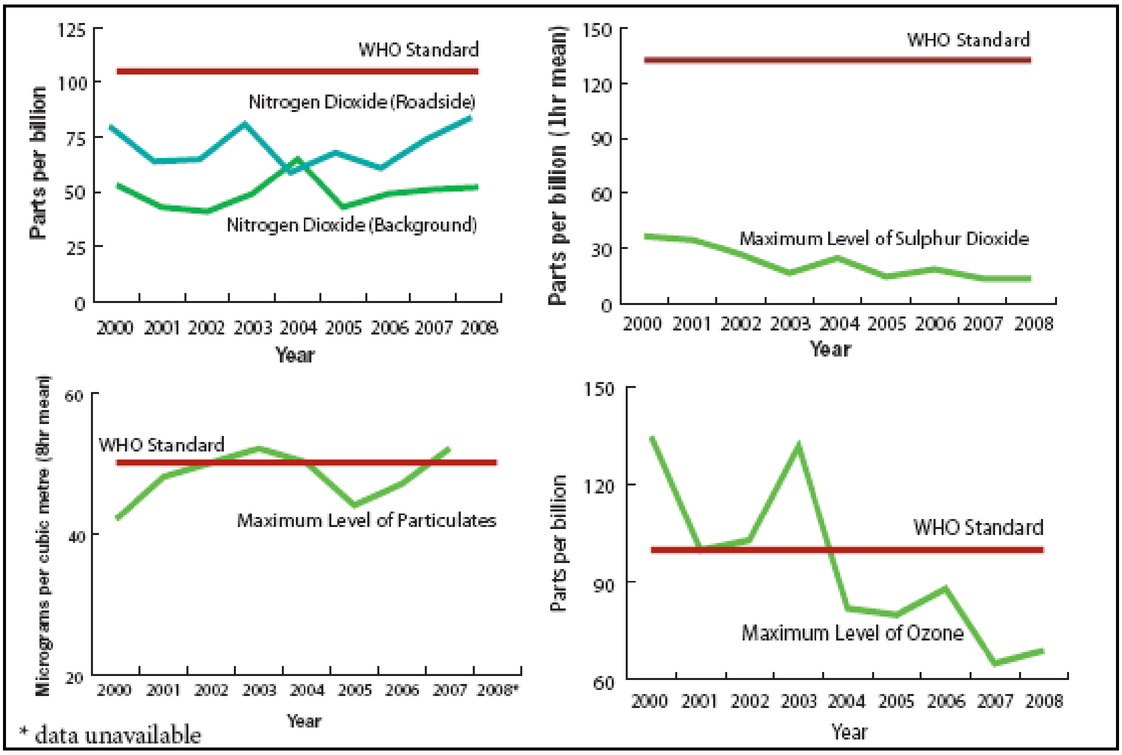
Lead has not been measured in Guernsey as airborne lead levels have been shown to be decreasing since 1981. This is due to the decrease in the amount of lead in petrol, from 0.45g/l to 0.40g/l in 1981, then to 0.15g/l in 1985 and the subsequent phased introduction of unleaded petrol. Atmospheric concentrations of lead are typically well under the thresholds set by the EU.

The main source of benzene emissions is from motor vehicles. Benzene was previously monitored in Guernsey by AEA Technology in 2000 in conjunction with an air quality baseline survey relating to the proposed Lurgi ‘waste to energy’ plant. The data did not indicate any exceedances of the air quality objective.

1,3-Butadiene is produced primarily from the combustion of petrol and other materials and emissions are typically related to the use of motor vehicles and industrial sources either manufacturing or using the compound. Guernsey has not historically monitored 1,3-butadiene as in the UK the average annual concentrations are very low and the levels of the compound have been shown to correlate closely with levels of CO and NO_x. These compounds are monitored within the Island and this, coupled with the great expense that is associated with 1,3-butadiene monitoring, has meant that the concept of a 1,3-butadiene monitoring system has previously been rejected.

Figure 18.2.1 below shows that Guernsey performs well compared the WHO guidelines. It is thought that most of Guernsey's air impurities come from road travel, especially as Guernsey has a disproportionately percentage of car ownership and use compared with other nations. However, there are also other sources of pollutants, with part of Guernsey's and all of Sark's electricity being generated by combustions power stations, flights to and from the island, gas and oil burning for home use and dust from construction and building works as well as emissions coming from other jurisdictions.

Figure 18.2.1 – Historic Pollutant Levels (Image – Guernsey Facts and Figures 2009)



Further data from HSSD shows that in 2009 there are only occasional peaks above general low levels of the monitored impurities. Even with these peaks there are very few that exceed guideline levels.

There is no information for the air quality in Bailiwick waters off Island unfortunately. However the main direct sources of particulates and other impurities are likely to be from marine traffic including the fishing fleet, pleasure craft and heavy vessels such as the car ferry. Terrestrial influences will be transported out to sea on the wind, so this may also affect air quality in the marine environment. Air travel would also contribute as this takes place above the marine environment, although this would only be a negligible contribution due to the dispersion and height of the planes.

18.3 Potential Effects

The potential effect on air quality both in the marine environment and in the terrestrial environment depends very much upon the lifecycle stage of the deployment. In deployment and decommissioning the effects will be negative on air quality; however throughout the operational phase of the devices life there is likely to be a positive effect secondary effect, so long as the electricity is used on the island, to reduce the reliance on the island combustion power station.

18.3.1 Deployment

During the deployment phase there would be an increase in marine traffic in the REA area, whether based in Guernsey or coming from France. This in itself would increase that amount of pollutants being released in the Bailiwick and so would have the effect of net reduction in air quality over the whole area. These pollutants would primarily take the form of increased boat exhaust fumes such as CO, CO_2, various nitrous oxides (NO_x) and particulate matter. These would represent only a small increase in total ambient air quality over the water and possibly land, although the overall significance of this would require monitoring to identify. Of the emissions, Carbon Monoxide and Nitrogen Dioxide are monitored, so only these could be assessed for impact. Should there be land based operations occurring in Guernsey then this may also increase the likely-hood of onshore transport and works occurring. This would also have the potential to reduce air quality.

Should any of the final construction take place on Guernsey, specifically involving industrial practices, then there is a further potential for increased industrial work to impact upon air quality. There is also the possibility of increased dust coming from any onshore work conducted as part of the development such as onshore cabling.

18.3.2 Operation

During the operation phase, with everything operating effectively, there will be no adverse effects anticipated on air quality from either wave or tidal devices. In fact it is very likely that there would be a number of positive effects relating to the production of electricity without combustion.

- The introduction of non combustion power can reduce the use of the on island generators, improving air quality.
- The introduction of “no go zones” (as suggested in 15.7) around the arrays may:

- Reduce boating traffic in and around the Bailiwick, which in turn could improve localised air quality, or;
- Reduce boating traffic in the areas of no go zones, displacing traffic to other parts in/near the bailiwick, leading to no effect on localised air quality.

The amount of reduction of combustion due to reducing the use of on island generators will depend on the amount of electricity produced by the devices, which is dependent on the number of devices deployed and their efficiency against their rated power in the waters in the Bailiwick, and how much of it comes to Guernsey. If more electricity is exported than comes ashore, and the on island generators continue to be used then there may not be any net benefit to the ambient air quality. The amount of air quality improvement will also be dependent on how any renewable energy affects the energy mix. If the renewable energy replaces energy coming through the cable connection to France rather than the on-island generators then the increase in air quality will be minimal.

The no go zones created may reduce boating in and around the Bailiwick by deterring pleasure boaters from coming to the region. However, it may also have the alternative effect of causing a displacement of boating activity. If the displaced shipping were to remain in the Bailiwick waters then there would be no benefit to Bailiwick air quality. If the boating activity was removed from the Bailiwick then there would still be trans-boundary movements, so the displacement location of shipping and the prevailing wind conditions would determine if there were to be any localised improvement in air quality.

18.3.3 Maintenance

During the operation phase there is likely to be times when the devices need maintenance, either as part of a regular plan to ensure smooth running of operations, or when something goes wrong and needs rectifying. This would have the potential to reduce air quality due to increased shipping.

18.3.4 Decommissioning

During the decommissioning phase there will once again be increased shipping in the area which would lead to increased emissions from engines.

18.4 Sensitivity of receptors

The main receptor to changes in air quality is the human environment on land. The other receptors are other air breathing animals such as birds in the area, air breathing marine mammals and other marine animals through diffusion of air into the water. In humans it has been suggested that the increase in allergies and respiratory diseases such as asthma is linked to an increase of pollutants in the air. This would suggest that humans are sensitive to changes in air quality, and improving air quality may well increase the quality of life for individuals.

There have been few studies performed on how atmospheric pollutants affect natural populations, although there has been relatively extensive work on laboratory tests. However it is important to note that pollutants are naturally dispersed in the atmosphere so field study information is important. General results indicate that in response to increased pollution birds and mammals produce increased mucus. This biological response to the pollution stimulus suggests that there is sensitivity to changes in air quality.

18.4.1 Effects on Humans

With regards to the atmospheric contaminants that have UK standards and objectives, as outlined in Table 18.2.1, their primary sources and effects on humans as a receptor are outlined below. These have been extensively studied and as such our understanding of the potential effects is greater than on other air breathing animals, and the marine environment.

18.4.1.1 Benzene

Benzene is an aromatic hydrocarbon consisting of six atoms each of carbon and hydrogen, arranged in a ring structure. At normal temperatures it is a liquid, which readily evaporates, and small amounts are detectable in the atmosphere. Almost all of the benzene found at ground level in the northern hemisphere is likely to have resulted from human activities, in particular the combustion of petroleum fuels by motor vehicle engines. Cigarette smoking is another contributor to the exposure of individuals to Benzene.

Benzene is a carcinogen that people may also be exposed to in certain industrial workplaces and studies have shown a link to leukaemia. The air quality standard for benzene represents a risk to the population which is exceedingly small and unlikely to be detectable by any practicable method.

18.4.1.2 1,3-Butadiene

1,3-Butadiene is a molecule comprised four carbon and six hydrogen atoms. At normal temperatures it is a gas and trace amounts can be found in the atmosphere. It is derived mainly from the combustion of petroleum in motor vehicle engines and from other sources of combustion of fossil fuels and accidental fires.

1,3-Butadiene is used in industry, mainly in the production of synthetic rubber for tyres. Studies in workers exposed to the chemical have indicated a slightly higher than expected risk of cancer of the lymphoid system and blood. Risks to the general population from the levels currently found in the atmosphere in the United Kingdom are exceedingly small. The Government has, however, still set very low levels as the required standard in the air we breathe.

18.4.1.3 Carbon Monoxide (CO)

Carbon monoxide is a colourless, odourless toxic gas produced in the process of combustion, such as in a car engine, domestic heating, a cigarette or a forest fire or volcanic activity. Of all the pollutant gases CO is one of the most dangerous as acute exposure to high levels of CO can cause loss of consciousness and can lead to death. The threat to health is due to CO binding with haemoglobin, forming carboxyhaemoglobin, causing a reduction in the oxygen delivery of the blood as haemoglobin has a higher affinity for CO than oxygen. Carboxyhaemoglobin in turn has a higher affinity for oxygen than oxyhaemoglobin and so it does not release the bonded oxygen to the tissues in the body.

Exposure to CO can lead to breathlessness and an increased chance of heart attacks, arteriosclerosis, hardening of the arteries, brain damage and in death depending on exposure levels. Fatalities tend to be confined to people exposed to very high levels - produced for example, by fires in buildings, blockage of flues, faulty appliances and deliberate self-poisoning by car exhaust gases. Outdoors, the main sources of atmospheric carbon monoxide in the Bailiwick are vehicle exhausts.

18.4.1.4 Lead

Airborne lead occurs as fine inorganic particles of sub micron size (smaller than 10^{-6} m). Lead has applications in the manufacture of batteries, pigments, alloys, plastics and ammunition. In the past it has been used in organic compounds as a petrol additive.

Lead can be absorbed into the body both through the lungs and through the stomach and intestines. Therefore people may be at risk of absorbing it when exposed either in the air, dust or soil, or as a contaminant in food and drink. The two main sources of exposure for the general public can be considered to be :-

- contamination of drinking water from lead pipes and;
- contamination of the air from industrial sources

Once in the body lead spreads through the body and accumulates in the bone, skin, teeth, and soft tissues (including internal organs, fat and skeletal muscle).

Approximately 2% of absorbed lead is found in the bloodstream and it is this proportion that is biologically active and has injurious effects.

High exposure to lead (>100ug/dl of lead in the blood) can lead to brain damage and the damage of other organs including the liver and kidneys, which usually act to remove lead from the bloodstream. In lower concentration lead exposure can cause intestinal pains and anaemia. The (UK) Expert Panel on Air Quality Standards (EPAQS) decided that lead should be included in the Air Quality Regulations 1997 as even at a level of 10ug/dl lead has been shown to cause small changes in the brain development of children.

18.4.1.5 Nitrogen Dioxide (NO_2)

NO_2 acts mainly as an irritant affecting the mucosa of the eyes, nose, throat, and respiratory tract. Extremely high-dose exposure (as in a building fire and accidental exposures in farm silos and in mines) to NO_2 may result in pulmonary edema and diffuse lung injury. Continued exposure to high NO_2 levels can contribute to the development of acute or chronic bronchitis.

There is now evidence that it has more subtle effects on health at the much lower concentrations that may occur in the ambient atmosphere. Low level NO_2 exposure may cause increased bronchial reactivity in some asthmatics, decreased lung function in patients with chronic obstructive pulmonary disease and increased risk of respiratory infections, especially in young children

There are several natural sources of oxides of nitrogen in the atmosphere, including lightning, forest fires and bacterial activity in soils. By far the largest amount is, however, formed as a result of combustion of the fossil fuels petrol, oil, coal and gas, especially by motor transport.

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. Nitrates can, however, 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}.

18.4.1.6 Particulates ($PM_{10/2.5}$)

Particulates are characterised by their physical properties and particles may be of very different chemical composition depending on the source and are always a complex mixture of chemicals. They are measured by determining the mass of the fraction of total dusts that is considered most likely to be deposited in the lung. These particles are called PM_{10} which typically comprise about 20% of total suspended airborne dusts. The extremely small size of PM_{10} (less than one millionth of a metre in diameter) is the main reason that they are able to penetrate so deeply into the lungs and reach the alveoli where the exchange of gases occurs between the blood and the air we breathe.

Recent research indicates that long-term exposure to combustion-related fine particulate air pollution is an important environmental risk factor for cardiopulmonary and lung cancer mortality.

$PM_{2.5}$ particles are recognised as being more harmful to human health than PM_{10} particles due to their ability to penetrate further into the respiratory system when inhaled. Target levels have already been set for $PM_{2.5}$ particles and it is likely that these levels will become objectives. Taking a precautionary approach and given that there are 2 PM_{10} monitoring stations on Guernsey it is recommended that serious consideration is given to replacing one of the monitoring stations with a unit that can measure the ultrafine particles. This will provide a more holistic overview of pollutant levels on-Island.

18.4.1.7 Sulphur Dioxide (SO_2)

SO_2 is an irritant gas which dissolves in water to give an acidic solution which is readily oxidised to sulphuric acid. The predominant source of sulphur dioxide is from the combustion of sulphur-containing fossil fuels, principally coal and heavy oils. Sulphur dioxide was one of the components of the dense fogs that occurred in industrial cities in the nineteenth century and the first half of the 20th century and was also a significant contributor to 'acid rain'.

High level exposure to SO_2, usually accidental, causes irritation to the eyes, nose, mouth and throat combined with acute chemical damage to the lining of the airways. This damage may elicit a difficulty in breathing and in extreme cases death. SO_2 has been shown to potentiate sensitisation to inhaled allergens in animals and may have a similar effect on humans. SO_2 has an irritant effect that causes reflex coughing, a tightness of the chest and even the narrowing of the airways. All of these symptoms are emphasised if the person suffers from asthma or chronic lung disease.

18.4.1.8 Ozone (O_3)

Ozone has the capacity to damage both humans and the environment. Ozone is a pollutant that is greatly affected by transboundary air flows and for this reason it is difficult to control at a local level and instead a more international, and global, approach must be taken. The effects of exposure to high concentrations of ozone include slight irritations to the eyes and nose. Atmospheric exposure to ozone has reached this level in the United States but has not been seen as a problem in the UK. Studies have also shown that exposures to concentrations of 100ppb or greater for a period of several hours can cause an inflammation of the airways and short-term respiratory problems in susceptible individuals

18.5 Potential Significance of Effects

Table 18.5.1 below illustrates the potential significance on the receptors of the different possible effects listed above. There are 4 categories the effect can fall into; Major, Moderate, Minor or None. This relates to the impact that the effect would have on populations of organisms and is calculated by working out the value of the receptor – based on how far reaching the effects are: local, regional or international – and the perceived magnitude of the impact on the receptor.

All of the receptors of air quality impacts are close to the sources of potential pollution. Therefore, the Value of air quality receptors is 'Local', as described in chapter 20.

Table 18.5.1 – Significance of Effects

Effect	Device Type	Development phase	Receptor	Significance of effects
Increase in Marine traffic reducing air quality	All	Deployment Maintenance Decommissioning	Human environment, Birds, Mammals	Minor
Increased Industrial work and land transport	All	Deployment	Human environment, Birds, Mammals	Minor
Reduction of the use of on island electricity generation	All	Operation	Human environment, Birds, Mammals	Moderate (positive)
Reduction of boating in the area	All	Operation	Human environment, Birds, Mammals	Minor

18.6 Likelihood of Occurrence

With the potential for reduced use of combustion power stations there is a chance to improve the air quality. However, equally there will be increased shipping traffic during deployment, maintenance and decommissioning. How these interact will affect the overall chances of a net gain or loss in air quality. The overall outcome of net increase or decrease in air quality, under currently measured criteria, is dependent upon the scale and location of the deployment.

Additionally, as it is thought that most of Guernsey's air impurities come from car emissions, the introduction of power from emission free devices would not reduce car use. This means that any improvement would only be minor, unless electric car use becomes popular alongside the island becoming heavily reliant on renewable electricity production. If this were to happen then there would be the potential to reduce air impurities. However as it currently stands the likelihood of any significant effects, either positive or negative, are very low.

18.7 Mitigation Measures

There is potential to mitigate certain aspects that could prevent reductions to air quality. While it will not be possible to prevent the increase in marine traffic, it may be possible to minimise the number of trips. It would also be beneficial to base as much of the activity as possible on Guernsey as this would reduce the distance covered and so fuel used by the boats and this would be most easily accommodated for maintenance. However it is important to point out it would be difficult to quantify any effects of mitigation.

18.8 Confidence and Knowledge Gaps

The types of impacts are fairly easy to predict, however the effect that they have on the receptors is largely unknown as the size of the impact is hard to predict. This is due to the intermittent nature of renewables having only some impact on reducing on island generation as well as the amount of boat work for delivering an array of marine renewables being unknown.

18.9 Residual Effects

The effects are foreseen to be minor before mitigation, and so any change for the better would be very small.

18.10 Recommendations for Survey and Monitoring

On land monitoring is currently very good, and so it is important to maintain this monitoring during installation and operation so as there is comparable data to show how marine renewables have affected air quality. Also, any emissions to air on land are covered by the Environmental Pollution (Guernsey) Law 2004, and this will continue to be the case for renewable energy.

Currently there is no information on the impurities in the air over the seas in the Bailiwick. It would be useful to generate a baseline air quality survey at sea to be directly comparable to air quality at sea once development has taken place. It would also be useful to identify the relationship between land and sea air quality.