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C4FF Air Quality Reports

A Sample of Air Quality Assessment Reports in Several Cities in the UK with Special References to the Situations in the USA and the EU

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2019-2020

This report is specially written for the local authorities and residents with a hope that it would shed some lights on ways that can be adapted to improve the quality of air we breathe in, and to reduce the adverse impacts of poor air quality on our citizens' health and well-being.

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Foreword

Air Quality Issues on the Midlands and Warwickshire with Special References to Situations in Coventry and Leamington

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There are nine reports presented in this collective publication on air quality assessment in several locations worldwide; three of them are general reports on the situations in the UK and the other six reports summarise the arrangements for improving air quality in several cities and makes special references to measures in place in the USA and the cities such as Paris, the latter as a specific example of what happens in the EU.

The main reason for this foreword is to ensure that local councils in the Midlands and Warwickshire become aware of the residents concern about air pollution in our cities and towns and hope that the local councils would do what is necessary to make sure any new planning for new buildings does not adversely affect the residents' health in the region and wider afield.

The local councils are probably aware that the World Health Organisation (WHO) has reported that 31 cities/towns in the UK have exceeded the pollution limits for NO_x and PM₁₀ and cities such as Coventry is one of 31 cities/towns. Having done some sampling in recent year I know that one of the worst levels of pollution are around Holyhead, Coventry town centre to University Hospital, Warwick-Leamington Road and around the Warwick University, the latter particularly in the morning and afternoon during the rush hours. The British Heart Foundation (BHF) is clearly concerned that the UK is not taking the pollution issues seriously. It is interesting to note that the UK Government (Department for Environment, Food and Rural Affairs) has stated that it is aware of the adverse pollution impact on the health of men, women and children as outlined by the British Heart Foundation (BHF) yet has not written into law the WHO guidelines.

I believe the local councils first objectives should be to safeguard the well-being of our residents and ensure that there is an adequate infrastructure is in place to ease the congestion and bottle-necks around the areas. The University should also take the concerns of the residents more seriously and be encouraged to consider expanding elsewhere. The new NAIC (National Automotive Innovation Centre) building will very shortly house some 2000 primarily young engineers once all associated vacancies are filled, all new comers would probably wish to drive to the University adding to the traffic chaos in the morning and afternoons. I am aware that we need to work with University, and the associated Councils, to make sure before any further developments there are serious plans for infrastructure to ease traffic and reduce the excessive amount of harmful pollutants by installing more pollution measuring devices and ensure that they are regularly calibrated.

The quantity and the impact of harmful emissions from traffic particularly during rush hours along the Westwood Heath Road are causing grave concern. You may be aware that some 100,1000,1000, 1000, 1000 kgs (Ziarati et al, 2018 - IAMU 2017 – IAMU 2017 Proceedings Maritime Energy Management System (MARIEMS) Online Delivery Platform, Varna, Bulgaria) of CO₂ alone is pumped into our atmosphere every year without any Council taking these poisonous pollutants into consideration. In addition a similar magnitude of NO_x and particulates and associated pollutants are



also discharged into our closed atmosphere. As an engine designer I have measured the level of pollutions in Westwood Heath several years ago during the rush hour the amounts of CO₂, NO_x and other harmful emitted pollutants were above the recommended levels. Considering that the level of traffic has increased considerably and heavier vehicles now used the area around the University regularly, I suggest the Councils (both Coventry and Warwick) jointly sponsor and carry out an independent investigation on the level of pollutants in the area during the rush hours. This investigation must be independent and carried out during the rush hours and should included days during winter.

Some of the residents have suffered respiratory related ailments and my own neighbour has been recently diagnosed with a chronic lung cancer. It is prudent and obligatory therefore that before any planning for new buildings or housing the local Governments do their duty and ensure people's well being is put above all else.

I am providing a link to series of development papers I compiled in collaboration with several major international organisations recently funded by the UKNA/EU so that interested parties can refer to it and note the problems our planet is facing - http://www.marifuture.org/Reports/Development-Papers/ADP_12_2016_MARIFUTURE.pdf. References should also be made to the Tokyo Protocol and the Paris Agreement. The UK is a signatory to these air pollution treaties. It is viewed that any plan which knowingly could lead to a greater amount of deadly pollutions to be discharged into our environment is against the core and spirit of the treaties signed. I am very much in favour of creating opportunities for young people and adults and in support of industry and commerce but surely we should not poison the students and all those who work at the University and make the life of residents around the University worse than what it is.

I have lived in the area for some 30 years and used to cycle to my office at University Campus but gave cycling up some 10 years ago when I developed serious chest pains and became aware that the traffic pollutions on the way to my office at several locations are well above the permitted levels. One of the reasons for moving my office from the Warwick University campus to Kenilworth several years ago was the level of pollutions during the rush hours.

In a recent University report it was noted that the mean pollution levels are well above the legal limits and may be more as the report does not include any actual readings. What is significant is that the actual readings, at the worst locations, damage one's health to a maximum. When a person is injured with a six-inch knife, it cannot be said that the cut has a mean value is 1/8th of an inch-inch over 24-hour period. As I stated earlier WHO and BHF are very concerned about 31 cities which includes Coventry exceeding the legal limits in the UK. What is equally alarming is that the UK has now been referred to European Court of Justice (ECJ) for exceeding the EU pollution limits; the fines are anticipated to be very high. The Cllr's and city leaders as well as Doctors are all very concerned. It would be negligent of our Cllr's both at Coventry and WDC to approve any expansion scheme in an area which already exceeds legal limits, jeopardising the well being, specifically compromising the health, of local residents as well as the unaware students and people working or visiting the University.

I have been informed that the UK Government has also been given the final warning and has been referred to the European Court of Justice for ignoring the well-being of its citizens. The UK Environment Act 1995 is now some 23 years old and the UK's Local Air Quality Management (LAQM)



and Air Quality Management Areas (AQMA) are inadequate for the reasons I have outlined below. I am not sure if WDC even have a AQMA and relying instead on air pollution and dispersion theoretical models which have proven to be unreliable.

Even if we ignore the WHO and the EU warnings and accept the current modus operandi **the majority of pollutant measuring stations in Coventry and several places in Leamington read over the UK Government's own targets**. Surely this is a cause for concern! Using the own local Council's readings it is clear the in most areas the pollution has increased by 10% each year and to the best of my knowledge the Council have not installed any measuring device around the University other than the two diffusion tubes near A45 despite their responsibility to include these in AQMA particularly because of the major constructions and substantial increase in student numbers. It is pertinent to note that readings on these shows alarmingly 10% increase each year and both over the target levels in 2018. The council has delayed the publication of air quality report for Coventry seeking to use fiddle factors to adjust the already obtain data. The fiddle factors arise from the diffusion tubes used to measure NOs. These tubes are useful low-cost method for indicative monitoring of ambient nitrogen dioxide (NO₂) concentrations only and do not provide a means of measuring fine Particulate Matter. It is mandatory for the councils to monitor the levels of these matters.

It is pertinent to point out that the diffusion tubes are affected by several sources of errors (●the laboratory preparing and analysing the tubes ● the exposure interval – weekly, fortnightly or monthly ● the time of year ● the exposure setting – sheltered or exposed ● the exposure location – roadside or background ● the tube preparation method ● the exposure concentration and NO₂/NOx ratio) which can cause substantial under and often not overestimation compared to the chemiluminescent analyser which are the European recommended method. I have informed the Council of the inadequacy of diffusion tube methods. I believe Defra may let Councils adapt the 'combined bias adjustment factor' which is far less accurate than the WHO and EU recommended chemiluminescent analysers. I strongly recommend regular calibration of the diffusion tubes by using more accurate means of measurement.

Furthermore, the issue is that although daily readings should be taken, and the tubes should be changed sooner than current practice of 5 weeks. Considering that these tubes clog up within two to three weeks and the chemical used loses its effectiveness soon after, the readings continue to be taken irrespective, hence making the average readings much lower. It is pertinent to point out that these tubes are at least adversely 25% inaccurate. Furthermore, allowing NO₂ to exceed 18 times/year and PM₁₀ 35times/year is also a cause for concern. To the best of my knowledge there are no meaningful measurements of PM_{2.5} throughout the City. Furthermore, the catalysts of almost all cars leaving the University during the rush hour are not operational and make the situation/readings much worse.

Please note that the only pollutant measured in Coventry is currently NO₂ in busy streets where people may spend 1-hour or more close to traffic and in narrow congested streets with residential properties close to kerb. In my view, if we are serious about our citizens' health then there should be measuring devices all over the City and around the both universities. The effectiveness of these devices should be verified on regular basis by mobile and more accurate instruments.

The UK Government, according to WHO and EU has failed to protect us and even accepting the practice, the level of pollution in most areas in Coventry is over the target levels; to this end no more



buildings should be constructed around places such Holy Road or the University until the levels of pollutants fall well below the target levels.

I do realise that we as citizens have a role to play and should support our Government to cope with its responsibility and support it in incorporating WHO guidelines and assist it to address the EU's concerns. The challenge in reducing emissions of pollutants in the air cannot effectively be encountered without encouraging more Engineers to enter politics. Most of our MPs and Councillors come from a background in economics, law or politics and some have now technical qualifications. We also need to encourage more young people to champion environmental issues and learn more about them.

My teams, in various stages in the last 40 years have worked round the clock to make engines more efficient and less pollutant. We designed the first hybrid car and bus in Europe and reduced emissions from these engines to minimum. There are new ways to reduce NO2 and PMs significantly; while these efforts are continuing we should be brave enough and raise our concerns and help the Council not to add to the challenges we are currently facing.

The drastic solutions such working from home and using readily available teleconferencing or reducing the number of working days are not that difficult to implement if discussions is encourage among people involved. Use of flettner cylinders on board ships and some buildings have proven to be immensely beneficial. New solar panels and turbines are proving to have a greater role in providing us with green energy. Encouraging electric cars without investing in green energies will not help to solve the pollution problems albeit would hope the cities and towns to have a cleaner air.

Let me end this foreword by stating what we could do in short term. The first thing to do is install diffusion tube around identified pollution hotspots and make sure there are at least one station with both a diffusion tube as well as a more accurate measurement device so that the reading from diffusion tubes are calibrated on a continuous basis. The councils should also immediately install PMs measuring devised in several key areas in cities and towns in the region. **We also need to establish an independent centre with a full-time secretary and a full-time pollution specialist to monitor and support the local councils on air pollution. C4FF is willing to part fund this centre.**

The references used in drafting this foreword were taken from the WHO and the BHF as well as several reports by the Guardian Newspaper. The key UK government report is presented at: <https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf> and proof that Coventry Air Quality has breached the UK own targets can be found at: http://www.coventry.gov.uk/info/68/pollution/171/air_quality.



The Air Pollution Collective Report

Introduction

This paper contains a research to assess the air pollution and its impact on the communities. The structure is made of a total of nine reports, which studies the Earth's atmospheric layers and the impact of pollutants from the industrial activities and the development of technology on the environment. It also looks at the air pollution levels in the UK, Scotland, the United State and the EU cities.

Air pollution Assessment UK Report 1 - August 2018

This report will focus on the obligation of the local councils on the technical report from the Department of Environment (Defra) on local air quality management (TG16) February 2018. This is designed to support local authorities to fulfil their obligation under the 1995 Environment Act. The local authorities must carry out monitoring, assessment and take action to improve the local air quality. In this process investigation of non-compliance with the air quality standards set out in table 1.1. This will lead to an action plan highlighting remedial required.

I refer to some of the alarms raised in recent years trying to address the severity of the impact of air pollution in the UK. With reference to the Telegraph (13 Nov 2016), England has the UK's dirtiest air with 25,002 deaths due to air pollution. Cornwall and the Scottish Highlands enjoy the UK's cleanest air. BBC reported 40 towns and cities in the UK are at or have exceeded the air pollution limits set by the World Health Organisation (WHO) estimate that 30 areas have fine particles of air pollution levels above ten micrograms per cubic meter, with another 17 at that limit. The areas that exceeded the said levels included London, Manchester and Swansea. It added that globally nine out of ten people breathe air containing high levels of pollutants. Fine particles of air pollution is particularly bad for us, penetrating deep into the lungs and cardio vascular system, causing diseases including strokes, heart disease, lung cancer and respiratory infection.

In accordance with the national centre for bio technology information, current levels of air pollution are consistently associated with asthma development and morbidity among children. This is suggesting current regulatory policies may be insufficient.

Identifying specific sources and toxic materials of air pollution and accessing air pollution related asthma outcomes are necessary to provide control measures. The local air quality management (LAQM) system in England, Scotland and Wales has now changed. There is now more emphasis on action planning in connection with the improvements in air quality. The more challenging pollutants for local authorities to focus on are: Nitrogen dioxide (Co2),



Particulate matter (PM10) and (except in Wales) Sulphur dioxide, whilst introducing a new approach to reduce PM2.5 in England and statutory obligation in Scotland. Now the emphasis are on action planning and to aid local authorities updated tools and measures have been introduced, which help assessment of the impact of actions taken and these are regularly reviewed and assessed for improvement, when obligations cannot be met.

For England there is a new flexible approach in reducing PM2.5, as examples of the interpretation of this approach highlighted in chapter 7 of ALQM (PG16). For Scotland the obligation for PM2.5 and is aligned to the existing methods, which are used for review and assessment of other pollutants. On the other hand for England there is no such prescription, instead, there is a flexible approach by which the local authority will be in consultation with the public health officials regarding a method statement and approaches to be taken to target reducing PM2.5. Following the LAQM review process it has been decided to retain Benzene, 1,3-Butadiene, Carbon Monoxide and lead regulations for England and Wales as all objectives for these pollutants have been met for several years, but reporting on these pollutants are statutory obligation for Scotland and Northern Ireland.

Table 1.1 shows pollutants and the UK air quality objectives see The Department of Environment LAQM technical guidance (TG16). Table 1.2 is for Northern Ireland, which shows summary of the round 6 of the process based on phased reporting being used until LAQM is reviewed.

England, Wales and Scotland adopted a methodology called Streamlined approach in order to review and assess air quality to produce Annual Status Report (ASR) and Annual Progress Report (APR). In London the Mayor has given power, by which an effective and more coordinated set of responsibilities to be discharged with respect to LAQM system by the secretary of state.

The local authorities in England have ASR in mandatory template form which replaces all other reports. Only action plan remains as separate. The ASR report must be made available by local authority on their website. Local authorities are mandated to complete a new public facing summary as well. Reports are expected to be submitted by 30 June each year. Extra appendices may be provided, when extra analyses such as screening assessment or dispersion modelling studies are carried out.

Fast track option may be used when persistent incidents of pollutant limit occurs, so that action plan measures to remediate the problem is provided. Clean air zones are introduced where the cleanest vehicles are allowed to operate, or introduce charges for vehicles not meeting emission standards in different class of clean air zones. In Scotland Annual Progress Report (APR) are required to be submitted annually. This includes Wales LAQM too, which replaces all other reports. Fast-Track AQMA is available for England.



Affective Air Quality Action Plan

There have been a number of approaches to improve the development of Air Quality Action Plans (AQAPs). The concept of sustainable development is the key order for the AQAP to be effective. An integrated package of measures linking with other policy areas cover:

- a) Land use planning and sustainable development.
- b) Transport planning
- c) Climate change policies in relation to carbon management.
- d) Low emission
- e) Public Health outcomes, improving well being of population and education programmes promoting health.

With the above plan there are key requirements, as follows:

- 1) Development AQAP in stages
- 2) Carry out monitoring assessment
- 3) Establish level of action
- 4) Provide links to other strategies
- 5) Communicate with key stake holders at the start
- 6) Take measures and carry out impact assessment
- 7) Monitor
- 8) Consult with organisations, residence, businesses, DEFRA, Environment Agency, transport bodies.

As part of my conclusion, I refer to a recent evening news report from Channel 4 (TV) on 17 August 2018, a 9 year old girl Ella lost her life in 2013 due to severe air pollution with asthma and acute respiratory failure as a result. Her distressed mother claims her daughter's death is due to spike in air pollution in her area. The Mayor of London Sadiq Khan called on the Attorney General to back a new inquest into the death of Ella. Forty thousand deaths per year is due to high level of air pollution experts say and also whole life impact to consider too, for example, the womb infant development is reduced and the size of the foetus is reduced too. Post birth, it produces pneumonia, reduced lung function growth and cancer.

The consumer group which found the majority of modern diesel engine cars exceed nitrogen dioxide level. None official tests are not accurate only official tests (EU tests) compares models on like for like basis. At the present time, current targets are not moving fast enough. For decades the focus is on sustainable development concept, which has been introduced and local authorities. They integrated this within their mandatory guidelines on monitor and control of pollution in their local areas under the umbrellas of sustainable development and public health. This carries a highly ethical values relating to well being of



future generations. The decision makers of the present generation therefore have an obligation to fulfil.

Air Pollution Assessment UK Report 2 - September 2018

The environment is consisted of 3 domains: Air, land and water. Pollution of any kind on our planet Earth today is the most controversial subject. The impact of pollution on water viz., causes of damage to the ocean, adverse impact to marine life, rivers and lakes, flora and fauna, and human health are important issues to all concerned. The air pollution, which is the subject matter for this report cause damage to the health of humans and the environment at ground level, and in the atmosphere by depleting the ozone layer and the dynamics of the atmospheres layers.

In our environment the impact of pollution causes the greenhouse gas and global warming resulting in climate change in the planet, this has been assessed in my paper published by the Dogus University Istanbul, which can be accessed online under Energy Conservation. The substantial development has been researched and some of the materials for this report have been referred to "Our common Future" Brundtland report (ref: Gro Harlem Brundtland report) emphasis are on Sustainable Development and how the subject matter ethically analysed. This may give us a direction as to how we can go about controlling the pollution and avoid many future catastrophic outcomes. At present, we are faced by many health problems, such as children's asthma, cancer, respiratory illnesses, damage to flora and fauna. In this report we examine the damage caused by Air Pollution and analyse the way by which remedies can be found to reduce the impact of air pollution on the environment.

We can look at the substances, which are damaging the ozone layer; this layer is formed in the atmosphere of the planet earth.

Types of Emissions:

- 1) Naturogenic, by natural volcanoes gas eruption, decaying plant and animals (not toxic, but inert) and having significant impact on health.
- 2) Anthropogenic, by human, such as, Industrial activities, shipping, marine, chemical works.

Industrialisation, transport, land/marine, has direct impact on the health at the ground level and atmosphere, which also causes global warming and climate change.

Climate is the whole system, which contains all interacting and retroacting between systems, such as, snow, ice, oceans, human and their activities (IPPC 2007). The following systems impact on the climate change, as a result of changes in the following systems.



- a) The lithosphere contains the surface of the earth down to the centre of the earth, that is, the crust, which is the hard solid soil with nutrients and a thin layer of oxygen and silicon. Below this layer is a thick layer of semi solid oxygen and silicon, iron and magnesium, below this is a thin layer of outer core of nickel and iron and finally the inner core solid nickel and iron.
- b) The Hydrosphere contains solid, liquid and gaseous water; it is 10 to 20 Km in thickness, 12Km into atmosphere and several kilometres into the lithosphere.
- c) The Cryosphere contains glaciers, ice caps and icebergs, but frozen water is part of hydrosphere.
- d) The Biosphere contains the Earth's living things. Such as plants, animals, microorganisms. Deserts, grass lands, rain forests are types of biomass within the biosphere. Humans have their sphere called Anthrosphere, which is included in the biosphere.

The Atmosphere - All air in Earth's system is called atmosphere. It is more than 10,000 Km. The Ozone layer is in the upper portion of the atmosphere, ozone layer is a layer of ozone gas O₃, which protects the biosphere from harm of the sun's ultra violet radiation.

Ozone Layer - The ozone layer (Ozone shield) is the layer in the earth's stratosphere, which is made of concentration of ozone molecule O₃. It observes sun's ultra violet radiation. This layer protects us against the harm from the sun's ultra violet radiation, which causes skin cancer. At ground level it can react with ultra violet rays (UV) from the sun and it is toxic. This gas can damage crops, forest plants and an irritant to human lungs. Ozone at ground level is produced due to pollutants from cars, industrial chemical plants reacting with UV rays. Ozone is an oxide, which can be produced from oxygen in air. It can be used to kill bacteria, viruses etc. In industry it is used to treat drinking water and as disinfectant for treating waste water Ozone depleting substances, for example, chlorofluorocarbon (CFC). The Ozone layer is destroyed, as ultra violet rays strike CFC in the upper atmosphere. Both chlorofluorocarbon (CFCs) and hydrofluorocarbon (HFCs) are manmade greenhouse gases influencing climate change. In industry CFCs and HCFCs are used for refrigerated vehicle insulation and Metered Dose inhaler (used for asthma), air conditioning and foam in building work, also as propellant for industrial aerosols. The existence of GHG green house gas in the atmosphere acts as a blanket to protect Earth to remain in equilibrium with respect to temperature not too warm and not too cold. But as GHG from human activities increases and together with natural emissions of gases by forests, sea and land, the general equilibrium is affected, which leads to global warming. The main GHG heat trapping gases are: Carbon dioxide (CO₂), which influences most of the global warming (IPCC- 2001), mainly produced by fossil fuel burning, also Nitrous Oxide from industrial farming, using fertilizers and emissions due to combustion of fossil fuels. Finally Methane CH₄ from agriculture, transportation, sewage, landfill. The atmosphere contains many layers, when these layers, which all take part in protecting the earth, are affected by the air pollution, they fail to protect.



Troposphere: This layer extends up to 14.5Km from the surface of the earth.

Stratosphere: It starts above the troposphere for about 50Km and it holds the ozone layer, which absorbs the UV and protect the earth.

Mesosphere: It starts above the stratosphere about 85Km. A Meteor known as a shooting star is visible as a glowing meteoroid, Comet or asteroid burns in this layer after a collision with air molecules in the atmosphere.

Thermosphere: It starts above mesosphere and have a thickness of 600Km. Aurora is known as polar lights of northern or southern lights. Aurora and satellites appear in this layer. It gets warmer as you go up.

Ionosphere: It is the ionised part of the Earth's atmosphere, it stretches about 48Km to above 1000Km altitude. It includes an area of Thermosphere and part of Mesosphere and Exosphere. It shrinks and grows based on solar radiation absorbed. It is a critical link in sun-earth interactions and where radio communications is made possible.

Exosphere: A thin layer being the upper limit of atmosphere extending from top of the thermosphere up to 10,000Km. It is the utter most layer of the atmosphere. The top of this layer is the boundary between the earth's atmosphere and interplanetary space

(References: NASA – GODDARD – July, 2015 www.marifuture.org/reports/Development-papers/ADP)

Defra and Kyoto protocol

There is a similarity, between the earth and its atmosphere as a system and the ecosystem with respect to interdependency of each element constituent to keep the momentum for survival each system. We have examined how interaction and retroactions, between the various layers in the atmosphere and the atmosphere itself with the earth is so vital to keep the equilibrium and continuity. This is being similar to ecosystem's survival, where each component is depending on the wellbeing of the other, healthy interactions, which keep habitats, flora and fauna to survive. All wellbeing of living things is depending on the health of all the above systems.

For pollution to be properly controlled, we need constant monitoring and assessment followed by reviewing. Actions need to be taken, where non-compliances occur. With this theme, the vision is working towards providing a better environment for our future generation.

Air Pollution Assessment UK Report 3 - October 2018



Global air pollution rises to alarming levels. It is estimated that at least 95% of the world's people are breathing air that is dangerously polluted. The people in developing countries are more affected than their compatriots in developed world (ref: Blue and Green tomorrow – Annie Qureshi). Of course, in the model or structure, many share the view of one world we love and its inhabitant's wellbeing to be the case.

The Nitric Oxide (NO) supplements are generally safe but they may cause some side effects. Before taking nitric oxide a doctor or dietician should be contacted. It is relatively unstable also it reacts with oxygen to form nitrogen oxide.

Nitrogen Oxide is a gaseous air pollutant recognised as toxic. The road traffic is a main producer of this gas. In air, this gas forms and modifies other pollutants into ozone, particulate matter (PM) and acid rains. At high temperatures nitrogen and oxygen in the air produce nitrogen monoxide. When this gas is released from vehicle exhausts, it reacts with oxygen and forms nitrogen dioxide. Nitrogen oxide gases are formed when combustion occurs in the presence of nitrogen. Examples of this are car engine and by natural lightening.

Impact on Human Health

Concentrations in excess of 1880 microgram per cubic meter (one part per million or PPM) are necessary during acute controlled exposures to cause changes in pulmonary function in healthy humans, as these concentrations almost never happen in ambient air. The focus is on the effect of nitrogen dioxide on people with asthma, chronic pulmonary disease or chronic bronchitis.

In Japanese studies, there have been reports on adults, shows more respiratory symptoms, such as cough and phlegm are related to people living alongside heavy traffic density road (WHO). The introduction of catalytic converters has decreased the nitrogen oxide concentrations and the levels are expected to decrease more in future. Heavy vehicles, such as buses and trucks in urban areas contribute more to concentrations. The road traffic only contributes to 30% to the total national emissions. Catalysts on private cars are limited to petrol vehicles.

The study of Danish urban streets shows they are less polluted than in many other European cities. There are only 5-20% of the nitrogen dioxide emission comes from traffic and the 80-95% emission is considered harmless (ref: WHO/EURO Copenhagen, 22-24 May 1995).

Nitrogen Dispersion Tube Method

This is the most common method of measuring air pollution available online for measuring pollutants such as nitrogen oxides, PM2.5, PM10 and NDIR CO2.



Diffusion tubes to measure local air quality are introduced by Frontline Safety UK Ltd which is a global supplier of gas detection equipment can be contacted online www.frontline-safety.co.uk (the average price of one system is under £100). Diffusion tubes are cheap and easy to use for measuring nitrogen dioxide. This gas in the air reacts with chemicals on the mesh at the top of the tube and changes into nitrite (ref: Lovecleaner.org).

Air quality module AM 1008W is highly integrated with PM1.0, PM2.5, PM10 laser particle sensor, NDIR Co2 sensor, VOC sensor and RH & T sensor, which can output digital measurement data (ref: www.gasensor.com.cn). These instruments detect and monitor the presence of pollution in the area. They can be used in indoor and outdoor situation.

Council use them to check the level of air pollution in their area. They put the tubes in different areas such as schools and residents. The chemical used is Triethanolamine (TEA), which absorbs nitrogen dioxide. These tubes can be attached to lamp posts, road signs, or drainpipes in a vertical position. The bottom wide cap is removed to allow the air to get into the tube (diffusion). The hourly levels of toxic nitrogen dioxide must not exceed 200micrograms per cubic meter more than 18 times in a year (ref: Euro Environmental). The conversion factors are: 1PPM. Nitrogen dioxide is equal to 1880microgram per cubic meter. The diesel vehicles are the key source of nitrogen dioxide gas emission (BBC NEWS- 10 January 2018).

Apart from motor vehicles internal combustion engines, there are other anthropogenic emissions, such as heating and refrigeration in accordance to the World Health Organisation, emission of nitrogen oxides from natural sources far outweigh those generated by human activities.

Catalytic converters contain catalysts. Catalysts are of noble metals, such as platinum, palladium and rhodium takes part to increase the rate of reactions and to reduce carbon monoxide and nitrogen oxide. At high temperatures nitrogen oxide is produced from reaction of nitrogen and oxygen. The catalyst reduces nitrogen oxide.

Two metals are usually used as catalysts, one used for the oxidation reaction (in the case of carbon monoxide) and the other for reduction reaction (in the case of nitrogen oxides). Emission gases pass through the catalytic converter, where molecules temporarily stick to the metal surface and react together (ref: Washington University Chemistry Lab).

The Case Study of City of Birmingham Council on modelling of nitrogen dioxide highlights that the NO₂ is the main pollutants in the city of Birmingham.

The main sources of NO₂ are:

- 1) Emissions from motor vehicles
- 2) Industrial combustion plants
- 3) Commercial combustion plants



4) Emission from Space heating services at home, schools, hospitals.

Computer modelling (using Vir Viro model) was based on full emission information and calculated on 250x250m space area, where people are exposed to pollution, in all six areas were chosen. The monitoring result showed the wider areas were affected and the pollution level exceeded the limits.

Air quality emissions show on 21 -22 November will focus on industrial emissions and look into monitoring by a regulator in UK and Northern Ireland. The medium combustion plant directive (MPCD) comes into force by 20 December 2018.

This will affect 30,000 plants in the UK 143,000 in EU. According to WHO there is need to protect the public from chronic nitrogen dioxide exposure.

The outdoor epidemiological studies shows high exposure results to lung disease in children, and those who are sensitive to annual exposures of 50-75microgram per cubic meter or high annual average concentrations. The trends are that now as the technology advances, one hope that the armies of young energetic and ambitious future generation have is to bring about a better control with respect to waste and pollutions resulting in cleaner land, water and air domains.

Air quality in Bristol, UK – November 2018

Air pollution has direct impact on health especially the vulnerable members of the community, people who suffer lung disease and cancer as a result. Children's health affected by air pollution and asthma sufferers' number is rising. The more at risk areas are where poorer people live close to city centre.

The particulate matter alone causes cost of £16 billion to the society each year. Over one million people live in both Bristol, the urban and surrounding areas. Bristol is the 8th populous city in the UK. Nitrogen dioxide (NO₂) and particulate matter are the main pollutants. Some sources believe that childhood obesity is related to air pollution (The Guardian).

We are currently in breach of Nitrogen dioxide (NO₂) annual limits of 40 and 200 microgram per cubic metre, with permissible 18 hours per year above the 200 Microgram per cubic metre. Over 100 sites around the city measure NO₂. The method to measure is the diffusion tubes site. The Amber circles shows concentrations are exceeding 60 microgram per cubic metre. This indicates that the hourly mean could exceed 200 microgram per cubic metre (data from 2017).



Bristol has expanded the monitoring to cover all the schools within the air quality management area. Nitrogen dioxide levels have remained stable over the last 20 years, but there have been slight improvements in the past 5 years.

Monitoring Particulate Matter

Bristol Council is in a process of monitoring particulate matter (PM), as there are concerns about the no safe limit to particulate matter. The department of food and rural affairs (DAFRA) have 2 stations in Bristol, one in St. Pauls and the other in Temple Way. The community monitoring are sometimes called "citizen sensing" to find out the sources and the scale of the problem. It is believed that 80% of the pollution is due to traffic activity, transport within and around the city.

Claircity (www.claircity.eu) now reflects on community finding on impact of air pollution by stating that 1 in 8 deaths around the world is linked to air pollution. Claircity states that increase in heart attacks and heart failure, due to toxic gases and particulate matter (PM) and that the damage to vital organs in our body from these pollutants leads to incurable diseases.

In accordance to Claircity, 5 people die each week in Bristol due to air pollution caused mainly by Nitrogen dioxide and particulate matter. This number would decrease, if the pollution levels were lower. Pollutant PM 10 caused by diesel emissions, also contributes to casualties of pollution, but this is not yet monitored in Bristol. A total of 56% Nitrogen dioxide and PM are caused by diesel vehicles (cars, goods vehicle and big lorries). Claircity raises self awareness by talking to citizens, carry out surveys, school workshops, collecting data and how to deal with air pollution, sending reports to the local authorities.

According to Claircity, each council decides about the location of the monitors. Two areas are chosen, one where the risk of breaking the Nitrogen dioxide level is high and the other area is where people are living near the main roads and central areas (hotspots). The problem is the chronic level of air pollution rather than short term incidents.

The annual status report (ASR) also indicates that there are other combustion processes that contribute to the air pollution and these are domestic heating, wood burning, industry and agriculture.

These could be significant, when weather patterns cause build-up of pollution in the atmosphere. There is also solid fuel burning which can generate high levels of particulate pollution too.

To reduce air pollution, Bristol is covered by a smoke control order under the Clean Air Act 1993. This means emission from chimneys must come from an authorised fuel (ref-DEFRA).



World Health Organisation (WHO)

WHO has guidelines for the communities on the international level? As air quality is becoming an issue especially in the 21 century, these guidelines are there to maintain a safe level of air quality. The first WHO guidelines were issued in 1987, which brought about improvement, but since year 2000, it was less. The regulations had a positive impact on increase in life expectancy. It was updated in 2005. It set targets for outdoor concentrations for PM, NO₂, SO₂ and Ozone (O₃). A study of NO₂ emissions in 2017 showed 96% of these emissions come from diesel vehicles and was marked as largest contributor.

Actions to Improve Air Quality

There is a statutory duty put on Bristol City council to provide an action plan for air quality in Bristol. The purpose of this clean air plan is to safe guard human health and to comply with legislation for reducing concentration of NO₂ as a main pollutant. As a result, both Bristol City council and South Gloucestershire council undertook a feasibility study for a clean air zone (CAZ), also raising awareness by communicating and engaging programme with the communities in the area.

In November 2016 the council called on the Mayors to develop a clean air action plan and implementation of the clean air zone (CAZ). On 18th July 2017 the council received a response feedback of progress. This indicated that a conjunction task force chaired by FI Hance councillor to implement CAZ. At the same time an emerging transport plans were linked with the action plan. A sum of £498,000 of government funding for CAZ was allocated to the feasibility study in 2016.

A Cabinet meeting in Bristol at City Hall College Green on 17 August and the item number 11 was about clean air action plan and clean air zone feasibility study, so that the cabinet was updated on the progress of CAZ for Bristol and South Gloucestershire.

A Metro bus has been designed to improve cycling, walking, parking, traffic and rail. A sum of £7million investment made in promotion of electric vehicles to provide charge points and car bays for improving air quality. The implementation is from 2017 – 2021. DEFRA funded the purchase of an electric car for the Bristol City council for testing the wider adoption of electric vehicles in Bristol City council fleet.

In 2016, data were collected and a map of Bristol region was created by each local council. Data was shown as dots of red and dark red dots. These indicate that air pollution breaking the national European Union (EU) limits, especially for Nitrogen oxide. Doted Yellow on the map means site is below limit but monitoring must be carried out. The green and grey areas



are “Air quality Management” areas. To view this, refer to Clair city, Bristol council data map, Air quality management area (Pollutant sites). Reference for this is: www.calaircity.eu

Council is planning for new charges on vehicles coming into the city. Steps are being taken towards using renewable energy in order to reduce the levels of air pollutant is welcome by communities in Bristol and other regions.

ClientEarth Air Pollution Court Victory - December 2018

ClientEarth informs that they won a high court case during April 2015 against the UK government. It is claimed that Mr Justice Garnham was in agreement with ClientEarth that the Environment Secretary failed to bring compliance with the Law “as soon as possible” and bring the dangerous levels of air pollution to a safe level.

As a result of this court Judgement, government came with a plan so poor that it forced ClientEarth to take the UK government back to the High Court.

ClientEarth CEO James Thornton said: “I am pleased that the judge agrees with us that the government could and should be doing more to deal with air pollution and protecting people’s health. The time for legal action is over. This is an urgent public health crisis control. I challenge Theresa May to take an immediate action now to deal with these illegal pollution and prevent tens of thousands of additional early deaths in the UK. The High Court has ruled that more urgent action must be taken. Britain is watching and waiting, Prime Minister”.

The ClientEarth Lawyer Alan Andrews said “hopefully the new government will come with credible plan to provide Clean Air Zone in all cities in UK and not just handful of cities. They should get to the core of the problem, such as what come out of the diesel car, rather than relying on the results of discredited laboratory tests”.

BBC- The British Broadcasting Corporation reported in February 2019, that campaigners have won a third High Court against the government in tackling Air pollution. The court ruling points at the issues of Air Pollution crisis, by saying that 45 UK local authorities under the Environment Secretary must speed up the action of achieving the targets. It says the local authority’s proposals to improve air quality in 3 years time and not as soon as possible is a sort of exhortation, which is not sufficient.

BBC News on 18th February 2019 reported that Japanese car company Honda are to closing in 2022 with a loss of 3500 jobs. It was also reported that last year 160000, Honda Civic cars were made in Swindon car plant of which 90% exported to EU.



The trade Secretary, Liam Fox pointed out the demand for cars has fallen due to the new diesel emission rules introduced across the Europe and therefore the demand and supply has been affected.

Sunday Express reports that a third of new cars in Norway last year were pure electric, a new world record, as the country makes advancement towards ending the fossil fuelled vehicle by 2028. This is a huge victory over the battle to get rid of combustion engines in Norway, one wonders, if this could be done in Norway it can be done in the UK and the rest of Europe. This development shows that there are stronger forces in action to combat against air pollution mainly Nitrogen dioxide (NO₂) and particulate matter from all forms of transport from countries with similar policies to Norway. The will of the people seems very powerful to put health before profit.

The Guardian reported that a spokeswoman for the Department of Environment, Food and Rural affairs said “we have put in place a

£3 Billion plan to improve air quality and reduce harmful emissions. We will also end the sale of new diesel and petrol cars by 2040, and next year we will publish a comprehensive clean air strategy, which will set out future steps to tackle air pollution.”

The report continues to explain that the government’s own analysis shows Charging Zones to deter dirty cars by far the most effective policy, but ministers have told the councils they should only be the option of last resort. This seems that the government is contradicting itself and delaying matters of such urgency as public health.

Thornton points out to more taxation on diesel cars to make them less attractive. He says “it s time ministers came clean about the size of the problem.”

MIT Technology Insight is a technology magazine on December 2017 wrote about China’s electric car programme. It explains “Chinese government is embracing the shift from combustion to electric engines in a way no other country could match. Since 2013, almost 500 electric vehicle companies have been launched in China.” It continues to report that the change of strategies of traditional auto manufacturers to electrification and the momentum behind China’s companies is hard to match, which is a threat to Ford, General Motors and European car makers.

“ The industry has always been dominated by Japan, Europe and the US”, says Jonas Nahm, an assistant professor of energy, recourse and environment at the Johns Hopkins school of advanced international studies. “The centre of gravity is shifting very rapidly. I don’t think anyone has figured out a good response to it yet”.

The environment may suffer with the decision made by heads of governments globally, more importantly by the developed world.



The Independent reports that Japan warns Theresa May its giant firms will quit the UK, if botched Brexit makes it unprofitable to stay. As China is moving towards electrification of its car industry the question of profitability from investment by Japanese in the UK, due to Brexit's uncertainty, could reflect on China's future investments too.

The friends of the Earth also believe that "No Deal Brexit" has a negative impact on our environment and it should be taken off the table, it says the government need's pushing.

It adds that some people believe getting out of the EU could be good for the environment. The example of these is a number of positive things introduced, for example: Clean Air Act, Climate Change Act and Door step recycling to every home. Some policies of the EU may not be perfect. For example, it claimed "The common agricultural policy, which promoted factory – style farming at the expense of the climate and nature". But on the other hand, the EU has been the main driving force behind the UK government to clean up its act.

In Conclusion, we can reflect back to the EU's court case victory against the government for the UK's failure to meet EU limits for Nitrogen Dioxide (NO₂).

The European Environment commissioner said "The EU owed it to its citizens to take action". What forced the EU to take legal action was real statistics produced due to UK's non compliance, as 50,000 British Citizens die every year due to toxic air pollution (reference: the Green MEP Keith Taylor).

Enough has been said about the catastrophic outcome of Non Compliance. Now we await the fruit of these positive campaigns for clean air in the UK.

Air Quality Assessment Report Southampton - January 2019

When air pollution in a city comes to mind, it indicates towards a number of problems such as, the levels of pollution people are exposed to, the main sources, locations, and the number of fatalities. The impact of toxic pollutants (industrial, road traffic and shipping) on communities health is as such that the illegal levels is now believed to be the failure of ruling powers for inaction to remove catastrophic health hazards and also the lack of being proactive to take action in the last decades. In some countries the levels are far below the legal limits and that indicates towards more investments together with attention given to compliance with rules, regulations and the requirements of the legislations on environmental health. There are no other magic solutions to the crisis of non- compliance, other than having a discipline of taking control and avoiding unacceptable risk taking. We have seen a shocking level of sanitation and also non existence of public health standards in some developing world countries, which is due to government culture and the lack of financial backing to proper investments in public health infrastructure. By now lessons



should have been learned, so that there is no air, land and water pollution on a large scale in the developed world.

According to the World Health Organisation (WHO), 47 towns and cities in the UK have unsafe air pollution levels but 32 of these are above the 10 micrograms per cubic meter, with reference to particulate matter PM2.5 levels. Their study shows that there are 20 towns and cities in the UK that are the top worst places for air pollution levels, but London with high pollution was not in the top 20. Southampton is in the top 20 worst cities and towns in UK, as it has reached level 10 micrograms per cubic metre.

With reference to petrolprices.com, 9 out of 10 people are exposed to air pollutant, and that 7 million people die each year because of it. On 10th January 2019 the BBC news were broadcasting that aeroplanes using electricity as a fuel will be soon flying around the world, and also that in most advanced car industries the trends show that they are diverting from pollution making vehicles to moving towards manufacturing electric type instead. Steps are being taken by the government that by 2040 the sale of diesel and petrol will be banned, but there are concerns about making batteries and using electricity (reference petrolprices.com). Technologies such as fuel cell to power vehicles which use hydrogen gas, has an output of electricity and water, is now in its infant stage. It is said that trucks and trains also will use Fuel Cell.

With reference to Andrew English, motoring correspondent, it was the Welsh scientist and Justice of the Peace Sir William Grove, who discovered that electricity can be produced by electro-chemical reaction between hydrogen and air which was called "Gas Battery", but now we know it as Fuel Cell, which has an output of, electricity, heat and water. The Telegraph (News-Cars), foresees the trains to run on hydrogen fuel cell for British railways by 2022 calling it the Breeze Trains. The British Broadcasting Cooperation (BBC) reported on 17th January 2019 the Cumbrian project for building the Nuclear Power Station for the Lake District region is not going ahead and that the decision making authority is looking into green power from renewable sources, which are cheaper than electricity from the Nuclear Power Station. From the Environmental Protection and public health point of view this may be a better choice for long term investment, but for the immediate boost to the local economy, some economist believe, it may not be an advantage.

The BBC reported on 11th January 2019, regarding the death of 9 year old Ella-Kisi-Deborah, that her mother Ms Rosemont Ado- Kisi- Deborah has delivered a 100,000 signature petition to the attorney general calling for a new inquest (2nd inquest in 2019 is now called for) into her daughter's death in 2013, which was as a result of illegal level of pollution near their home in Lewisham, London. This alarming situation and other reports of asthma sufferers and vulnerable people indicate towards an immediate change into nationalisation of public transport. For example railways are in dire need of good management as the delays and cancellations cause the need for people to use cars and buses more, which adds to the pollution. There is a need to review the problems of public transport with reference to air



pollution and bring about an action plan for serious commitment to develop a strategy to provide a reliable infra-structure for running electric cars, trains and other vehicles together with preparing for other options for a free pollution fuel system, such as fuel cell for cars and public transport.

According to the Department of Environment, food and rural affairs (DEFRA) 331,000 tonnes of Nitrogen Oxide (NOx) pollutants, was produced mainly as a result of powering petrol or diesel vehicles. It seems that Southampton Council is offering concessions to electric vehicle drivers. They are working to develop infrastructure for the use of electric cars, for example a network of charging points in strategic parts of the city, or car parks. They are giving parking reductions of 90% for electric cars, and also free crossing over the Itchen Bridge for electric cars. The government offers grants for new plug-in vehicles and tax incentive concessions. Transport networks reports that Southampton City Council wants the City's port to be first in the country to implement Shore Power for cruise liners to resolve the ship pollution problem. BBC reported that Southampton port does not monitor air pollution caused by shipping.

How Shore Power Works

BBC says while cruise liners and container ships waiting in the docks, instead of leaving their engines running for power, they can use plugs at port to power their vessels and this prevents the air pollutants damaging the health of the local community and population. Southampton council and the residents want shore power to be implemented. In USA 99% of nitrogen dioxide and 70% of the particulate matter (PM) pollutants have been removed, as a result of ships using shore power (reference Alan Whitehead Labour MP for Southampton Test).

The University of Southampton points out that the research carried out by Dr Matthew Loxham, BBSRC Future Fellow in Respiratory Biology and Air Pollution Toxicology on the impact of air pollution on health in Southampton docks is very alarming. He says "we should not only just think air pollution relates to traffic vehicles, but we also need to focus on ships and docks that could have an impact on our health". He adds "there is no quick fix. I don't think pollution will ever be completely eradicated, but it's about using science to understand what the effects on health are and how we can minimise those, to improve quality of life in an intelligent way while reducing the potentially disruptive effect of some measures on the economy and infrastructures". According to a new report involving Southampton researchers, air pollution causes around 40,000 deaths and costs the UK economy £20 billion every year (Reference: University of Southampton).



Southampton Air Quality Action Plan

There is a 2nd Atmospheric pollution workshop, which was set up at the University of Birmingham in 2017. From the associated British Ports input we have the following:

The cause of pollution in Southampton is assessed to be 34.1% from heavy goods vehicles, 23.9% cars, 23.1% household pollution, 7.6% light goods vehicles, 6.9% port and 4.5% buses. These results are based on nitrogen dioxide at M 271 and A 33 junction, Redbridge. Monitoring from different locations in the port area shows NO_x, PM₁₀ and PM_{2.5} below national levels.

The following measures have been highlighted:

- 1) All vessels visiting must operate on low sulphur diesel/exhaust cleaning systems.
- 2) Proportion of shore power ready vessels low. All sectors favouring use of LNG (Liquid Natural Gas) as future operating fuel.
- 3) Cost of shore power infrastructure high.
- 4) Feasibility study for shore power connection nearing completion.

Southampton Council's input would be in form of taking action on delivering the Clean Air Strategy. These require transition to low emission fleet, clean air zones and penalty charging. Supporting green transport by incentivising and improving the road network could reduce emissions from both domestic and industrial building.

We can summarise by pointing out the Environment Act 1995, and its requirement for local authorities to monitor, review and assess the air quality in their environment. They need to check if there will be a breach and then take the necessary steps to prevent and reduce the level of pollution. They are required to designate air quality management areas (AQMA). Southampton ports are said to be handling 14 million tonnes of freight every year. There is also 6.9% NO₂ emission in the city to tackle. The port operation is asking for more monitors at the strategic points on site to help better assessment, which can lead to implementing more improvement. Air quality has been improved in the past 30 years, but more improvements are required to bring Southampton to a satisfactory compliance outcome with reference to government targets.

Comparisons of Air Quality in Scotland with the Rest of UK – March 2019

The Telegraph reports on 18 March 2019 that over 28000 people die from air pollution in the UK each year with reference to the government statistic. It added that out of 43 air quality zones in UK, 38 exceed European Union's safety limits. London's air pollution kills almost one in 10. According to the statistic, outside London, are highest for Birmingham, Manchester and Bristol more than 10 microgram per cubic metre of particulate matter (PM_{2.5}) and the lowest for Glasgow, Edinburgh less than 10.



England has the highest death rate due to air pollution with 25002 deaths and it suffers the most from polluted air in the UK. The air quality is improving since 2010 figures and also there is less greenhouse gases emitted since 2010 (reference: The Telegraph).

British Broadcasting Corporation -BBC News on 27 January 2019, broadcast air pollution in Scotland is getting worse especially in the city of Glasgow. It reports that Nitrogen dioxide (NO₂) levels on the Hope Street in Glasgow are averaging 60 microgram per cubic meter last year in comparison with 58 in 2017.

The NO₂ levels in Glasgow hot spots are 60, Edinburgh 51 and Dundee with 43 exceeding EU directive of 40 microgram per cubic meter.

The transport and vehicle traffic are the main cause of air pollution in Scotland. The Scottish government said that comparing Scotland with other countries it has better air quality and stricter targets. The strategy to reduce the emissions of air pollutions in main cities with high pollution levels came to exist as a Low Emission Zones (LEZ). It was first introduced in Sweden in 1996.

In London, Low Emission Zone started to operate on 4 February 2008. The first Ultra Low Emission is to be introduced in London this year.

In Scotland, the LEZ will be introduced to Glasgow, Edinburgh, Aberdeen, and Dundee by 2020. The first phase of Glasgow's LEZ, which is about a change on buses, came to effect on the 31st December 2018; changes on alternative vehicles will come before the end of 2020. The local authorities of Scotland will be responsible for implementing LEZ in their own areas, where Air Quality Managements (AQMA_s) operates.

Roseanna Cunningham said "compared to the rest of the UK and other parts of Europe, Scotland enjoys a high level of air quality and we have set more stringent air quality targets." She added: "we recognise that a few hotspots of poorer air quality remain in some Scottish cities and towns, and are working with local authorities and other partners to address this as soon as possible."

In accordance to Brexit Environment Scotland Report, Brexit will make a major change in environmental governance between Scotland and the UK. It has caused a constitutional dispute, which can impact on the future of environmental governance. It has created more uncertainty and making Brexit presentation highly challenging. Scottish stakeholders are worried that the English influence will dominate the design of environmental governance. It points out that it is important for both parties to cooperate on environmental policies in such a way to allow Scotland to develop policies, which works better with its local conditions. This also helps the post-Brexit environmental governance too.



Method of Monitoring Air Pollution level

Glasgow city council provided details of monitoring methodology and data. The Nitrogen Dioxide (NO₂) diffusion tubes are a simple, effective and low cost method for monitoring pollutants level, at the kerb side in the Glasgow centre.

There are 100 tubes located in a number of spots throughout the city. The tubes are exposed for a month and are all stored in a cool area before use and then the caps are removed when they are placed at the monitoring points. The annual mean concentration is determined and compared with the target levels.

In England, City of York Council proposed measures to improve air quality. It included Clean Air Zone (CAZ). Unlike low Emission Zone, CAZ will arrange different entry standards for vehicle entry frequency into the zone. It claims that this achieves more air quality benefit than the Euro emission Standard of LEZ, which affected all buses.

Cleaner air for Scotland publication by Scottish Government, November 2015, points out that there are reasons for non-compliance and these are:

- a) Increase in diesel engine vehicles
- b) Increase in total number of vehicles
- c) Disparity between laboratory and real world emissions from vehicle engines
- d) Topography and planning of urban area creating street canyons, which is trapping air pollution.
- e) Lack of integration of air quality and climate change policies
- f) Tran boundary emission sources.

It also highlights that the 'sustainable development' being the focus of the government side by side of sustainable economic growth will create a successful country. The vision is that the air quality will be the best in Europe and the Mission is to protect health, well-being, environment, place making and sustainable economic growth via improved air quality throughout Scotland.

(Reference: <http://www.gov.scot>)

According to the department of Environment Food and Rural Affairs (DEFRA) Publication, July 2007, air pollution is estimated to reduce life expectancy by 7-8 months. This strategy presented to the parliament states that the measures taken now will improve life expectancy to reduce 5 months by 2020.

In DEFRA's strategy, it is estimated that there are still massive reductions in air pollution levels that are achievable by 2050. The Particulate Matter reduction for Central London is about 55% and 63% in urban background. Similarly, 55% and 70 % for NO₂ levels are the figures.



BBC News reported on 31st October 2017 that Glasgow is more polluted than London, according to the World Health Organization (WHO). Records show Glasgow with 16 microgram of particles in every cubic metre in comparison with London and Leeds 15, Cardiff and Birmingham with 14.

In conclusion, generally people in major English cities are feeling the impact of air pollution more than other smaller city and towns, where the population is less together with smaller scale of industries concentrated. Welsh and Scottish population enjoy better quality of air as the land topography is different with a number of lakes. This is also true for South of England counties with seaside holiday locations and in the North with the Lake District, which offers better air quality. In the UK, there are more strict rules and regulations that are placed to reduce air pollution. As technology advances and evolves, the transport system will require being equipped with electric vehicles, following the non combustion vehicle engines policies. The prediction for 2050 is that the air pollution will be reduced by 70%. All these attempts are to bring about a better life expectancy, well-being, better communication and collaboration to improve the economies, which will provide a foundation for eliminating causes of air pollution internationally and this may be the ultimate theme.

Air Pollution Assessment United States of America (USA), April 2019

In total eight major cities in United State are with high levels of air pollutants. Four of these are in California. The state of California suffered from wild fires too in recent years, which has added to the air pollution due to smoke.

Comparison of pollutant limits set by European Union and United States shows both have the same mean limits set for Nitrogen Oxide (NOx) being one hour at 200 microgram per cubic metre and for particulate Matter (MP) PM 2.5 (1 hour) is 25 microgram per cubic metre. In USA the Ozone pollutant at ground level in hot sunshine seems to be of more an issue in terms of its impact on general Health.

Here we look into each of the most polluted cities in USA to find out how they end up having unacceptable levels. These are:

Sacramento California- it was reported to be the worst air pollution city in 2018, due to camp fire blaze. After the smoke was lifted, cities' air quality has improved with an average of 15.

Los Angeles suffered from camp fires before the 2018. The city did not have one day clean air for almost 4 months. Then the November wild fires added to the bad air in the city.



San Francisco- in November 2018, had air pollution level which could have impacted on the public health and cause eye, throat, nose irritation and damage people's respiratory system, more so on the health of the vulnerable and disabled individuals.

San Diego- together with Los Angeles and Sacramento receive, 'F' - failing grade in 2018 from the American Lung Association. The Lung Association stated that global warming had an impact on the general health, as ground level Ozone is increasing.

It is reported that Cincinnati suffers from Particulate Matter PM pollutant. In this they believe both construction industry and traffic caused the high levels.

Cincinnati Ohio- in 2018 was said to have satisfactory air quality levels comparing it to high levels in California still rank the most polluted city in PM due to power plants, construction industry and unpaved roads.

Indianapolis Indiana- suffers from coal-fired power plants, but still ranked as satisfactory air quality levels. Most of its pollutant comes from road traffic and power plants in the same way as Cincinnati.

Pittsburgh Pennsylvania- in 2018 escaped the World Health Organisations, clean air threshold. Only Allegheny County received 'F' failing grade due to high levels of Ozone and PM from the Lung Association in USA.

Boston Massachusetts- suffers from traffic congestion. Road traffic causes 10% of adult and 13% of children's asthma. It had the worst rush hour traffic in the whole of USA (reference: Business Insider).

In USA after the war, we had economic growth, rise in population and increase in numbers of high ways which led to increase in air pollutant. The Environment Protection Act formed and as a result there came Clean Air Act 1970, which regulated vehicle pollution. As a result of the law reinforcement, pollutant levels reduced, for example: sulphur levels by 90%. Generally new vehicles became cleaner almost completely. There are examples such as New York smog in 1970 with poor visibility, which is now much different with cleaner air and a much safer environment.

Since the 1960's despite the increase in population and number of vehicles and road construction, the progress continued to improve air quality in the major cities of USA.

For over 40 years the strict control and law enforcement brought about much reduction in air pollution by marine engines, public transport such as buses, locomotives and household machineries.

The statistics show that the vehicles were much cleaner by 19% compared to levels in 1970 for pollutant, such as Nitrogen Oxide, Carbon Monoxide and particle emissions.



Since 1995 fuel became lead free, as phasing out leaded petrol in 1970 it resulted in reduction of lead in the air by 94% up to 1999. Cleaner cars, trucks and fuel led to the development of technologies such as automotive catalytic convertor and now moving towards electric cars, trains, aircraft and shipping. Progress in the development of technologies also led to fuel injection, on-board diagnostics and computers. Today's cars are not only cleaner but they are more reliable and durable.

The efforts to reduce emission from transportation had a good impact on the economy when considering cost effectiveness. That is for every one dollar spent on the improvement, people received 9 dollars benefit in both the environment and public health (reference: EPA United States Environment Protection Agency).

Air Pollution Assessment in Edinburgh - May 2019

The Scottish government has put regulations and strategies to control air pollution emissions with the support of Scottish Environment Protection Agency (SEPA).

The local authority carried out the implementation of these strategies, which includes industrial emission. There is a hotline (telephone no: 0800807060) to report urgent pollution accident or incidents.

Policy action for air quality will lead to reducing risk to human health. Clean Air Scotland therefore focused on the road traffic pollution and the way it can be reduced and it was finally published in November 2015. Following this development, the Clean Air for Scotland annual progress report was published 2016.

Scottish government works in partnership with UK government Department for Environment Food and Rural Affairs (DEFRA) to ensure objectives are achieved.

Despite efforts to reduce air pollution in the last decade poor air quality still harms humans, because of this, it is now believed health inequalities has direct connection with it. People with disabilities, young, the elderly and those with medical conditions come in the category that lacks health equality. At the present 38 areas are under the Air Equality Management Areas (AQMA). Except for two the rest are for road traffic emission. The key objective is to reach a major progress towards a significant reduction by 2020. As a result of Clean Air Scotland policy action, we can achieve benefits in terms of public health/general health, efficiency, and cost saving together with climate change policy interventions and the renewable energy policies such as electric vehicles too. With this approach more pollution reduction will be achieved.

Clean Air for Scotland (CAFS) new initiatives are:-

- a) A national modelling framework



- b) A low emission framework
- c) Adoption of World Health Organisation (WHO) set limits for Particulate Matter (PM 2.5)
- d) (CAFS) Air quality awareness campaign

CAFS aims to progress a number of actions on 6 of the main areas. These are:-

- 1) Transport – it looks for a way to change from use of petrol and diesel fuel vehicles towards walking and cycling and reducing the need for travel. BBC 14th May 2018 reported that travelling by aircraft regularly has caused emission in and around airports and added to overall pollution and as climate change campaign now seeks low to zero emission altogether, this will be a step forward.

Legislation and policy – All European and Scottish legal requirements relating to air quality are complied with.

- 2) Communication – Information is available for all citizens and people are well engaged and empowered to improve air quality.
- 3) Health – Scotland protects its citizens from the effects of air pollution, hence reducing health inequalities.
- 4) Placemaking – Scotland will not compromise air quality by development both existing and new. The places must be designed to remove air pollution and defects.
- 5) Climate change – Scotland will reduce greenhouse gas emissions and will focus on renewable energy targets.

The positive results of the above 6 themes of CAFS strategy will depend on the full commitment of all parties in this battle, the public, industry and the government. There is an ongoing report assessing the progress of CAFS and it shows measures are being taken to achieve the targets set by CAFS as soon as possible. Reports will be completed by end of 2019. For example, steps taken to address the urgency of the reduction from low to zero emissions. To achieve this target, a number of platforms are provided, for example, Clean Air Day (CAD) Scotland on 21st June 2018 has been encouraging public to use active travelling and buying electric vehicles. Teaching packages (www.learnaboutair.com) provided to teach pupils about air quality, CAFS launched a revised system to implement Local Air Quality Management (LAQM), which reports the annual progress. This has helped Scottish Environment Protection Agency (SEPA), Scottish government and local authority to work in collaborative ways under CAFS. Monitoring of PM 2.5 was carried out for 44 sites, but now 10 more sites has been added in 2018/2019. Regulation 2016 was amended to include the WHO PM2.5 of 10 microgram per cubic metre by 2020.



Scotland has adopted the Dutch modelling methodology. SEPA has tested the performance of the modelling which is based on Aberdeen and Glasgow via National Modelling Framework (NMF) city model progress. There is still a lack of good traffic data, SEPA is trying to find a solution by developing more effective data collection process.

The National Health Service board (NHSB) survey in Scotland was completed in 2017; it found out that the majority of the NHSBs included air quality as a topic in their Joint Health Protection Plan (JHPP) in late 2017.

The City of Edinburgh Council- Transport and Environment committee set up a meeting on 16th May 2019 and it called for tackling air pollution Low Emission Zone (LEZ) in Edinburgh. It arrived in restricting access to the most polluted vehicles in the city centre boundary and extending it to a city wide boundary for all selected vehicles. It also calls for grace period different vehicles and phasing in arrangement, which allows for owners to prepare. Other measures are: extension of term to Newhaven and expansion of electric vehicle charging infrastructure with higher emission standards for taxis, action on targeted environmental enhancement.

Air Pollution Assessment in the EU, Paris – June 2019

For European Union, this study will focus on the capital city Paris and air pollution impact. Since 1990 there has been a rapid increase in emission of air pollutants in urban mainly vehicle traffic and industry also in countryside by livestock and agricultural spraying. In recent years, Paris suffered from heavy smog in the past mainly in winter. Its streets are choked with traffic and emission of pollutants from vehicles mainly diesel engine type.

The Mayor of Paris has been tackling pollution by phasing out older vehicles and putting end to diesel vehicles. He is facing opposition in all fronts, but major cities in Europe are also facing the same problem and therefore this move seems to be a good example for others to follow too.

Cars are now identified for their emissions by using coloured stickers, so that they can come under a traffic ban targeting most polluted vehicles. This includes other cities too. Paris is now going towards step by step system of getting rid of petrol and diesel cars. Now all cars built before 1997 are banned to enter the city centre on weekdays from 8am to 8pm. Diesel vehicles registered before 2001 are also facing heavy penalties too, if they breach the ban. Next year, pre

2005 diesel vehicles will be banned and this continues to 2024 for diesel to be outlawed and petrol cars by 2030.



There are now bus lanes and cycle tracks introduced to reduce traffic congestion. Earlier a package of subsidies has been introduced to encourage people to choose other form of transport (Reference: BBC.co.uk - 2018).

In conclusion, looking at 2 major cities, Edinburgh - Scotland and Paris – France and assessing the air pollution impact on the health of their citizens, it is evident that trends are indicating towards the preparation for less traffic noise and pollution emission free cities in the near future. Some experts believe that the future is already here. They predict that the time has come to see the gradual elimination of gasoline engines and replacing them with electric cars. With this petrol stations will go and electrical recharging station replace them. This also said for auto manufacturers starting to invest in building new plants that only build electric cars, which means that there will be the end of coal industry and oil companies.

The future is approaching faster than most of us can handle. The study of both Edinburgh and Paris air quality showed that they both rejecting petrol and diesel as fuel and instead encouraging drivers towards electric vehicles and the renewable energy. This was clearly evident in this assessment.

Summary

With respect to UK the road traffic has a major part on public health in recent years and the Government has been receiving people's plea in reducing air pollution, which has devastating effects on general health, causing the children's asthma and respiratory disease in the health of old and vulnerable people and now also know to exacerbate memory loss and reduce learning capacity. The environmental issues such as air pollution and climate change became more controversial especially since the millennium. The public no longer can tolerate the level of pollutant caused by road traffic, because the death rate has gone up as a result of it. Only recently, 15 April 2019, for 2 days London roads were blocked in Oxford Circus, Marble Arch and Waterloo Bridge, by environmental activist protestors. People demanded that they want change now and not 2050. They want clean air everywhere, maximum use of renewable energy, good incentive for having electric cars and most importantly a good infra-structure for power parking bays and charging power points.

The proposal by Ziarati (2019) to encourage people to work from home and suggestion to companies to reduce the number of working days are some of the drastic solution which could be implemented if discussed objectively among the people concerned. It is also pertinent to say that congestion charge schemes in the long run do not remedy the pollution problems in smaller cities as the main cause of the emissions are from old buses, taxis and delivery vans which are almost invariably run on diesel engines. Furthermore, such scheme would have major impact on the city centre's long term future; it may be worth noting that in some cities in Iran in during the working hours some days car with odd



number plates are allowed in other days the even number ones. Such schemes could encourage people to share cars.

In Ireland solid fuel is main source of air pollution in areas where bituminous coal is permitted. These are in smaller cities and villages, but in major cities it is highest in traffic influenced areas.

Welsh and Scottish population are enjoying better air quality and as the technology become more advanced and available together with better cost effective results the prediction 70% air pollution reduction by 2050 also becomes more real.

In the same way, USA with its lead free fuel and taking advantage of advanced technology in reducing harmful car pollutant emission and applying renewable energy will reach all its targets. However, we should not lose sight of the fact that USA, together with China, are by far the two of greatest polluters of the mother earth.

The mother earth has always been more protected during peace time, as war and conflicts have had devastating impact on the planet and the ability of its inhabitants for survivor. The author believes that the future will bring sensible solutions and burning of fossil fuels would be a thing of the past!