SIMPLE TRAFFIC MEASURES SIGNIFICANTLY REDUCE THE EXPOSURE OF PRIMARY SCHOOL CHILDREN TO NO_2

by Dr Valerie Cameron, Dr Kehinde Oduyemi, Tobin Cook and Cathy Rirsche

Introduction

According to Public Health England (PHE, 2019) air quality is the largest environmental health risk in the UK; long-term exposure to air pollution claims some 28-36,000 premature deaths each year. It shortens lives and contributes to chronic illness. Health can be affected both by short-term, high-pollution episodes and by long-term exposure to lower levels of pollution. Environmental Health Officers (EHOs) are directly involved in managing and monitoring local air quality, but often direct action is only taken when there are exceedances of statutory limits and standards. A previous publication, REHIS Journal Autumn 2018, makes the case that long term exposure to lower than limit levels of air pollution can have significant health impacts in later life and that the developing lungs of children are at risk. PHE goes on to state that 'effective communication of health messages about air pollution and appropriate action can save lives and improve quality of life for many' (PHE, 2019).

The National Institute for Health and Care Excellence (NICE) guidance on air quality (NG70, 2017), provides an interactive flowchart on improving air quality including the following metrics:

- planning,
- active travel,
- reducing emissions from public sector transport services and fleet vehicles,
- smooth driving and speed reduction,
- clean air and congestion charging zones,
- raising awareness.

In addition, NICE quality standards provide information to NHS and local authority staff (NICE QS 181, 2019) on improving health through interventions on air pollution. (It is noted that Public Health departments as well as Environmental Health services are located in local authorities in England).

It is estimated that poor air quality costs more than £2.7 billion per year in poor productivity (Defra, DoT, 2017) but the new measures outlined in the Clean Air Strategy 2019 claim to bring about a cut in costs of £1.7 billion per year by 2020, rising to £5.3 billion per year from 2030. These are ambitious targets and it will be interesting to learn over time how this will bring about improvements at a local level.

During 2008-2012 a PhD research study ('the initial research') was conducted into the impacts of Nitrogen dioxide (NO_2) on the health and wellbeing of asthmatics in Guernsey. This identified that spatial and temporal variation in NO_2 exists in Guernsey and that there was direct correlation between elevated levels of NO_2 and hospital admissions during that period (Cameron, 2014; Cameron and Oduyemi, 2018).

Although Guernsey is in the Channel Islands there were many similarities in air quality with Scottish rural, coastal and island environments, including NO_2 (Cameron and Oduyemi, 2018).

The detailed analysis of the hospital admissions data showed that the vast majority of people admitted to hospital during, and following, asthma attacks were young children (Fig.1).

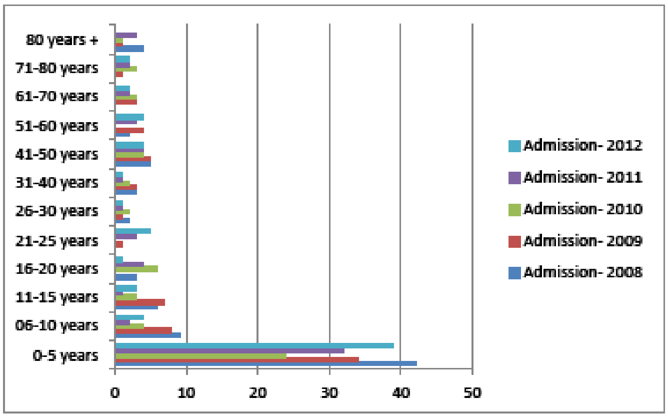


Fig. 1. Demographic distribution for hospital admissions for 2008-2012

It was acknowledged that there were a number of confounding factors in Guernsey, such as the cost of accident and emergency (A+E) consultations, which was around £150. Once admitted to hospital, the cost of secondary care was free for all patients. It was considered that an adult suffering an asthma attack was more likely to wait for a GP consultation, which cost around £50, rather than paying for an A+E consultation.

It was assumed that the parents of a child suffering from an asthma attack were however, more likely to be willing to pay for an immediate consultation in A+E. In addition, it was impossible to assess GP data on asthma consultations as Primary Care in Guernsey was delivered by three private practices who did not have shared patient information systems so the research was based on hospital data only.

The impacts of NO_2 on the development of the lungs has historically been understated. It is now believed that NO_2 can have detrimental impacts on the developing lungs in young children and that chronic exposure to even low levels of NO_2 can lead to respiratory conditions like asthma and COPD in later life (European Respiratory Society White Book, 2019).

In January 2019, the UK Attorney General granted a new inquest into the death of a child and this was the first case where air pollution was stated as the cause of death. The child, Ella Kissi-Debrah, died in February, 2013 as the result of an asthma attack associated with spikes in air pollution from traffic near her home in London (bbc.co.uk, 2019). She had experienced good health until the age of six and had then been admitted to hospital on numerous occasions following levels of traffic pollution which breached statutory standards. It is likely that local authority staff will be called to give evidence to the Inquest into air pollution levels.

In November 2018, it was announced that Professor Campbell Gemmel, former head of the Scottish Environment Protection Agency (SEPA) had been appointed to Chair the independent review of the Scottish air quality strategy – Cleaner Air for Scotland published in 2015. This appointment followed the resignation of two members of the review panel who resigned due to delays in implementation, lack of ambition and lack of action. The outcome of the review is awaited.

The initial research identified that NO_2 levels well below statutory standards could have a significant impact on the respiratory health of children and this led to further work by Guernsey's Office of Environmental Health and Pollution Regulation (OEHPR), the results of which are reported herein. The aim of the research work contained in this manuscript was to investigate the exposures of NO_2 on children walking to a school in Guernsey and evaluate the effectiveness of the mitigating interventions deployed.

The role of raising awareness and partnership working, rather than statutory action, should not be underestimated in bringing about improvements in local air quality.

A study into exposures of NO_2 on children walking to school and mitigating interventions.

The initial research indicated that throughout the day there appeared to be three daily peaks in NO_2 levels, one in the morning from 08.00-09.00 and two in the afternoon from 15.00-16.00 and then from 17.00-18.00. This observation was consistent with traffic flows and jams associated with people going to school and work in the morning and then leaving school and later leaving work (Cameron 2014).

First Phase

In 2015, the OEHPR was approached by the Parent Teachers Association of a local primary school who had heard about the initial research. They were concerned about exposures to children following traffic jams in the lanes around their school and so the first phase of the programme was to monitor the exposures of pupils to NO_2 on walking route to St Martin's Primary School (Fig.2).

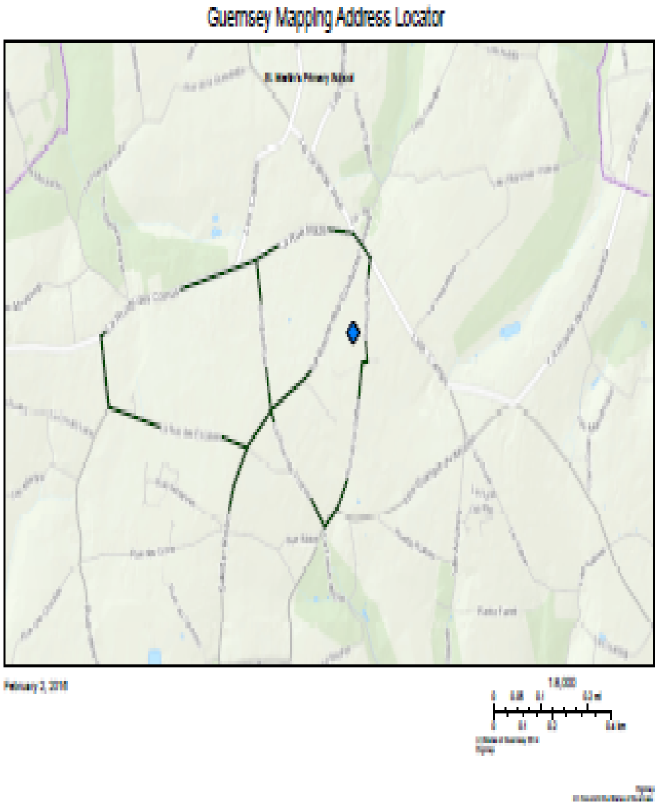


Fig. 2 – Walking routes to St Martin's Primary School

Once the walking route was established, personal NO_2 dose meters were worn by OEHPR staff and children walking along the route (Fig.3). This took place in March 2016. The dose meters were procured from Ricardo AEA and associated software installed on the OEHPR IT system for analysis of the data collected.

Fig. 3 NO_2 Dose meter

The NO_2 exposure data were downloaded and evaluated. The evaluation and assessment of the data identified that there were a number of locations on the route where NO_2 levels were elevated and these were associated with vehicles waiting with running engines at car and bus drop off points and with traffic idling at traffic lights and junctions enroute. The lanes in the area were generally single track with a speed limit of 15mph and connected to main roads where the speed limit was 25mph. Traffic jams around the school were frequent.

In partnership with the Active Travel policy group and the States' Traffic team, new drop off points were agreed with a new footpath access into the school, along with minor changes to traffic light timing and some minor traffic re-routing during school drop off and pick up times. The local Special Constables assisted to ensure the traffic moved smoothly and to reduce waiting and idling vehicles.

Following implementation of these measures, the walking route was monitored for NO_2 levels again in March 2017.

Second phase

The NO_2 levels surrounding 15 primary schools in Guernsey, including St Martin's Primary School, were monitored during the morning school drop off period. It was acknowledged that all schools have different traffic routes and walking/cycling varied across the schools. The purpose of measuring NO_2 levels surrounding 14 schools, in addition to St Martin's Primary School, was to establish baselines for the NO_2 exposure levels of pupils in these schools, during their walking to school.

The OEHPR worked closely with partners and a factsheet was drawn up for distribution to all the schools. Work is ongoing to assist schools in developing new ideas and initiatives to reduce children's exposure to NO_2 whilst travelling to and from school and the OEHPR offers to carry out further monitoring to support schools in establishing the effectiveness of any further co-ordinated interventions.

General advice for schools

- Stagger drop-off times to reduce peak traffic times and prevent congestion around your school;
- Most schools have different start times for different age groups – encourage parents to drop kids nearer to this time;
- Introduce pre-school clubs e.g. breakfast clubs, foreign language clubs, sports and activity clubs;
- Consider in and out parking flow to reduce static traffic and idling vehicles;
- Negotiate off-site drop-off areas with safe walking routes to school;
- Make sure your school has suitable provisions to encourage Active Travel, such as cycle sheds and areas to store helmets and outer clothing;
- Arrange walking buses and cycle trains to school starting from an accessible location and travelling along commonly used routes to pick up other children;
- Work closely with PTAs, Active Travel Groups etc. to ensure that these arrangements are supported and sustainable;
- Take part in initiatives promoted by Active Travel (e.g. Walk to School Week);
- Facilitate car sharing and encourage the use of school buses.

Results, analysis and discussion

The NO_2 exposure levels of St Martin's Primary School pupils during the morning drop-off period (see appended Figs. 4(i), 4(ii), 4(iii)) in 2016 show that pupils are exposed to a very high dose of NO_2 on their walk to school. For these pupils, the notion of 'average' air quality standard might not help protect their health. Similarly, the NO_2 exposure levels of pupils in 14 other Primary Schools in the area during the morning drop-off period (see Table 1) in 2017 also show that pupils are exposed to very high doses of NO_2 on their walk to school.

Table 1: Average exposure of pupils to NO_2 over the walking distance, during morning school drop-off (ppb)

School	2017
St Martin's	16.72
Acorn House & Beechwood	33.98
Ladies College	25.48
Blancheland College	16.8
Forest and La Rodin	16.75
Vauvert	16.07
La Mare de Carteret	8.69
Notre Dame Du Rosaire School	29.8
Vale School	16.56
Amherst School	25.57
La Houguette School	15.4
Castel Primary	10.46
St Mary & St Michael	13.76
Haute Capelles	12.86
Beaucamps	9.05

The results showed that, for St Martin's Primary School, the NO_2 exposure of children walking to school along the same route had reduced significantly (Figs. 4(i), 4(ii), 4(iii), 4(iv)). For St Martin's Primary School, the average NO_2 exposure of pupils during the morning drop-off period (approximately 08:30 – 09:15) has reduced from 20.12 ppb in 2016 to 16.72 ppb in 2017. This shows that the co-ordinated mitigating interventions implemented for St Martin's Primary School have resulted in approximately 20% reduction in the average NO_2 exposure of pupils during the morning drop-off period. This reduction suggests that the mitigating interventions implemented for St Martin's Primary School pupils have worked well.

For 14 other Primary Schools in the area, the 2017 data sets of NO_2 exposure of pupils during the morning drop-off period, the general advice provided, and the invitation by OEHPR to co-ordinate mitigation interventions, now form a basis for future reductions in the NO_2 exposure of pupils during the morning drop-off period for pupils in these schools. It will be important for future interventions to be properly co-ordinated, so that these not lead to unintended consequences for pupils walking to neighbouring schools.

As a profession, EHOs work tirelessly to improve health through enforcement of statutory standards but there is a case for going beyond statutory action when we know the interventions make a difference.

Conclusions

This research shows that simple interventions can achieve impressive reductions in exposures to traffic pollution by children walking to school, and indeed anyone else walking or cycling in the area. This will have a long-term effect and improvement in health. This manuscript calls for EHOs to use their professional skills to create interventions in their area to improve air quality regardless of statutory limit levels, to protect and improve public health now and for the future. Our communities deserve to breathe cleaner air now, not from 2020-2030. It is social and environmental justice. We need to act now to save lives.

Fig. 4 (i) Nitrogen Dioxide at St. Martin's, NO_2 (ppb) vs.Time

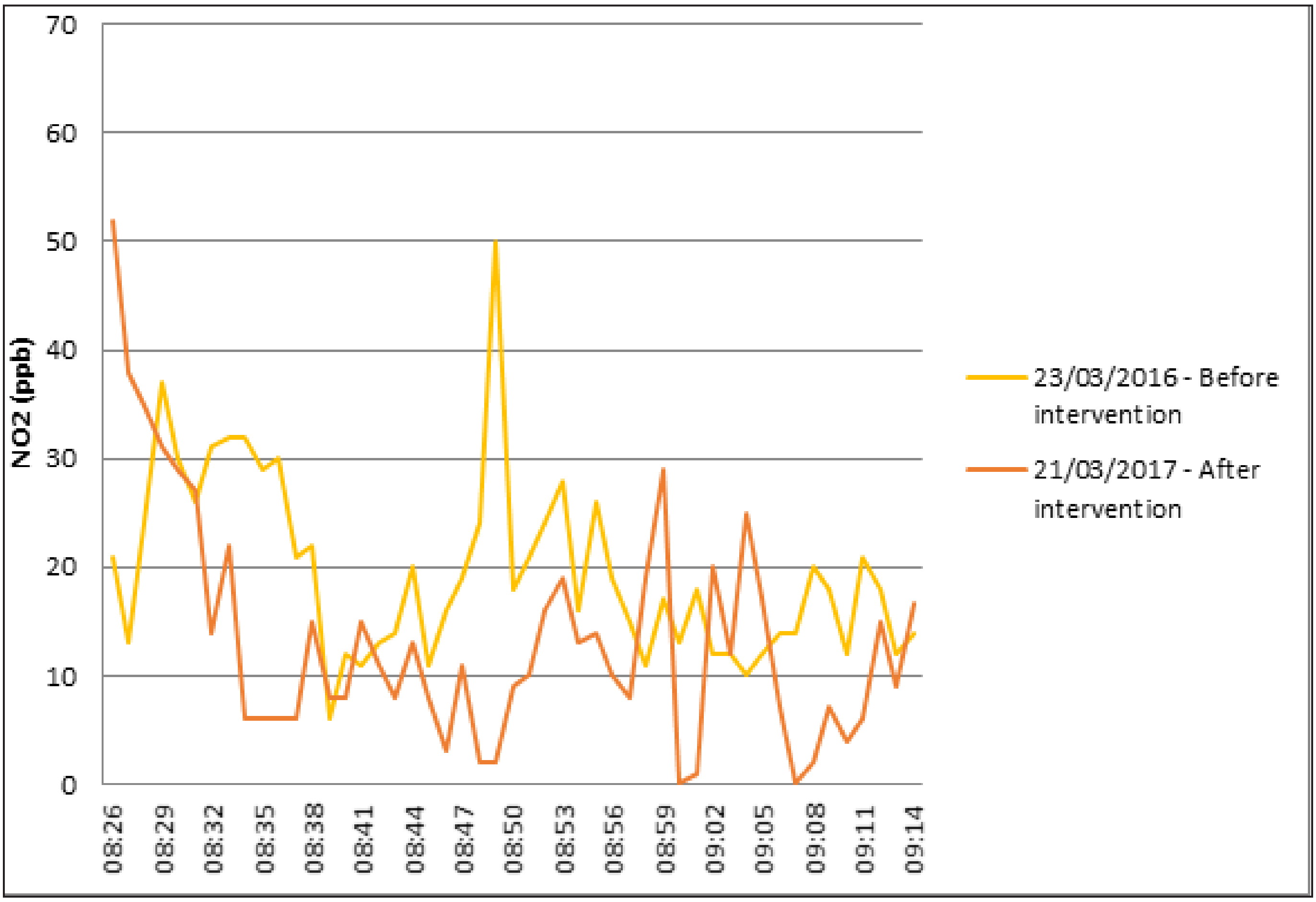


Fig. 4(ii)

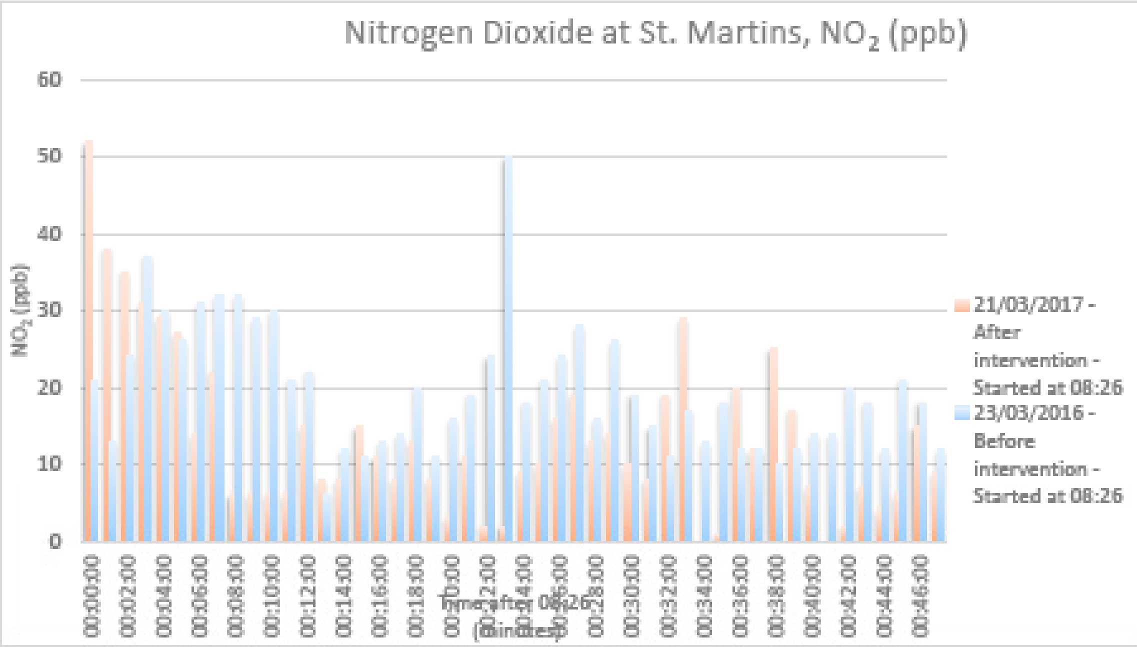


Fig. 4(iii)

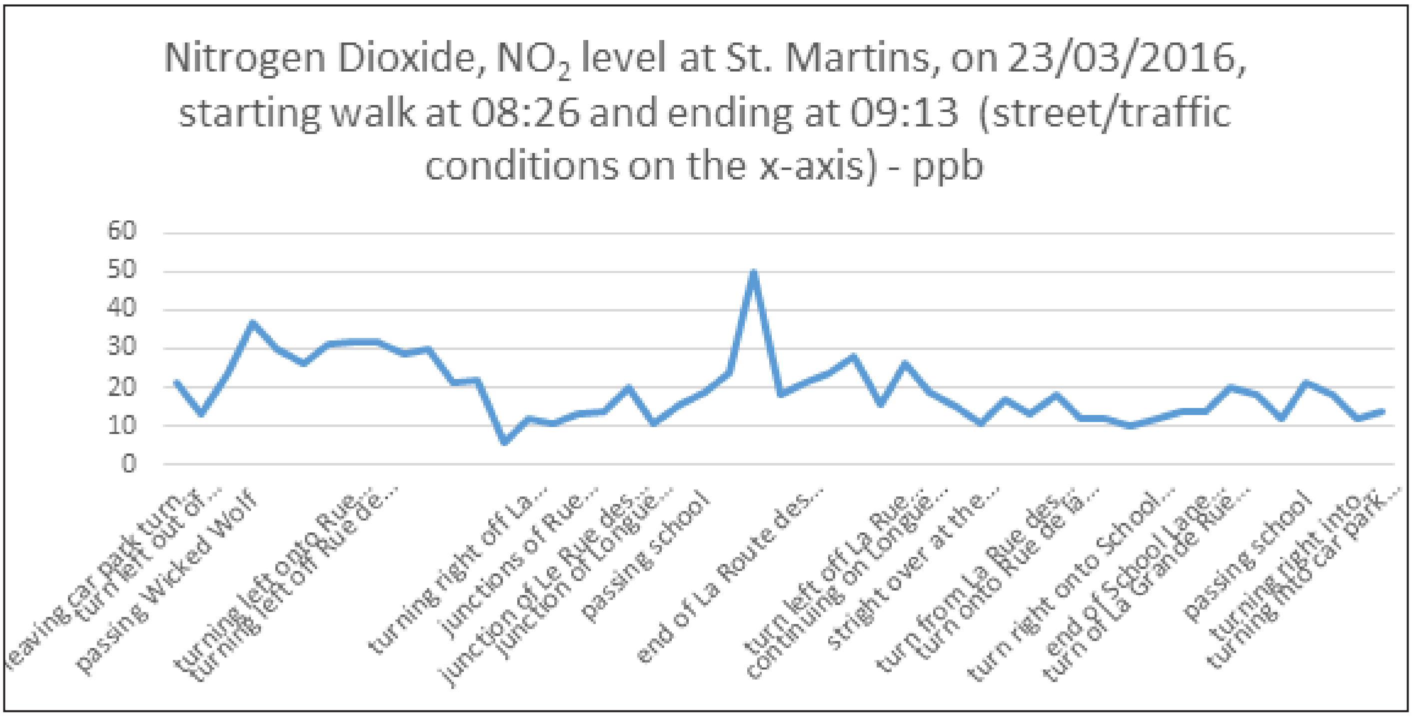
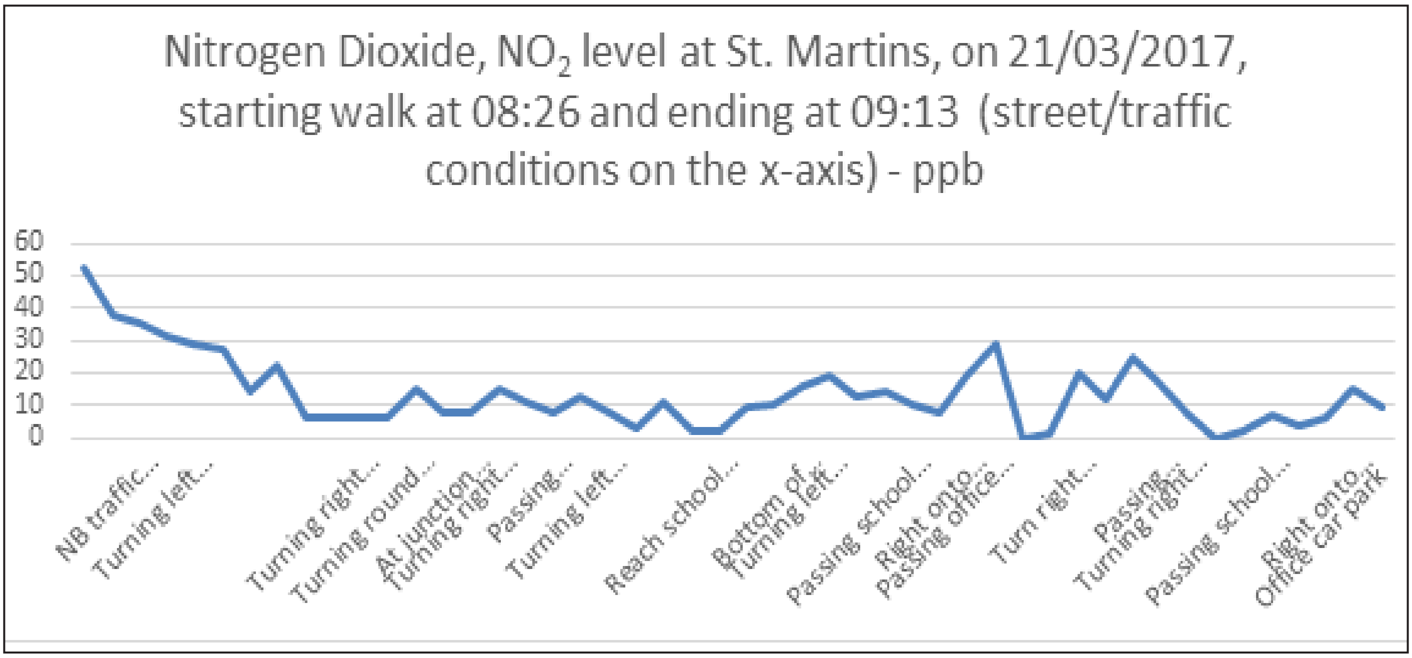


Fig. 4(iv)



Authors:

Valerie Cameron, MBA, PhD, FFPH, Ch.EHO MREHIS, FCIEH, CEnvH Chartered Environmental Health Officer.

Kehinde Oduyemi BSc, PhD, PGCert (HET), CEng, C.WEM, MCIWEM, SFHEA. Academic Curriculum Manager, Abertay University, Dundee.

Tobin Cook MSc, MCIEH CEnvH, Director of Environmental Health and Pollution Regulation, States of Guernsey.

Cathy Rirsche MSc, MCIEH CEnvH, Environmental Health Officer, States of Guernsey.

* * *