NITROGEN DIOXIDE (NO_2) MONITORING TOOLKIT

OCTOBER 2021
(English, UK)

mapping for change

INTRODUCTION

WHAT IS NITROGEN DIOXIDE?

Nitrogen dioxide (NO_2) is one of the major air pollutants found in our towns and cities. It is largely attributed to the burning of fossil fuels (coal, natural gas and oil) and vehicle emissions. The reaction of nitrogen and oxygen during combustion processes produces oxides of nitrogen, known as NO_X (pronounced knocks). These gases can react in the air to create into nitric acid and nitrates, which may remain in the air as very small particles.

WHY BE CONCERNED?

As an irritant gas, NO_2 can damage cell membranes and proteins. High concentrations can produce airway inflammation (experienced as cough, chest tightness and difficulty breathing), and may lead to narrowing of lung airways, particularly among people with pre-existing asthma. In addition air pollution is:

- A major threat to health and climate
- Responsible for ~ 7 million premature deaths[1]
- In the UK, between 28,000 and 36,000 deaths p/a are attributed to long-term exposure[2]
- Living within 50m of a major road could increase the risk of lung cancer by up to 10%[2]
- Living near busy roads in London may stunt lung growth in children by 12.5%[2]

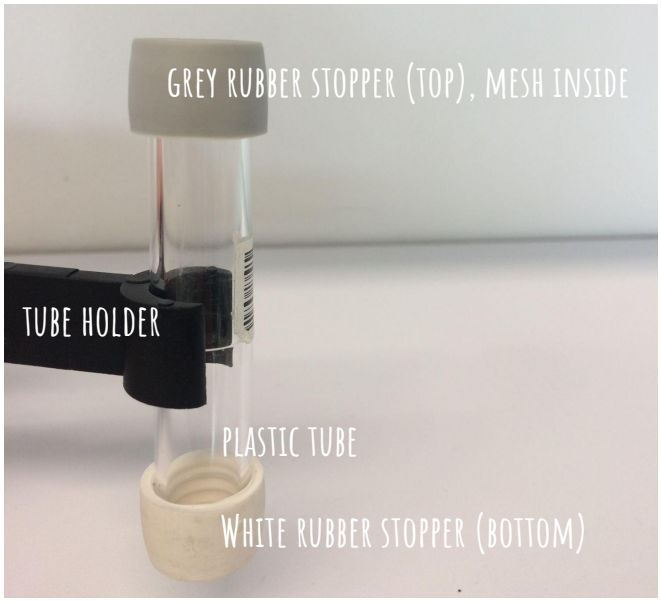
Studies have also linked air pollution to dementia[3], cognitive development[4] and depression[5].

The UK and EU governments have set legal limits for NO_2, however the World Health Organisation (WHO) recommends lower values for the protection of our health:

	NO_2 CONCENTRATION	
AVERAGING PERIOD	*UK and EU Air Quality legal limits*	*New WHO guidelines*
hourly	200 µg/m^3	200 µg/m^3 | 25 µg/m^3 (24-hr)
yearly	40 µg/m^3	10 µg/m^3

[1] Burden of disease from the joint effects of Household and Ambient Air Pollution for 2012. Public Health, Social and Environmental Determinants of Health Department, World Health Organisation, 2014.
[2] Personalising the Health Impacts of Air Pollution – Summary for Decision Makers, 2019 -King's College London.
[3] CCarey IM, Anderson HR, Atkinson RW, et alAre noise and air pollution related to the incidence of dementia? A cohort study in London, England BMJ Open 2018;8:e022404. doi: 10.1136/bmjopen-2018-022404.
[4] Sunyer J et al. Association between traffic-related air pollution in schools and cognitive development in primary school children: a prospective cohort study. PLoS Med 2015; 12(3): e1001792.
[5] Braithwaite I, et al. Air pollution (particulate matter) exposure and associations with depression, anxiety, bipolar, psychosis and suicide risk: a systematic review and meta-analysis. Environmental Health Perspectives 2019; 125(10).

DIFFUSION TUBES



MATERIALS NEEDED FOR THE SAMPLING

- DIFFUSION TUBES
- TUBE HOLDERS
- CABLE TIE
- SURVEY SHEETS (PROVIDED AT THE END OF THIS DOCUMENT)
- MAPS (OPTIONAL)
- CLIPBOARD
- RE-SEALABLE SAMPLES BAG
- PEN

Diffusion tubes are one of the most cost effective and easy ways to measure NO_2. This method is used for the passive monitoring NO_2 levels in ambient air. The tubes are commonly used by Local Authorities to obtain data in addition to those from high-end fixed monitoring stations. The results from the tubes provide a mean average reading over the period for which the tube was exposed to the environment. For more details, see AEA Report. It is important to note that this method of monitoring will not provide information on the day-to-day variation of air quality throughout the month or highlight any daily or hourly peaks in pollution. For this you would need to invest in more sophisticated and expensive equipment.

Diffusion Tubes are made from clear plastic, with a rubber stopper at each end. The tubes collect information about NO_2 by using a steel mesh coated with a chemical called **triethanolamine** (TEA), which is located at the end of the tube with the grey stopper, see image. TEA absorbs nitrogen from the air when the white stopper is removed, and the laboratory analysis can show the levels of the pollutant in the air (N.B. the grey cap should never be removed and tubes should always be positioned to allow the air to circulate freely).

Diffusion tubes can be fixed across various locations using a bracket and general-purpose cable tie; on lampposts, street signs, a fence or other appropriate sites. They should be left in the location for a month, and then sent to the laboratory for analysis. A new tube is required at each site every month so consider this when budgeting for your monitoring.

Please note: the diffusion tubes should be stored in a cool place before and after use and have a limited shelf-life.

INSTRUCTIONS

LOCATE: Select a suitable site to position the diffusion tube, depending on what you wish to monitor. Consider that pollution levels vary so further away from the road is likely to be lower than at the kerbside. To reduce loss or theft, it is recommended that tubes are placed at a height of 1.5m - 2m on public thoroughfares.

FIX: Clip the diffusion tube into the holder and position vertically with the **GREY** cap facing upwards. Attach the holder and tube in this position firmly with cable ties (or string) to a pipe, fence or lamppost. Make sure there is free circulation of air around the tube and that it is more than 10m away from air-conditioning outlets, extractor vents or heater flues.

SAMPLE: On the agreed start day, once in position, remove the **WHITE** cap which should be facing downwards. **DO NOT REMOVE THE GREY CAP** (you should see the absorber- small mesh in the tube beneath the grey cap). Leave tube in position until the specified changeover day – usually around 4 weeks later. Keep the white cap in a safe place as you will need to re-cap the tube for analysis.

RECORD: Fill in the site sheet with as much detail as possible about the location of the tube. Record any information that will help identify the location if someone else needs to collect the tube, e.g. photos of the location, and also to help explain the results when you get them. Complete the monthly record sheet with tube barcode number and accurate date/ time. Store these with the white cap in the re-sealable sample bag.

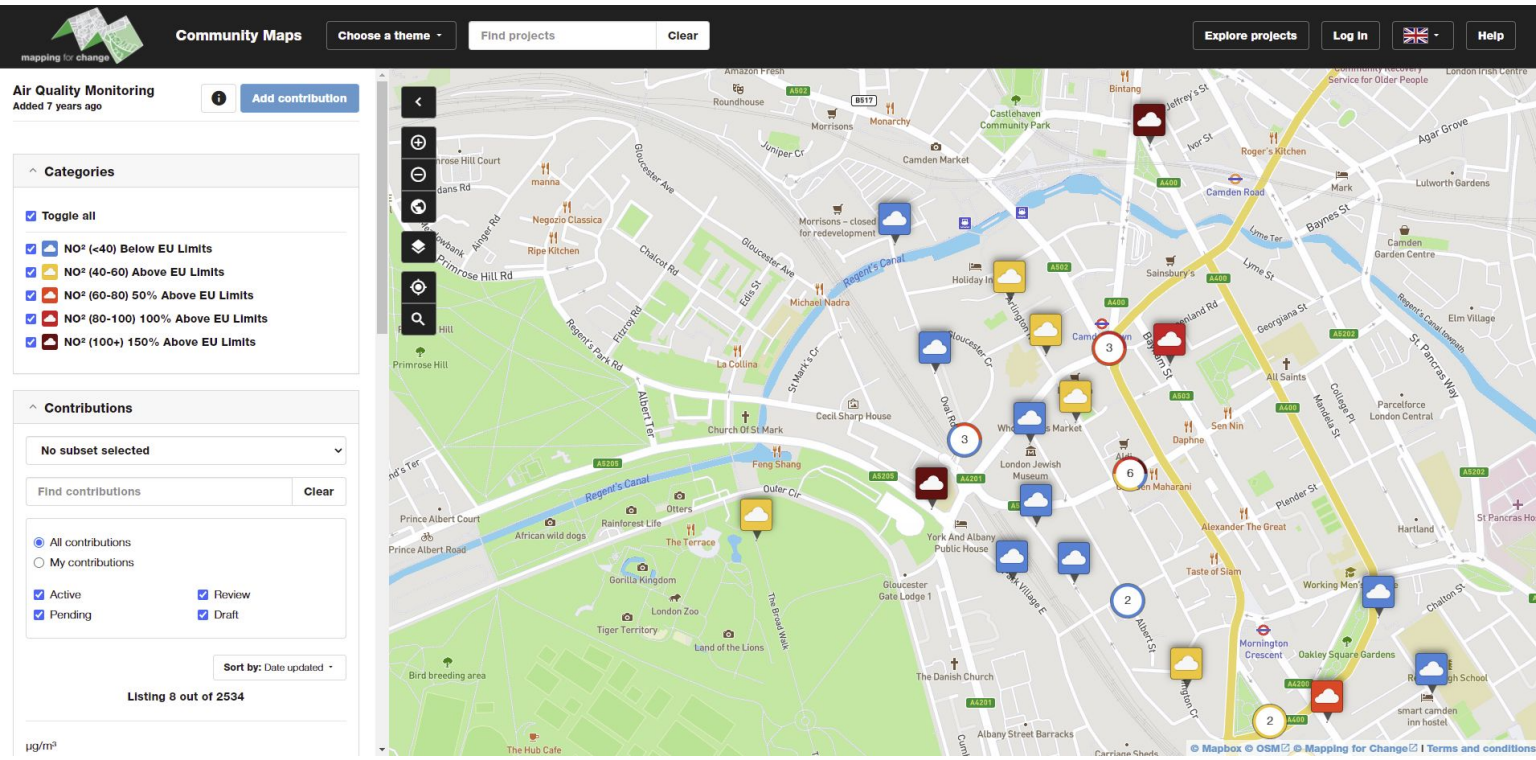
COLLECT: During the specified time-period, collect your replacement tube and store in the fridge until changeover day. On the changeover day, collect the old tube from its location and instantly replace the **WHITE** cap securely (leave the grey cap in place). Note any details regarding the tube condition, changes in site conditions, or anything that might affect the results. Record collection date and time on the survey record sheet and place everything in the re-sealable bag with your name clearly marked on it. Ensure the bag is tightly sealed. Then return your sample and wait for the results.

REPEAT: You have now completed all the steps necessary to collect your data! All you need to now is take your new replacement tube and follow the last three steps. You do not need to complete the site sheet again as you should keep the same location each month.

If you are monitoring more than one location, please make sure you remember which site number relates to which location, so they don't get mixed up each month.

RESULTS

You have now completed all the steps necessary to collect your data! All you need to now is to send your sample/s off to the lab for analysis and wait for the results. The lab may have their own record sheet that you will be required to complete when sending samples in for analysis. Once you have your results be sure to enter them onto the 'Air Quality Community Monitoring Map' to be shared with others.



PURCHASING EQUIPMENT

Diffusion tubes are not available directly from Gradko International if you are an individual or community group, so please contact Mapping for Change or your local authority. If you are a charity or established organisation and require many tubes it would be worth contacting Gradko to check. Allow 4 weeks for delivery.

MAKE IT COUNT

Why not hold a community meeting to share your results and begin thinking about what steps can be taken to reduce your exposure to poor air quality and deliver change real change.

MORE HELP?

If you would like **Mapping for Change to support you** with your air quality project, please **contact us** for a quote: info @ mappingforchange.org.uk

SITE SHEET

SURVEYOR NAME:

CONTACT DETAILS:

SITE NUMBER:

DETAILS OF YOUR TUBE POSITION	*(please fill in as much detail as you can and mark the position on a map)*
NAME OF ROAD(S) BUILDING ETC	
LOCATION DESCRIPTION (e.g. on the lamppost outside the school gate).	
APPROXIMATE HEIGHT OF TUBE FROM STREET LEVEL IN METRES	
SITE CHARACTERISTICS (e.g. busy main road, in the park)	
ANY OTHER INFORMATION	

RECORD SHEET

SURVEYOR NAME:

SITE NUMBER:

DETAILS	TO COMPLETE ALL THE BOXES
TUBE BARCODE NUMBER	
START DATE	
START TIME (24 HOUR CLOCK)	
FINISH DATE	
FINISH TIME (24 HOUR CLOCK)	
TUBE CONDITION (e.g. tube found on the ground, dirt, insect or liquid inside tube)	
ANY CHANGES IN POSITIONING OF TUBE SINCE LAST MONTH	
ANY UNUSUAL ACTIVITY (e.g. road works)	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