

FROM DATA TO ACTION

CITIZEN SENSING



JENNIFER GABRYS | [CITIZEN SENSE](#) | GOLDSMITHS, UNIVERSITY OF LONDON
[ASIC](#) | OAKLAND | 11-14 SEPTEMBER 2018

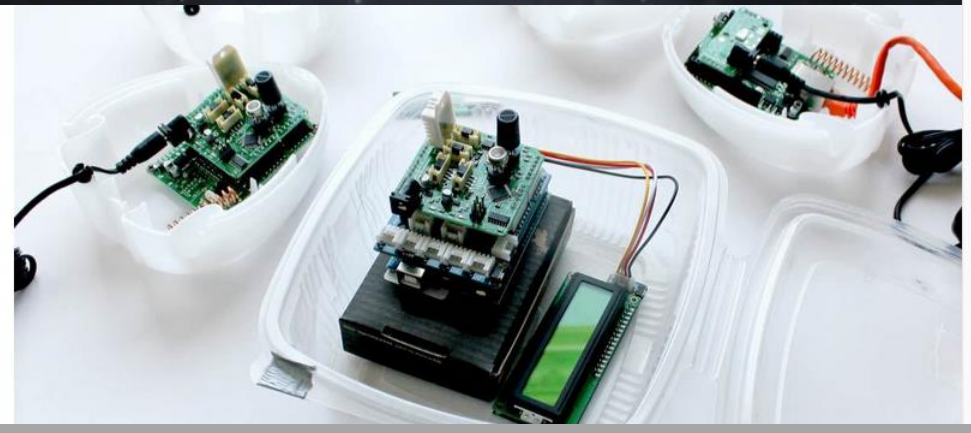
CITIZEN SENSING

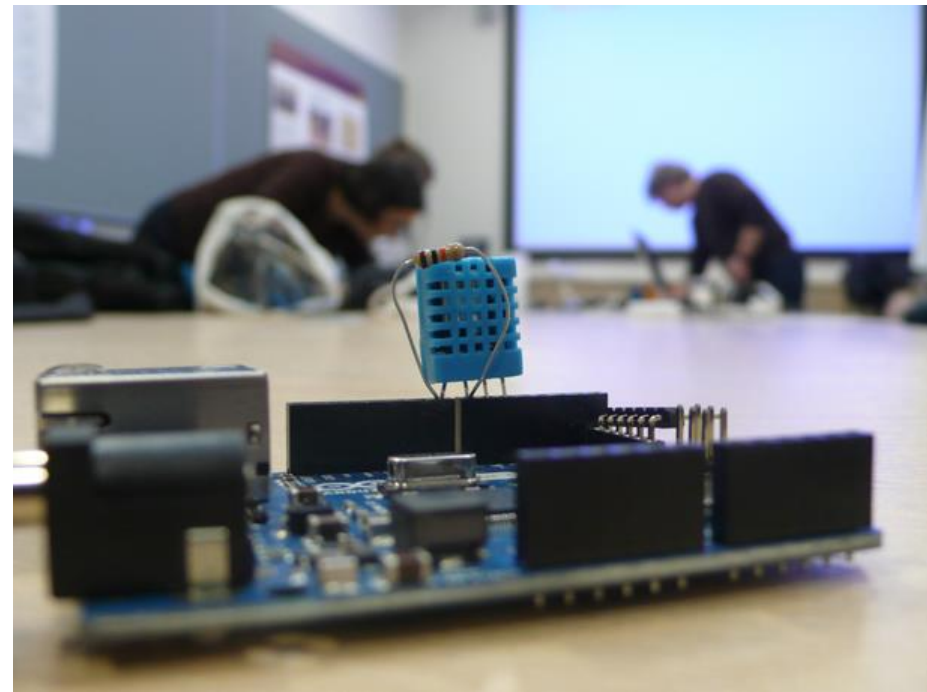
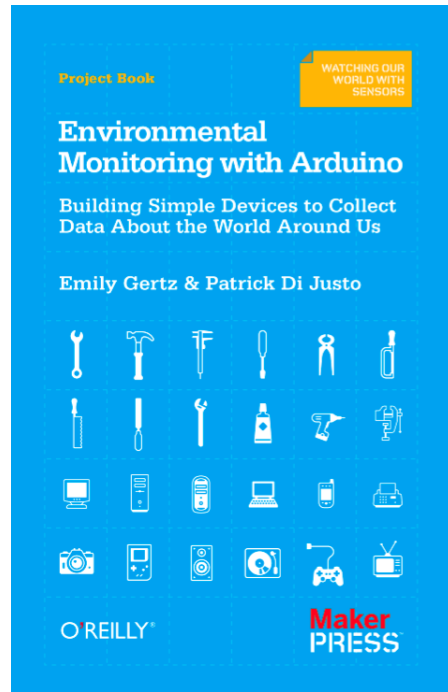
Citizen Sense

Investigating Environmental Sensing Technologies and Citizen Engagement

Democratizing environmental data

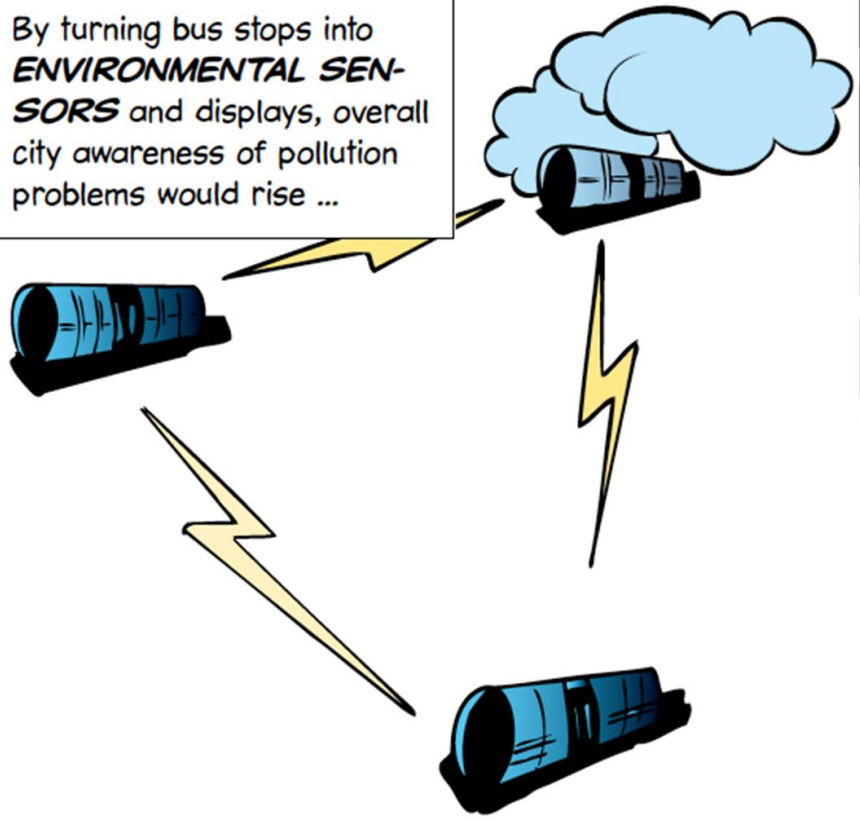
Practices of monitoring and sensing environments have migrated to everyday participatory applications, where users of smart phones and networked devices are able to engage with modes of environmental observation and data collection. Yet how effective are these practices of citizen sensing in not just providing “crowd-sourced” data sets, but also in giving rise to new modes of environmental awareness and practice?



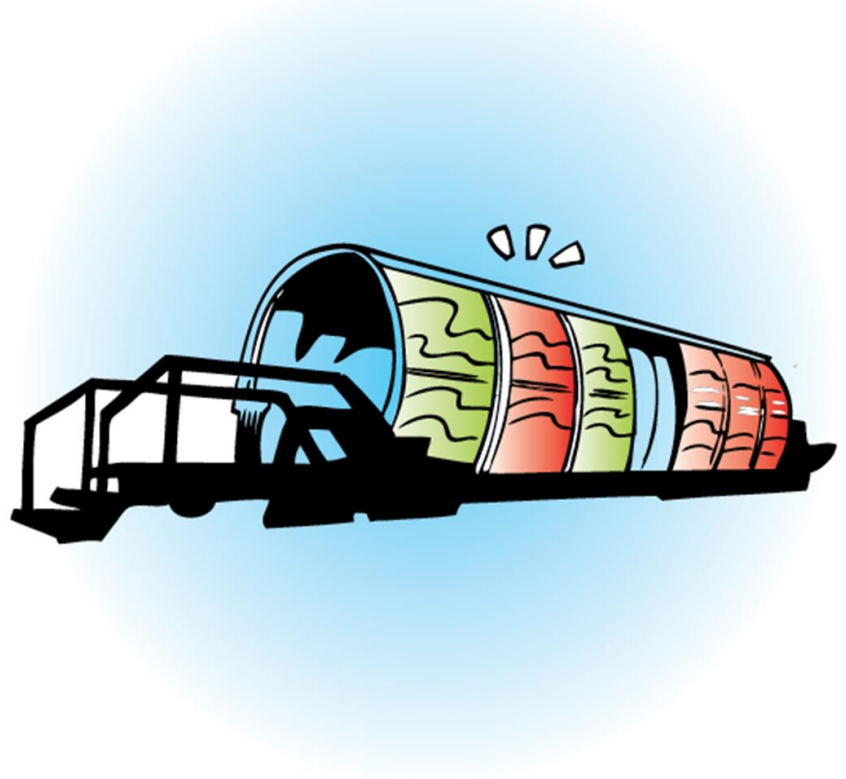


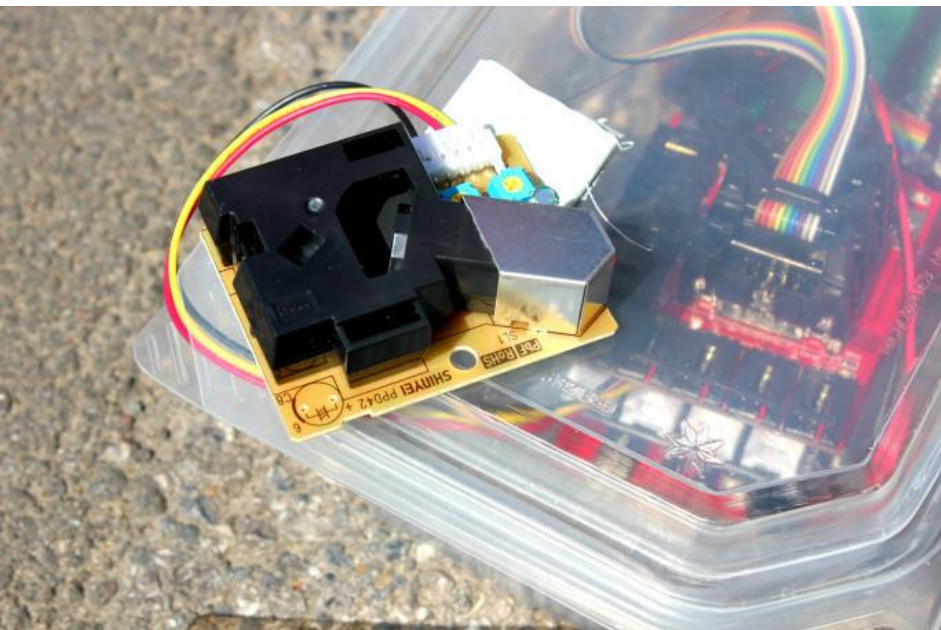
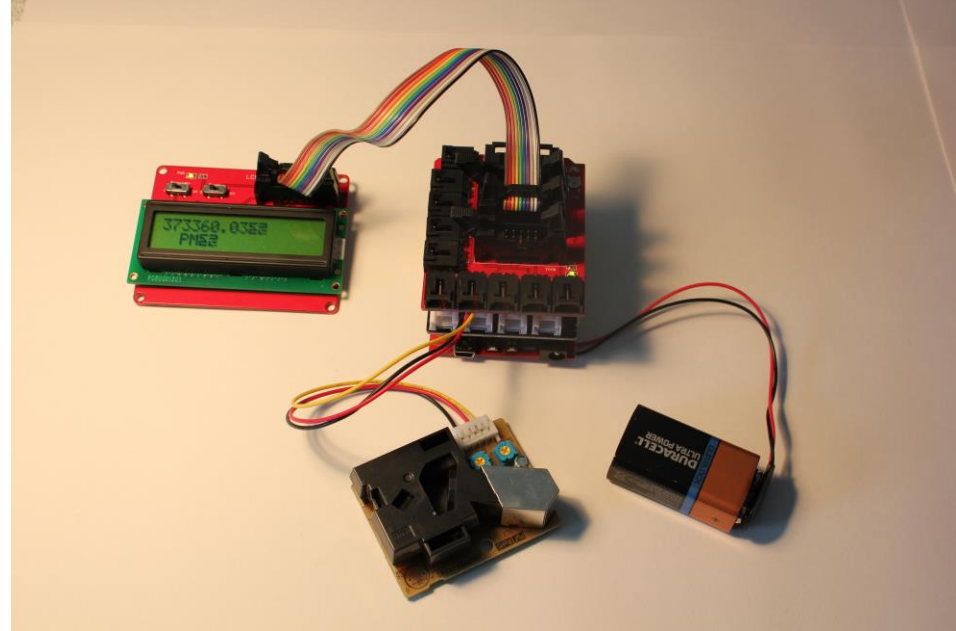
ENVIRONMENTAL MONITORING ARDUINO KIT / WORKSHOP
TOM IGOE, LONDON CYBERSCIENCE SUMMIT (2012)

By turning bus stops into **ENVIRONMENTAL SENSORS** and displays, overall city awareness of pollution problems would rise ...



... and Curitiba's mobility system could become the envy of the world!





POLLUTION APP AND PROTOTYPE SENSING KIT
CITIZEN SENSE (2013-2014)



AIR QUALITY EGG
CITIZEN SENSE (2013)



POLLUTION SENSING WORKSHOP WITH SPECK
CITIZEN SENSE (2014)



Checking on the Frackbox at Dimock

Which direction is $PM_{2.5}$ coming from?

Wind direction has a considerable influence on pollution measurements. A sensor will only record emissions from a particular source or activity if the wind blows it from the source towards the sensor. Therefore, we can investigate where a source of pollution is likely to be located by plotting wind direction against pollution concentrations.

Just good enough data: Figuring data citizenships through air pollution sensing and data stories

Big Data & Society
July–December 2016: 1–14
© The Author(s) 2016
DOI: 10.1177/2053951716679677
bds.sagepub.com
SAGE

Jennifer Gabrys¹, Helen Pritchard¹ and Benjamin Barratt²

Abstract

Citizen sensing, or the use of low-cost and accessible digital technologies to monitor environments, has contributed to new types of environmental data and data practices. Through a discussion of participatory research into air pollution sensing with residents of northeastern Pennsylvania concerned about the effects of hydraulic fracturing, we examine how new technologies for generating environmental data also give rise to new problems for analysing and making sense of citizen-gathered data. After first outlining the citizen data practices we collaboratively developed with residents for monitoring air quality, we then describe the data stories that we created along with citizens as a method and technique for composing data. We further mobilise the concept of 'just good enough data' to discuss the ways in which citizen data gives rise to alternative ways of creating, valuing and interpreting datasets. We specifically consider how *environmental data* raises different concerns and possibilities in relation to Big Data, which can be distinct from security or social media studies. We then suggest ways in which citizen datasets could generate different practices and interpretive insights that go beyond the usual uses of environmental data for regulation, compliance and modelling to generate expanded data citizenships.

Keywords

Citizen sensing, citizen data, environmental data, data practices, data stories, data citizenships

From Fitbit to the Air Quality Egg, there are an increasing number of devices and practices now available for generating data. Whether monitoring a pulse or capturing the daily patterns of air pollution, users are able to measure, track and analyse environments and health. Yet despite the proliferation of these technologies, the practices and objectives for collecting data are diverse and are oriented toward different monitoring objectives. In this paper, we consider how the rise of citizen sensing, or the use of low-cost and accessible digital technologies to monitor environments, has contributed to new types of environmental data and data practices. Through a discussion of participatory research into air pollution sensing with residents of northeastern Pennsylvania concerned about the effects of hydraulic fracturing, we examine how new technologies for generating environmental data give rise to new problems for analysing and making sense of citizen

We use the term 'citizen data' here to refer to data that citizens generate and gather typically outside the domain of scientific research, using a broad range of monitoring technologies and techniques. We also employ 'citizen data' to refer to the challenging claims that citizens can make with data, which is a key distinction when addressing types of citizen science that are not only referring to amateur accounts, but which are deliberately invoking the political possibilities of this data (cf. Irwin, 1995). In the course of collecting data, multiple questions inevitably emerge about the validity

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URBAN SENSING

Air pollution


Revealed: every Londoner breathing dangerous levels of toxic air particle

Exclusive: Every area of the capital breaches global standards for PM2.5 pollution particles, with most areas exceeding levels by at least 50%

Matthew Taylor
Environment correspondent

Wed 4 Oct 2017 16.31 BST

   14,573 2,152

 This article is over 8 months old



▲ Pollution haze over London seen from the Shard. Mayor Sadiq Khan described the new air pollution findings as 'sickening'. Photograph: Matt Dunham/AP

The scale of London's air pollution crisis was laid bare on Wednesday, with new figures showing that every person in the capital is breathing air that exceeds global guidelines for one of the most dangerous toxic particles.

The research, based on the latest updated London Atmospheric Emissions Inventory, shows that every area in the capital exceeds World Health Organisation (WHO) limits for a damaging type of particle known as PM2.5.





DEPTFORD BRIDGE / NEW CROSS ROAD
CITIZEN SENSE (2017)

THE ATTACK OF THE CRANES



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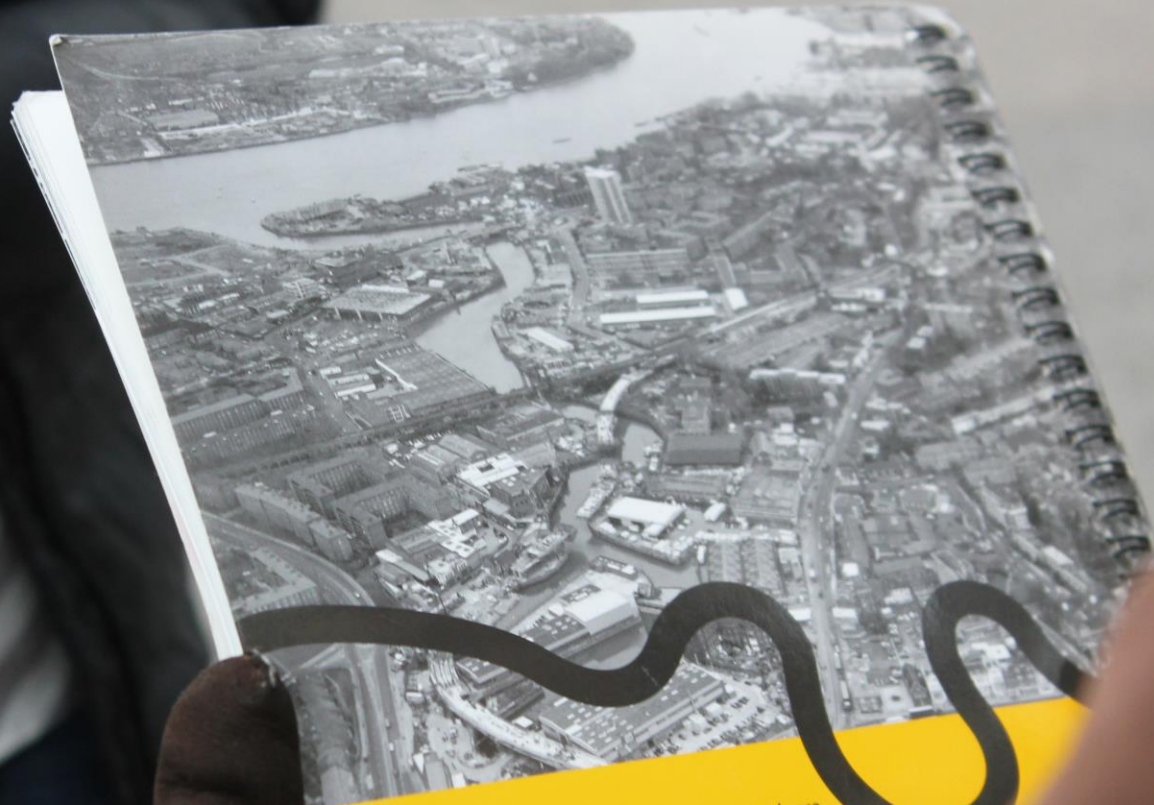
VOICE 4

ACTION WE ARE TAKING WITH YOU!



CREEKSIDE DISCOVERY CENTRE

DEPTFORD REGENERATION
CITIZEN SENSE (2016)



Deptford Creek, a tidal tributary of the river Thames and once a thriving centre of wharves and warehouses, fell into decay 50 years ago. Neglect and disuse protected the remains of the industrial legacy and allowed a great diversity of wildlife to colonise its crumbling walls and rotting timbers. Suddenly in the mid-1990s this forgotten parish became a strategic location, attracting £8.2 million of regeneration funding.

When a recent public meeting asked "what does regeneration mean to you?", most answered "destruction" – of communities and of the environment. The process of renewal described in this book was driven by concern for the loss of the character and assets of this special place.

Over 20 surveys on the area's history, ecology and environment led to a plan for renewal, and nearly three years of debate, consultation and action together to tell the story of Creekside. This book is a celebration of the unique asset we have inherited and how we can regenerate it and influence the future of the area.



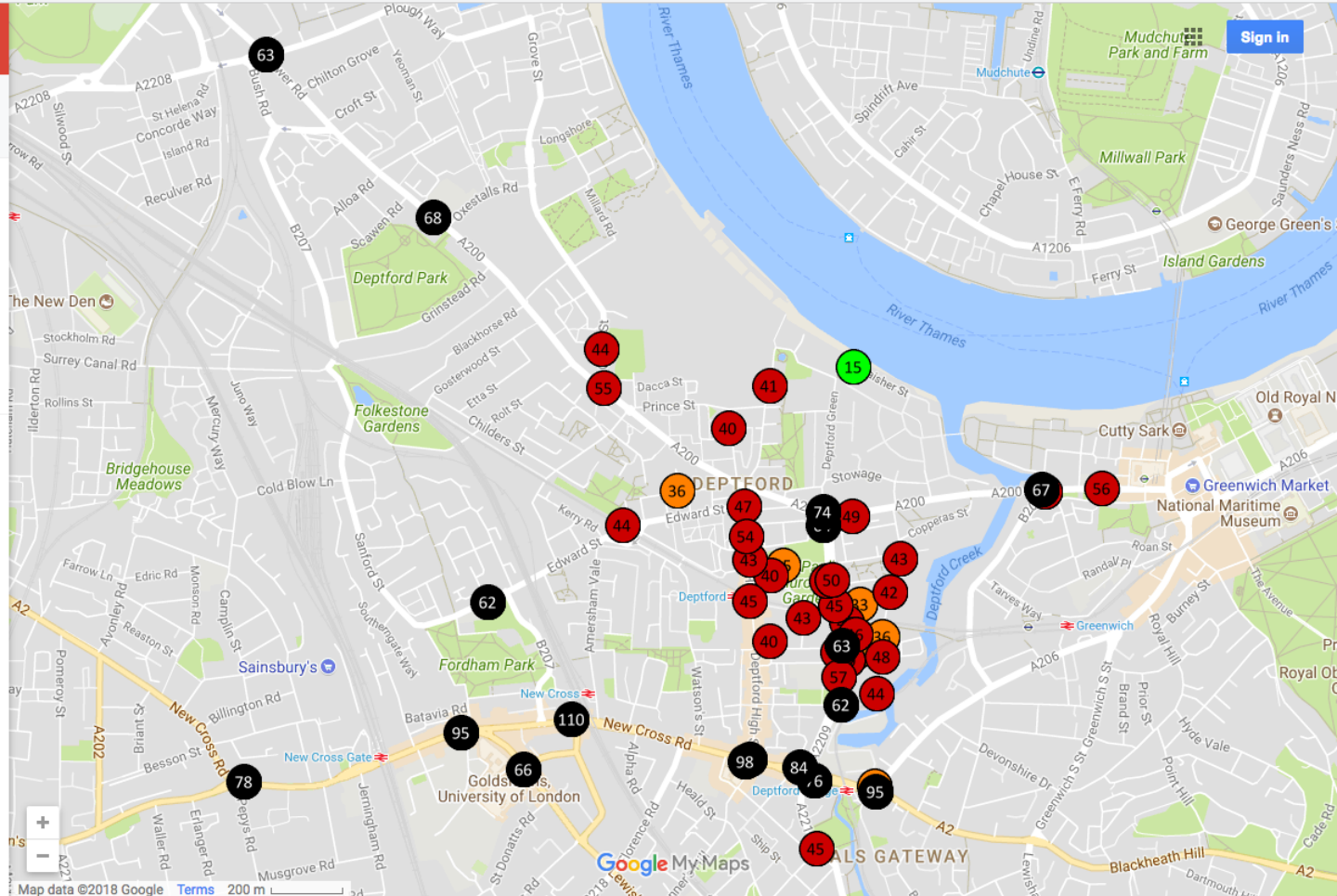
DIFFUSION TUBE MONITORING, THAMES TIDEWAY TUNNEL
DON'T DUMP ON DEPTFORD'S HEART (2013-2014)

Don't Dump on Deptfor...

972 views
SHARE

Untitled layer

- DPD019 - 15 ug/m3
- DPD002 - 33 ug/m3
- DPD018 - 35 ug/m3
- DPD021 - 36 ug/m3
- ... 48 more



Made with Google My Maps

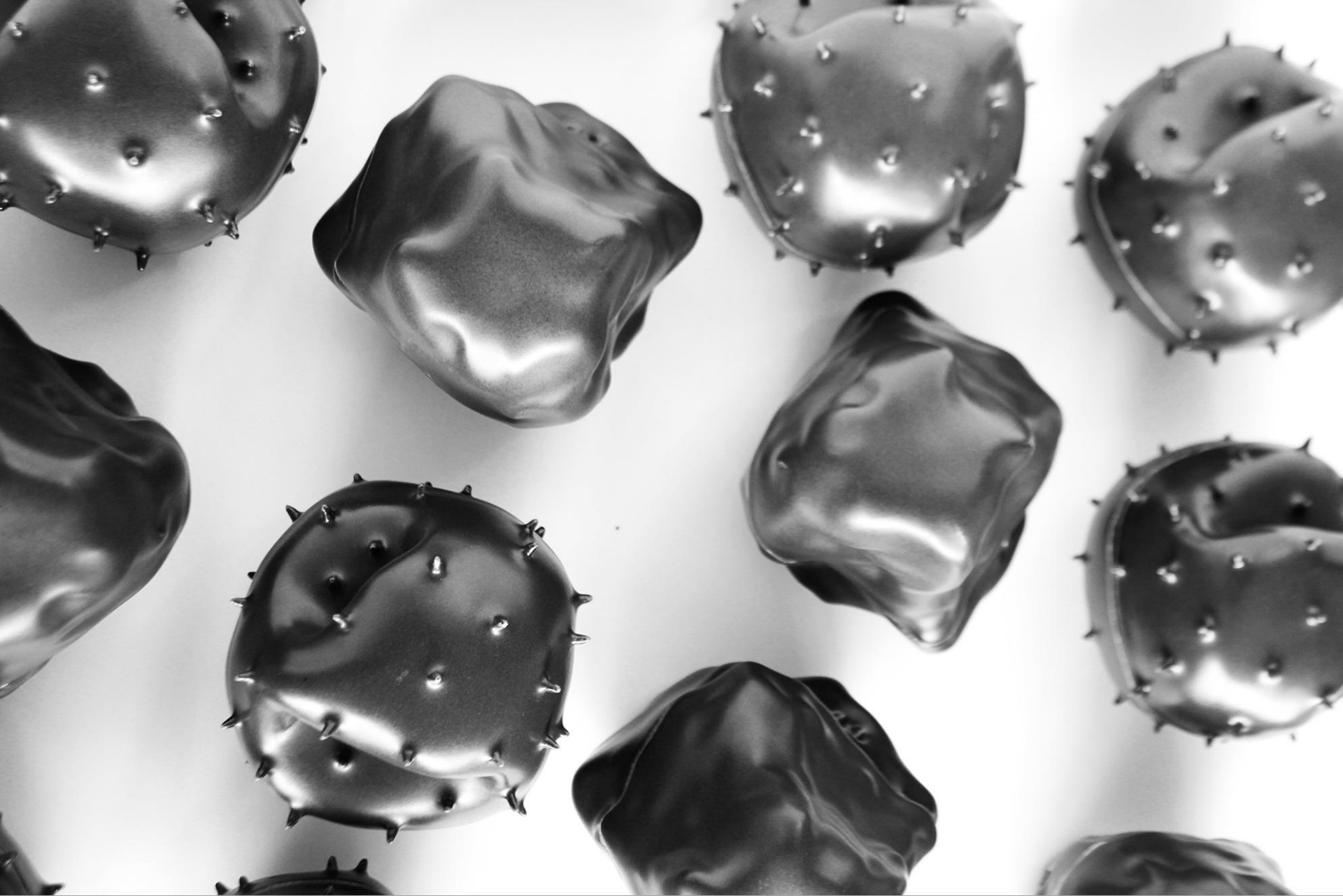
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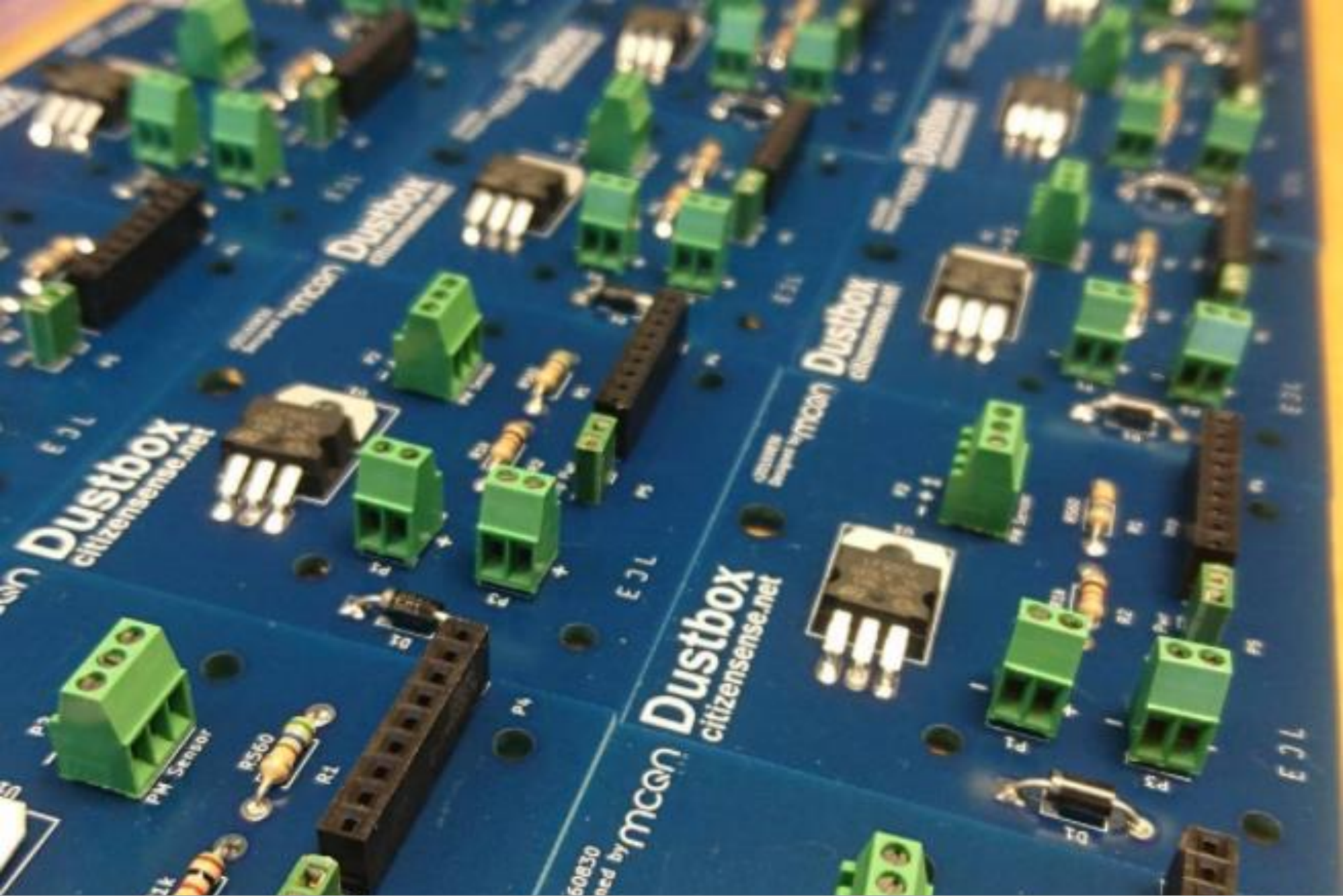


Our
Neighbourhood
Plans

DEPTFORD OLD TIDEMILL GARDEN
CITIZEN SENSE (2016)

DUSTBOX SENSING

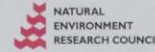




DUSTBOX PCB
CITIZEN SENSE AND ADRIAN MCEWEN (2016)



DUSTBOX CALIBRATION
CITIZEN SENSE (2016)



Marylebone Road Urban Atmospheric Observatory

This monitoring station measures a wide range of gaseous and particulate air pollution concentrations. It also records meteorological data.

These measurements are used to help understand people's exposure to pollution close to roads; to assess the emissions from different vehicles; and to help understand the influence of the weather on air quality.

Measurements made here can be found at:

www.londonair.org.uk

<http://uk-air.defra.gov.uk/>

Please do not obstruct the door

Emergency contact number 0207 848 4022





DUSTBOX CALIBRATION
CITIZEN SENSE (2016)

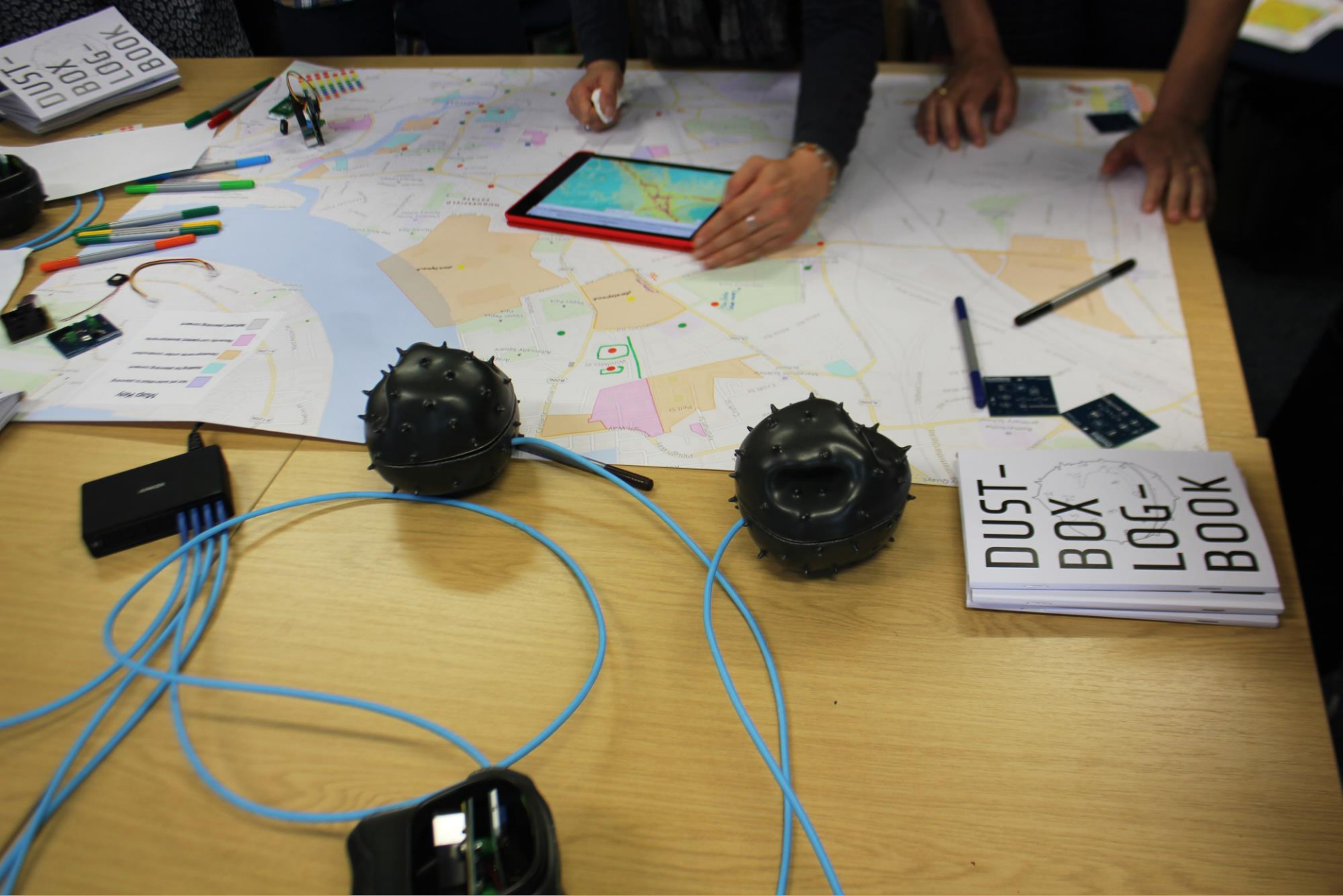


DUSTBOX CALIBRATION
CITIZEN SENSE (2016)

WORKSHOP AND WALK



DEPTFORD LOUNGE
CITIZEN SENSE (2016)







URBAN SENSING WORKSHOP
CITIZEN SENSE (2016)







DUSTBOX SETUP

Small white card with text, partially visible on the left edge of the image.



DUST-BOX-LOG-BOOK



DUSTBOX SETUP
CITIZEN SENSE (2016)

OBS- ERVA- TIONS



VISIBLE POLLUTION

Visual signs of pollution might include haze, dust, smog, debris both suspended and settling on surfaces and buildings. Note date and time of day, together with location:



DUSTBOX SETUP
CITIZEN SENSE (2017)



DUSTBOX SETUP
CITIZEN SENSE (2016)



DUSTBOX SETUP
CITIZEN SENSE (2016)

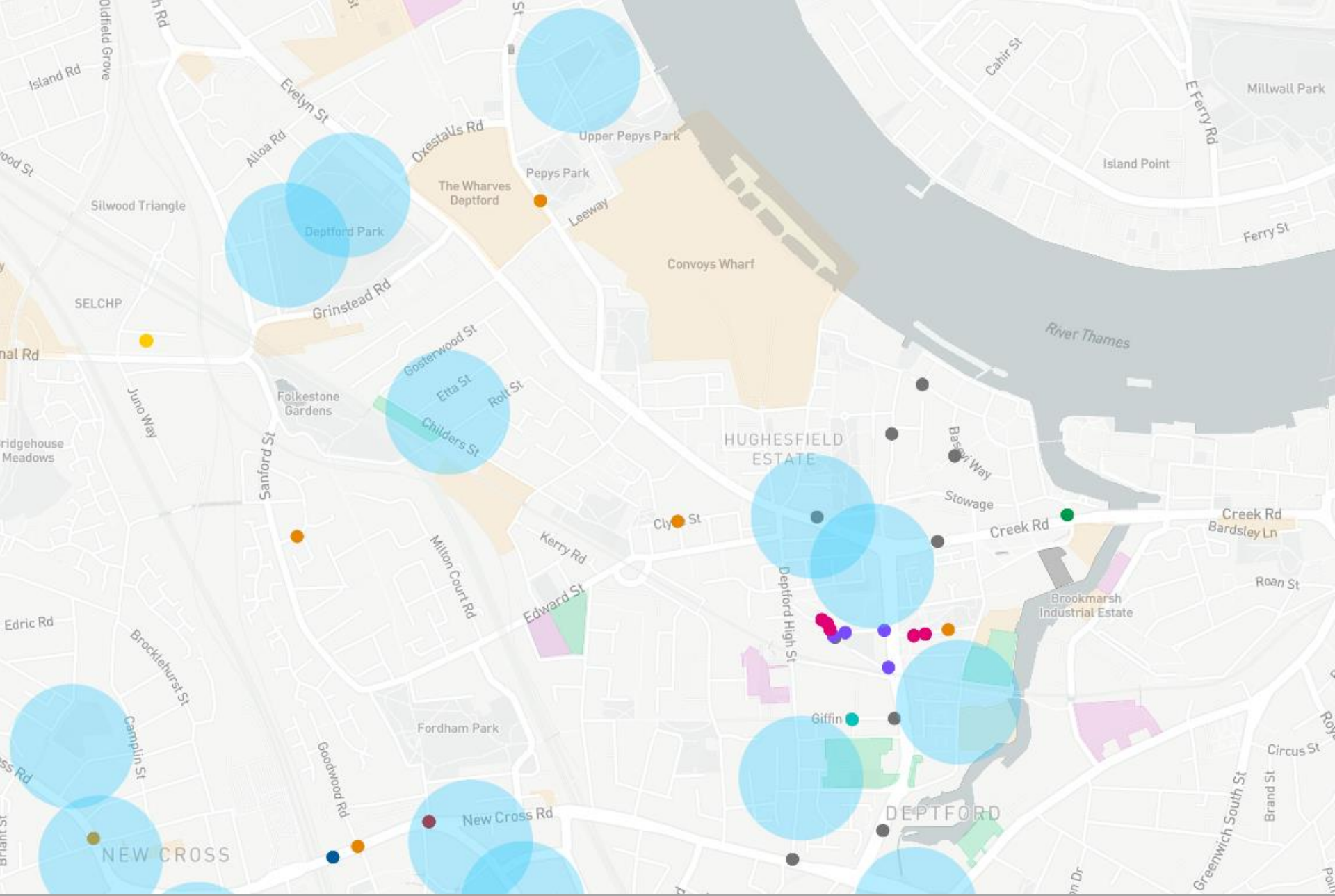


DUSTBOX SETUP
CITIZEN SENSE (2017)



DUSTBOX AT BESSON ST GARDENS
CITIZEN SENSE (2017)

DEPTFORD DATA STORIES

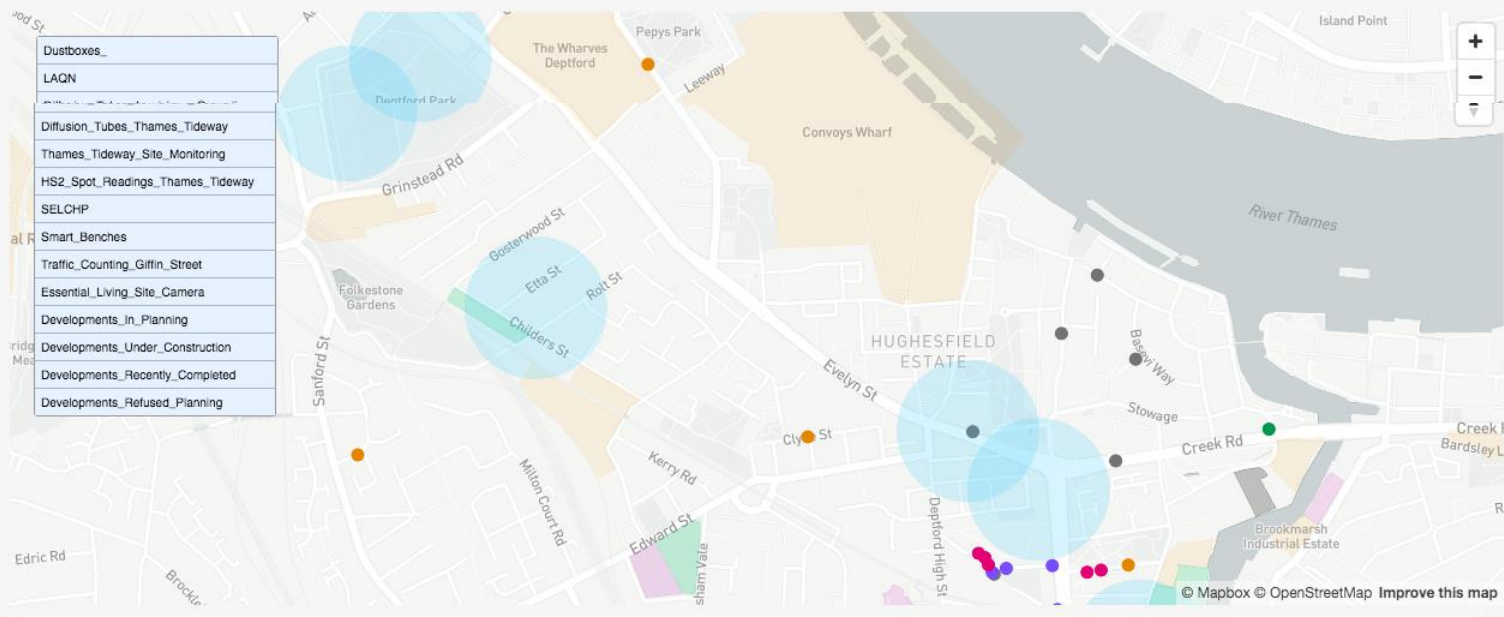


AIRSIFT DUSTBOX MAP
CITIZEN SENSE (2016)

Airsift Dustbox Data Analysis

This Citizen Sense Data Analysis Toolkit makes it possible to analyze and download citizen-generated air-quality data points collected in Deptford and surrounding neighborhoods in South London, UK. You can use this data analysis toolkit to explore Dustbox data, create plots and identify air pollution problems.

The Citizen Sense Airsift Data Analysis Toolkit searches citizen-gathered $PM_{2.5}$ datapoints from [Dustboxes](#), and at times can take up to 5 minutes to plot a graph. You can track the progress of the query at the top of the page. Read the toolkit's instructions [here](#)



Data Stories: Deptford

From late October 2016 to early September 2017, the Citizen Sense research project collaborated with residents of southeast London to develop a citizen-led air-quality monitoring project. Residents in this area were particularly concerned about air quality levels in relation to road transport and construction, and had already begun to undertake community activities for monitoring environmental pollutants.





Pepys

by CITIZEN SENSE

The Pepys area includes high-rise and low-rise residential housing, numerous construction sites and busy roads. Pepys is adjacent to the River Thames

Citizen Sense

Chapters Menu

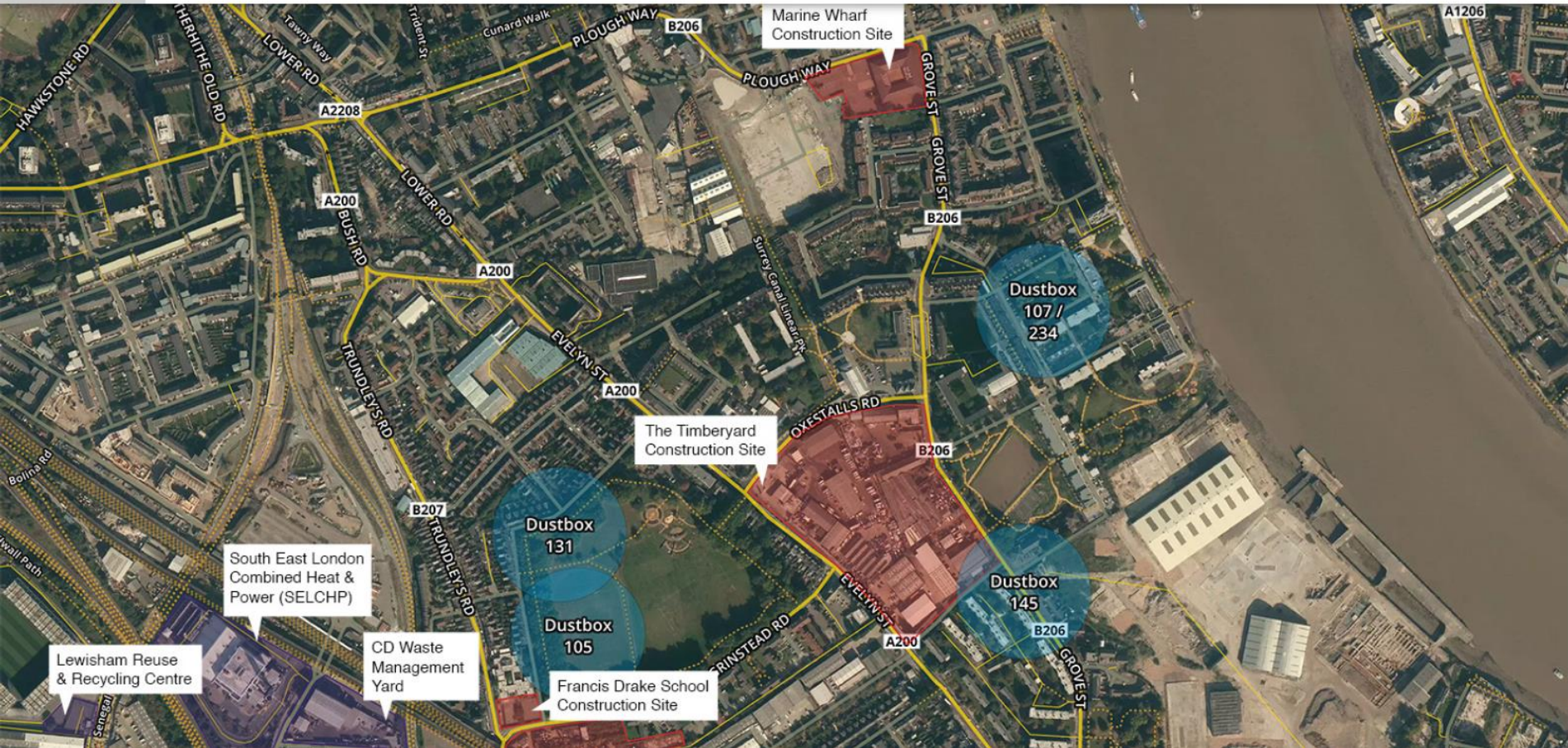


Figure 1: Dustboxes 107/234 and 145. Line graph of 24-hour mean PM_{2.5} concentrations during a pollution event in February 2017 (units: µg/m³).

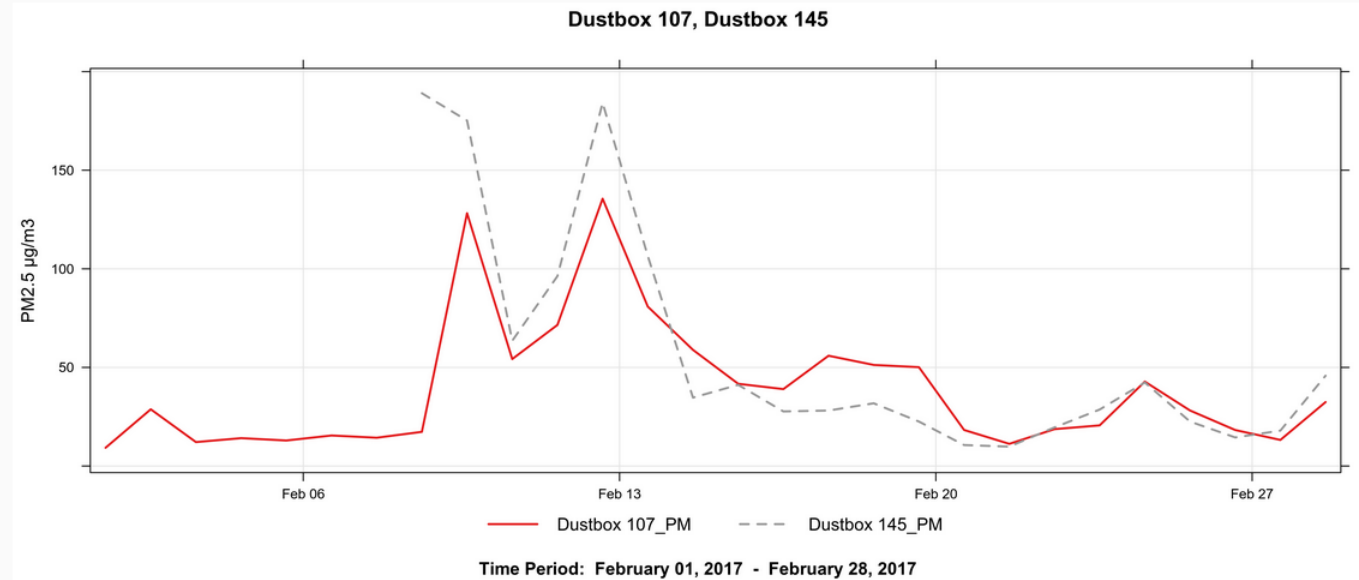


Figure 1 shows daily mean concentrations of PM_{2.5} during an acute pollution episode in February 2017. Two peaks show high levels of PM_{2.5}, that clearly breach the WHO 24-hour mean guideline.

There are many possible sources of pollution in the area, and we have to look at the measurements more closely to see if we can deduce which

Citizen Sense

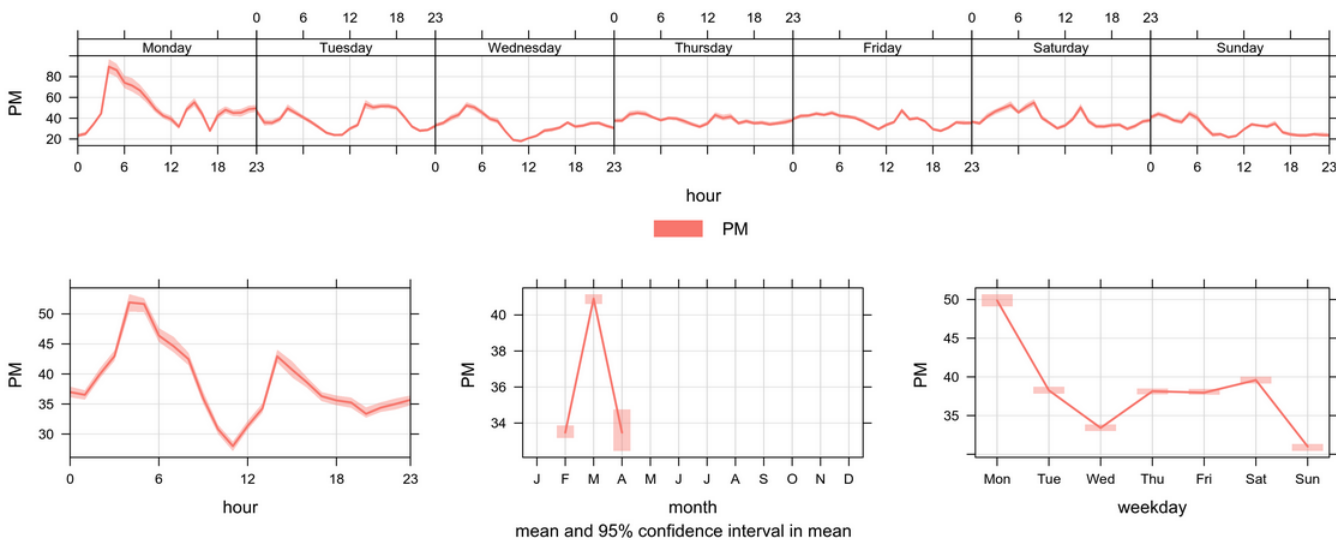


Figure 4: Dustbox 107/234. Time plot showing mean PM2.5 concentrations grouped by hour, month and weekday from 14 February to 1 April 2017 (units: µg/m3).

In Figure 4, Dustbox 107/234 levels are highest at approximately 5 am, which could reflect a morning rush hour peak due to deliveries and construction crews. However, the lowest levels of particulates are registered around 11 am rather than during the night, something that requires further investigation. Additionally it appears that these high levels are more pronounced on Mondays.

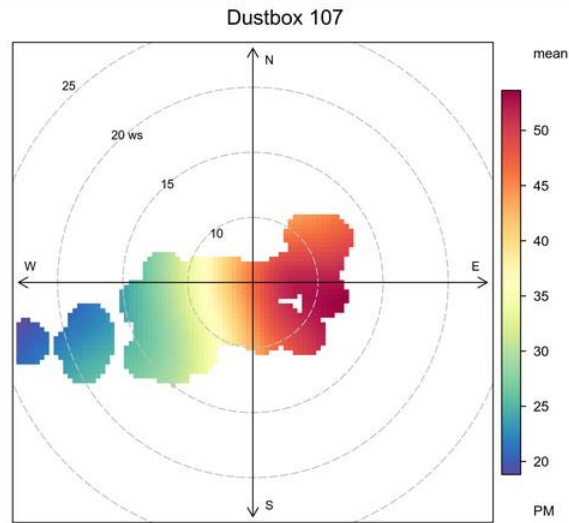


Figure 7: Polar plot showing mean PM2.5 concentrations during different wind conditions at the monitoring location for Dustbox 107/234 from 14 February to 1 April 2017. The mean concentrations shown here are relative, e.g., for Dustbox 107/234 the highest mean concentration is approximately 50 $\mu\text{g}/\text{m}^3$ and for Dustbox 145 below it is approximately 65 $\mu\text{g}/\text{m}^3$. Emissions levels are displayed on polar plots according to a gradient of low to high pollution levels. The colour coding refers to a different range of readings in each plot.

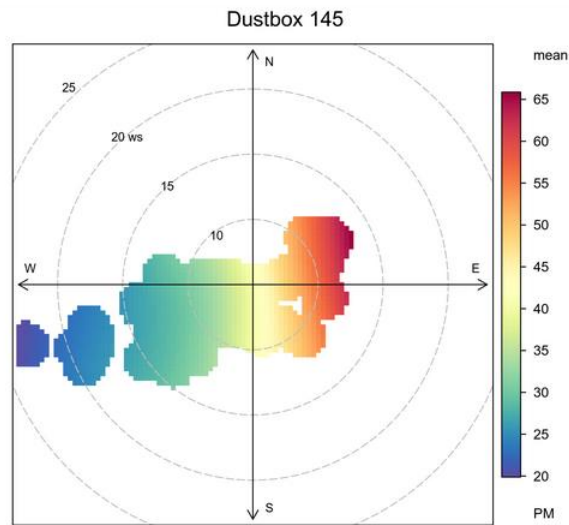
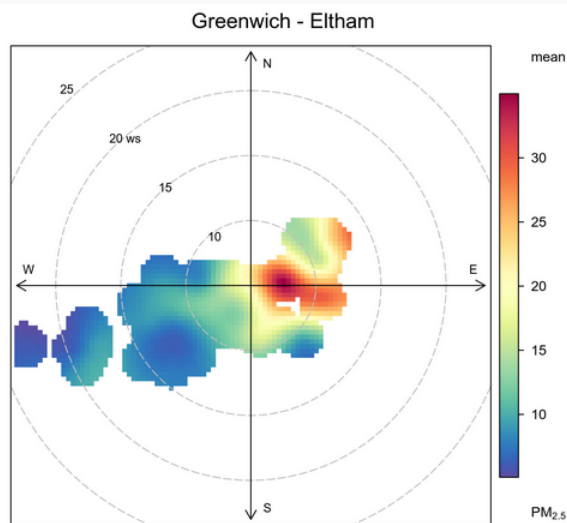


Figure 8: Polar plot showing mean PM2.5 concentrations during different wind conditions at the monitoring location for Dustbox 145 from 14 February to 1 April 2017.

Time Period: February 14, 2017 - April 01, 2017

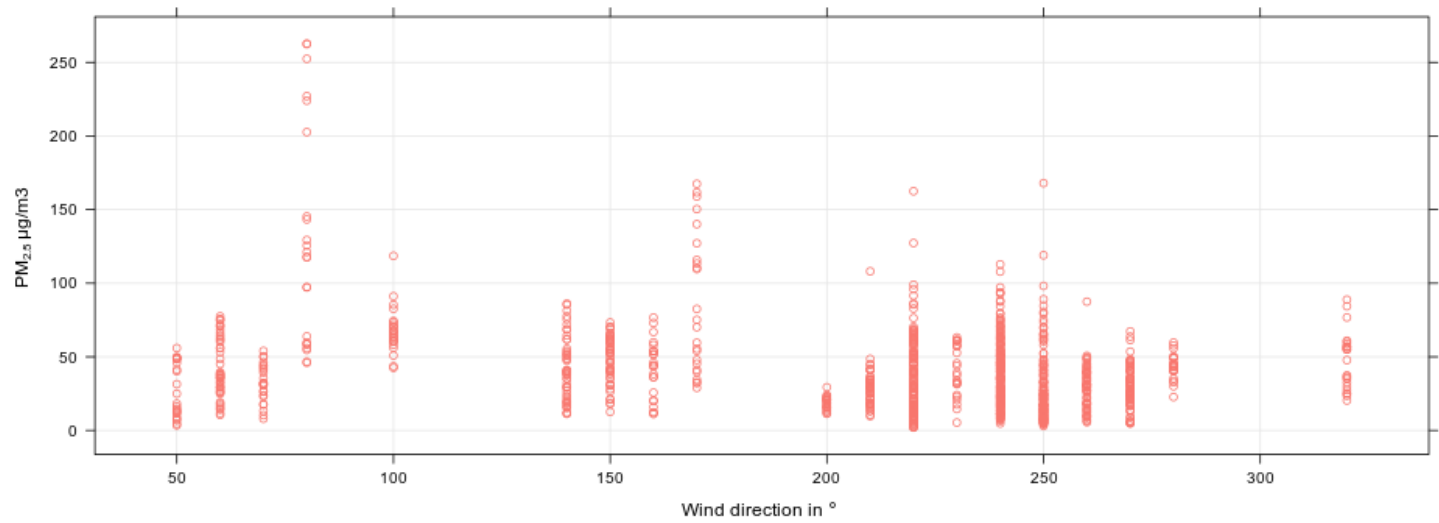


Time Period: February 14, 2017 - April 01, 2017

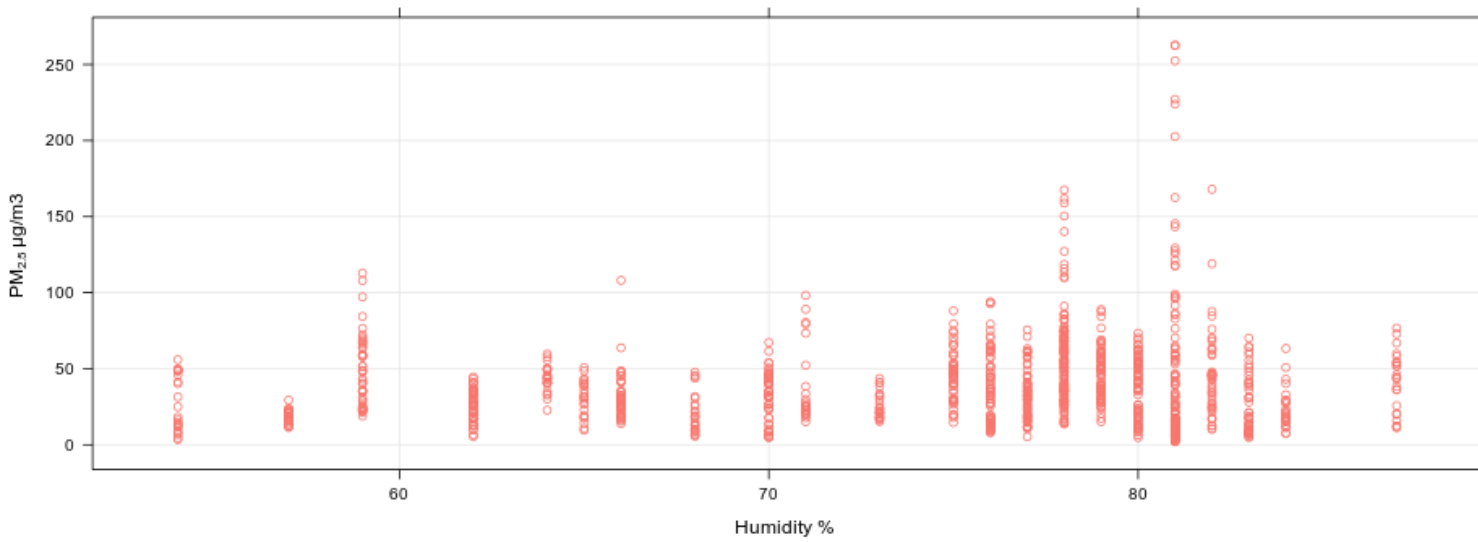
Figure 9: Polar plot showing mean PM_{2.5} concentrations during different wind conditions at the monitoring location for the LAQN Greenwich Eltham monitoring station from 14 February to 1 April 2017.

The polar plot in **Figure 9** is provided as a comparison with Dustboxes 107/234 and 145 to indicate that while there is an easterly source of emissions at a regional level, levels at the two Dustboxes are higher than the regional levels at this urban background site. This suggests that there are additional local sources at the Dustbox 107/234 and 145 locations.

Dustbox 107



Time Period: February 14, 2017 - April 01, 2017

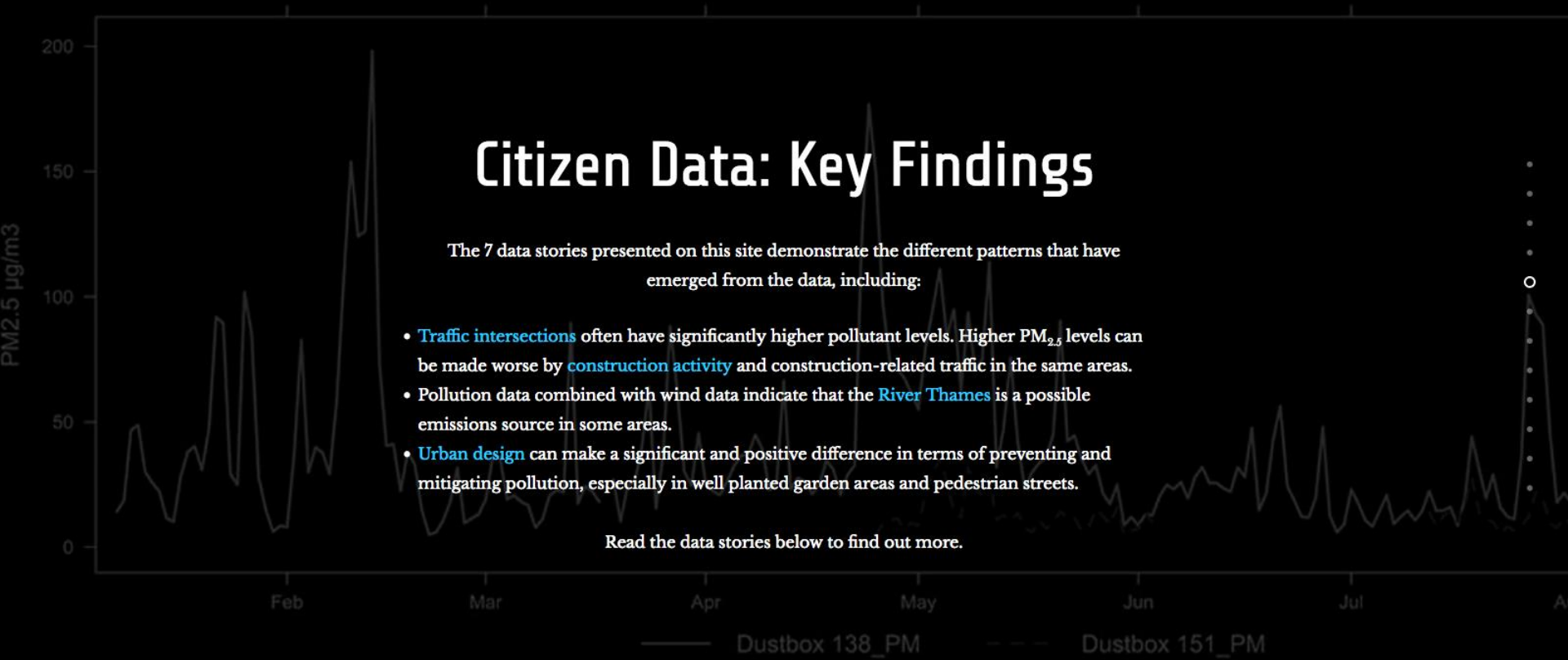


Time Period: February 14, 2017 - April 01, 2017

Citizen Sense

Chapters Menu





V. Actions

In relation to the evidence and findings from the Dustbox citizen monitoring study, preliminary actions are proposed here that take into account the neighbourhood context and existing community organisations and initiatives. The key areas for addressing air pollution include transport, construction, green infrastructure, and additional monitoring. These actions have been developed in consultation with monitoring participants and local area residents. Some actions are shared across the 7 data stories, while others are specific to this data story location:

Traffic and transport

Construction and development

Green infrastructure

- Require an audit of green spaces in the borough, including an assessment of the suitability of green space as green infrastructure in relation to air pollution mitigation, and in relation to improving walkability and cycleability. Using existing [London tree mapping resources](#), develop a tree plan for planting in the borough, and in relation to best guidance for trees suitable for minimising and lowering air pollution.
- Plant trees and preserve green spaces in relation to air quality guidance for vegetation.

Air quality monitoring

News › London

'It's time to act now', say researchers who found pollution at six times world safety limit in Deptford and New Cross

BEN MORGAN | Tuesday 14 November 2017 11:55 | 4 comments



Like Click to follow The Evening Standard



Polluted: Parts of London have been shown to have sky-high levels of particulate matter (Getty Images)

The level of toxic particles in parts of south-east London is six times higher than world limits, research revealed today.

Dozens of volunteers, directed by Goldsmiths University's Citizen Sense group, were given Dustbox devices to measure levels of Particulate Matter 2.5 in the air in **New Cross** and **Deptford**.

The microscopic particle has been linked to a rise in asthma and heart disease.



vickyfoxcroft @vickyfoxcroft

Following

Research from @GoldsmithsUoL found that air pollution in South East London is up to *six times* higher than @WHO limit. I called for a debate on this urgent public health matter.



1:01 3,363 views

12:09 PM - 7 Dec 2017

81 Retweets 136 Likes



11 81 136



About the project

Photo: Malcolm Smyth

What's happening?

- reducing traffic on local streets
- new crossings and continuous footways to prioritise pedestrians at side roads and reduce danger from traffic
- new cycle parking, seating, trees and street lighting for the area.

Before we progress the proposals any further we want views on the area from the people that know it best, *you*.

Why?

Deptford's population is growing fast but currently suffers from significant deprivation, communities cut-off by dangerous roads and railway lines, poor air quality, and childhood obesity. We want to tackle these issues by creating safe places to walk and cycle, reducing the amount of cars on the roads as well as creating attractive places to sit and relax.

Help us Save Reginald House and Tidemill Wildlife garden

by Save Reginald! Save Tidemill!

420 Shares



22

days to go

£12,868

pledged of £16,000 stretch target by 159 people



Pledge now

This case is raising funds for its stretch target.



BE A PROMOTER

Your share on Facebook could raise £26 for the case

Human rights Lawyers: Richard Buxton London, United Kingdom

We need your support to expose how the Council is going against it's own environmental, housing, human rights, equality and air pollution policies, how they have abused the planning process to push the plans through, and the sham nature of their consultation process. And to force them to redraw these plans in partnership with the community, via a transparent and collaborative process.

Our solicitor is Richard Buxton, an environmental and public law lawyer who is also concerned about social housing and social justice - he recently saved saved Lewisham's Croft Street Trees.

AIRKIT

PROOF OF CONCEPT



CORDIS

Community Research and Development Information Service

European Commission > CORDIS > Projects and Results > Citizen Sense Air Monitoring Kit

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AirKit

Project ID: 779921

Funded under: [H2020-EU.1.1. - EXCELLENT SCIENCE - European Research Council \(ERC\)](#)

Citizen Sense Air Monitoring Kit

From 2018-07-01 **to** 2019-12-31, ongoing project

Project details

Total cost: EUR 150 000	Topic(s): ERC-2017-PoC - ERC-Proof of Concept
EU contribution: EUR 150 000	Call for proposal: ERC-2017-PoC See other projects for this call
Coordinated in: United Kingdom	Funding scheme: ERC-POC - Proof of Concept Grant

Objective

In January 2013, the five-year ERC funded project Citizen Sense was launched, investigating the role of low-cost and digital monitoring technologies in facilitating and organising new types of environmental engagement. This proposal brings together a comprehensive citizen-sensing toolkit for users to undertake air quality monitoring that realises the social and environmental potential of these technologies. With the benefit of five years of intensive and cutting-edge research...



Host Institution

GOLDSMITHS' COLLEGE
LEWISHAM WAY
SE14 6NW LONDON
United Kingdom

United Kingdom

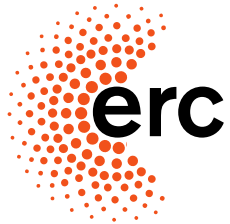
EU contribution: EUR 150 000

A photograph of a network patch panel with several blue cables plugged into it. The cables are bundled together and extend across a light-colored tiled floor. A white sign with black text and a small diagram is placed on the floor in the foreground. The sign reads "DUST-BOX LOG-BOOK" and features a small circular diagram with a jagged edge and some internal lines. The cables are plugged into a black patch panel in the bottom right corner of the image.

DUST-
BOX
LOG-
BOOK

THANK YOU

CITIZEN SENSING AND ENVIRONMENTAL PRACTICE (313347)
European Research Council (ERC) Starting Grant
Prof Jennifer Gabrys (PI), with Helen Pritchard and Lara Houston



European Research Council

Established by the European Commission

Citizen Sense

Goldsmiths

UNIVERSITY OF LONDON

Thanks are due to participating residents and community groups in Southeast London (Deptford Folk, Deptford Neighbourhood Action, Voice for Deptford, Pepys Estate, Crossfields Estate, New Cross Gate Trust, APT Gallery), as well as consultants including Dr Benjamin Barratt and Khadija Jabeen (atmospheric science), Lau Thiam Kok (data architecture), Raphael Faeh (web design), Sarah Garcin (graphic design), Francesca Perrona (materials design), and Adrian McEwen (electronics design).

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