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Challenges of measuring PM_{2.5} in the next decade

26th October 2022



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Five challenges of measuring PM_{2.5} in the next decade

26th October 2022

 **Clean Air
Programme**
www.cleanair.org



100 years of air pollution measurement networks

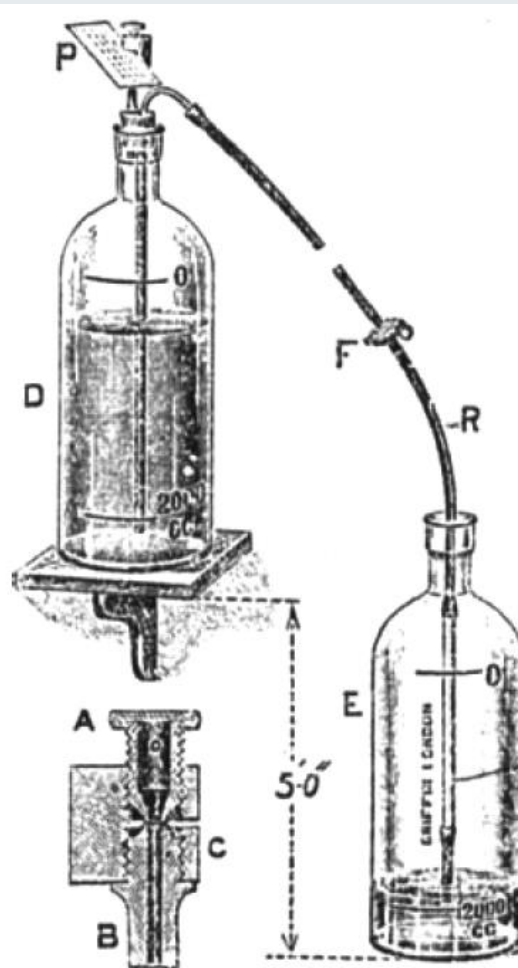
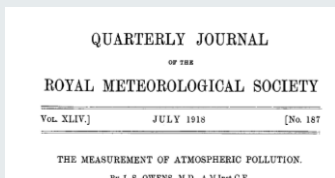
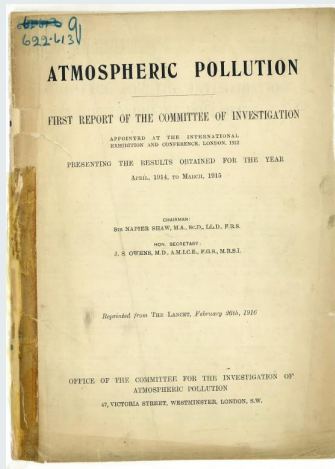


FIG. 2.—Standard Filter.

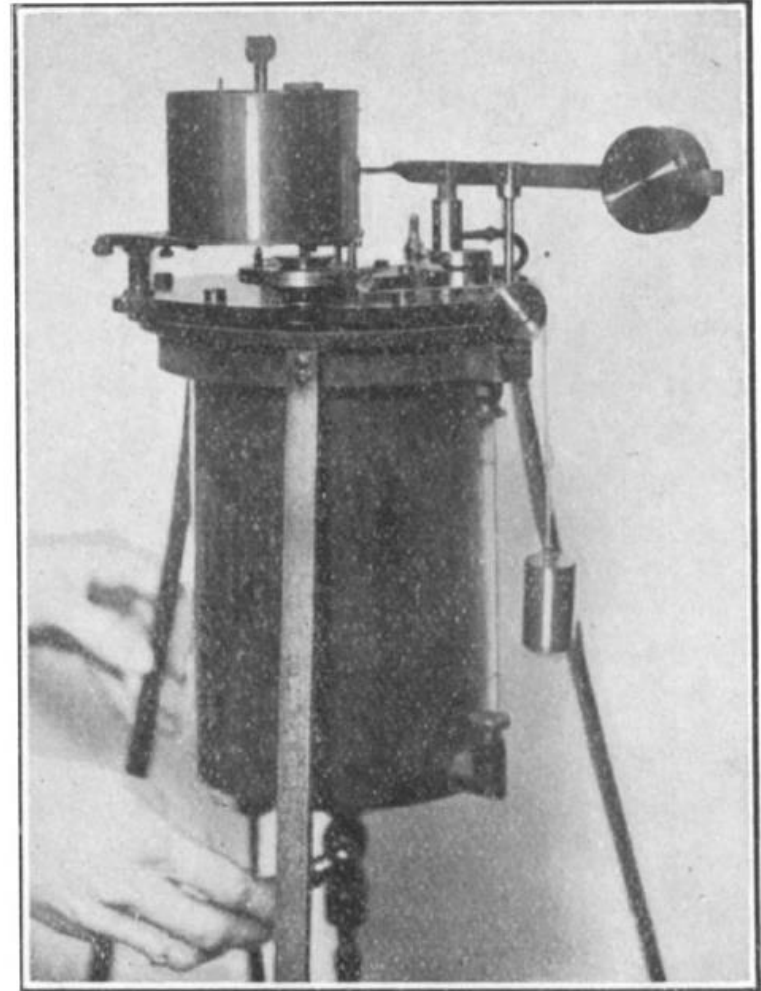
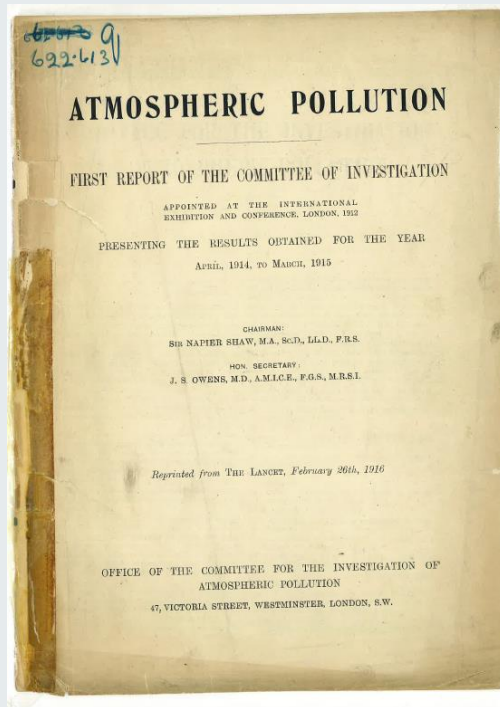


Fig. 2.

100 years of air pollution measurement networks



2

OWENS: MEASURING THE SMOKE POLLUTION OF CITY AIR

Measuring the Smoke Pollution of City Air.

By J. S. OWENS, M.D., A.M.I.C.E.

(Advisory Committee on Atmospheric Pollution.)

(Read at the Meeting, December 2, 1925.)

THE SMOKE PROBLEM OF GREAT CITIES

SIR NAPIER SHAW,
LL.D., SC.D., F.R.S.
AND
JOHN SWITZER OWENS,
M.D., A.M.I.C.E.

LONDON:
CONSTABLE & COMPANY LTD.
10 & 12 ORANGE STREET LONDON W.C.2
1925

QUARTERLY JOURNAL

OF THE

ROYAL METEOROLOGICAL SOCIETY

VOL. XLIV.]

JULY 1918

[No. 187

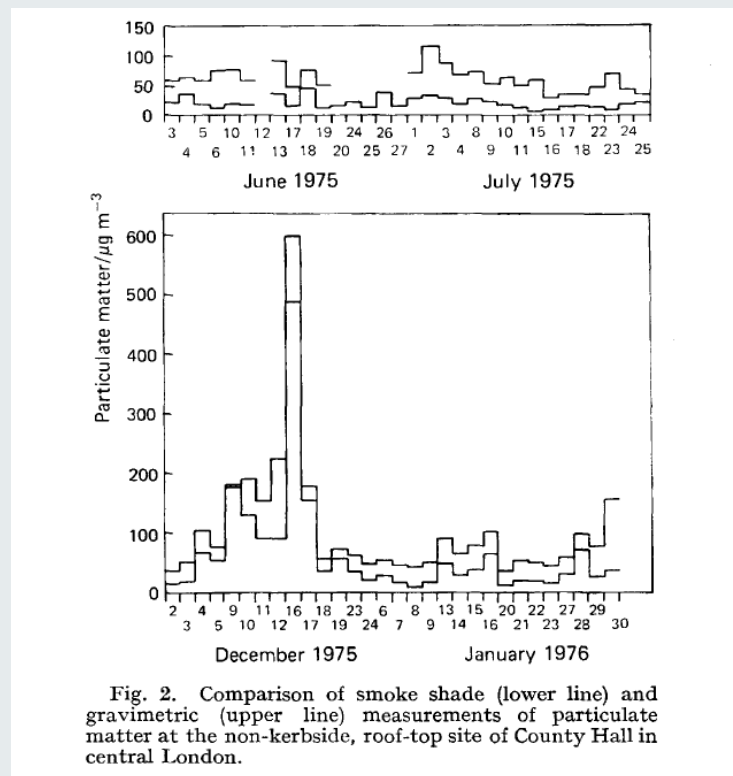
THE MEASUREMENT OF ATMOSPHERIC POLLUTION.

By J. S. OWENS, M.D., A.M.Inst.C.E.



“John Switzer Owensmore than any other person defined the transformation of air pollution science from the haphazard investigations of Victorian gentlemen into a systematic national surveillance programme.”

Challenge #1 - changing PM composition

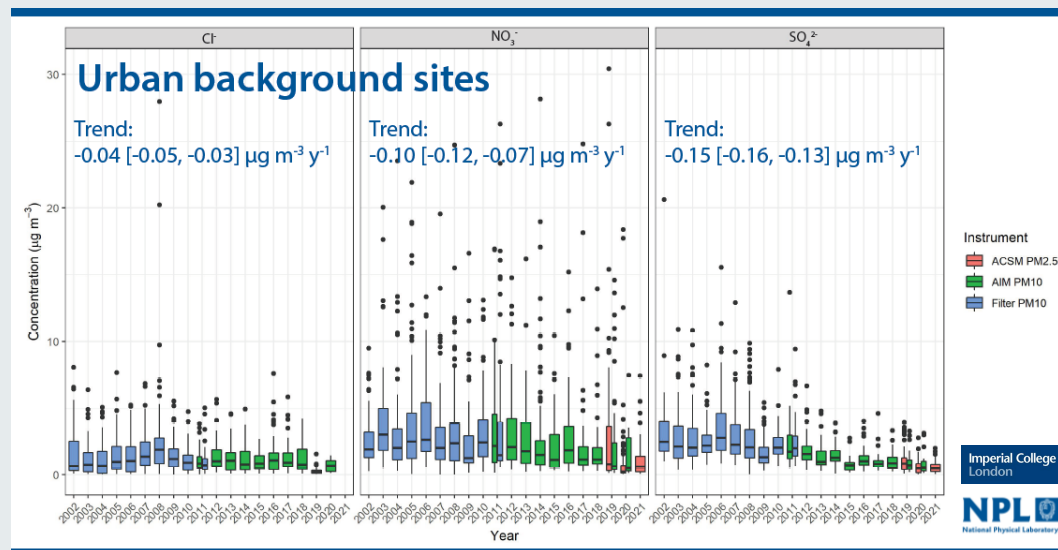


The following is the summary of a paper presented at a Joint Meeting of the Atomic Spectroscopy and Particle Size Analysis Groups held on November 30th, 1976, at the Geological Society, Burlington House, London.

Some Measurements of Atmospheric Pollution by Aerosols in an Urban Environment

D. J. Ball

Environmental Sciences Group, Scientific Branch, Greater London Council, County Hall, London, SE1 7PB



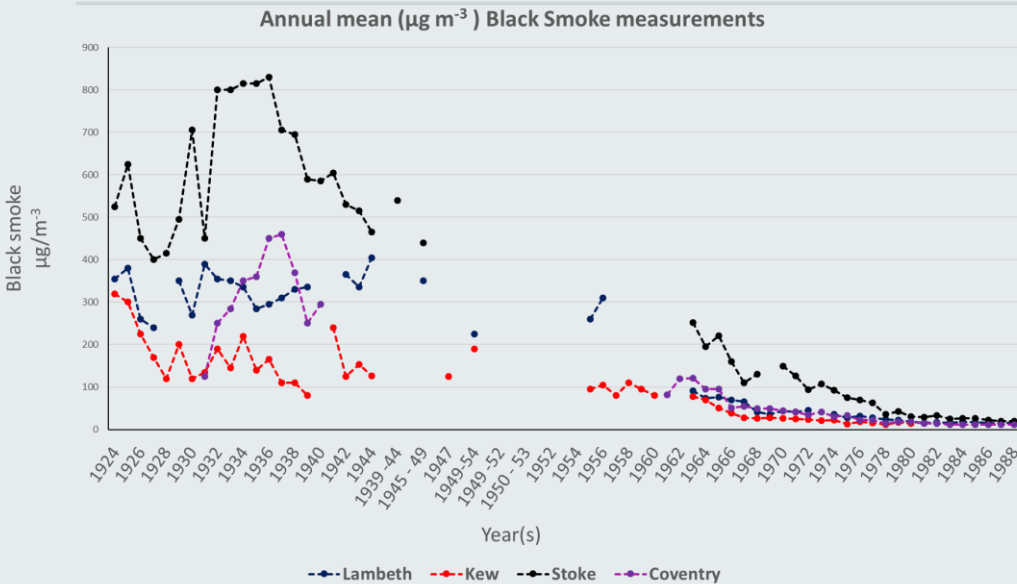
Brown et al 2022

Changes in PM composition can create measurement challenges.

Through the 20th Century PM changed to be less dominated by coal smoke.

In the 21st century our PM is becoming more volatile.

Challenge # 2 - lower concentrations

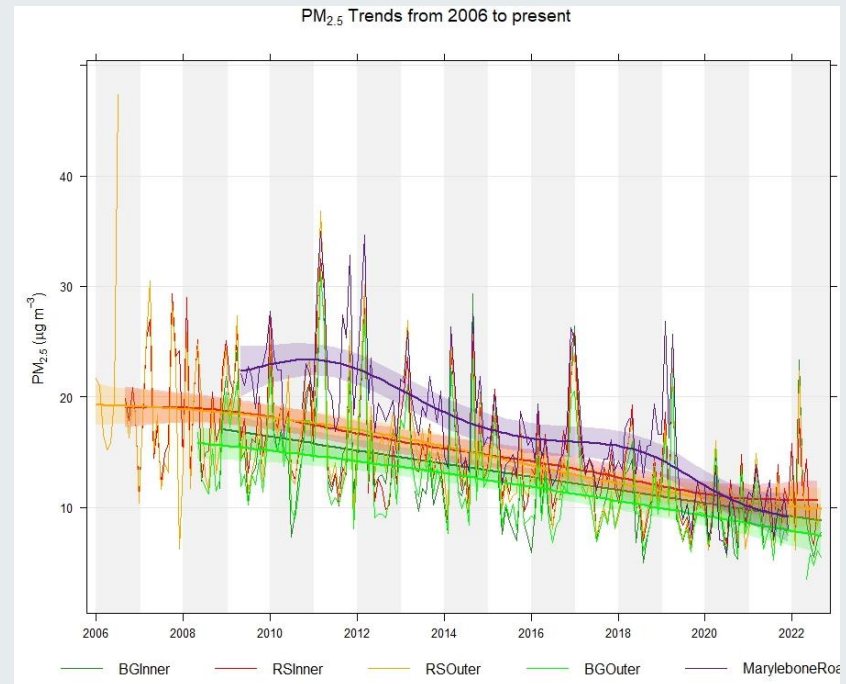


From a health perspective this is good news...

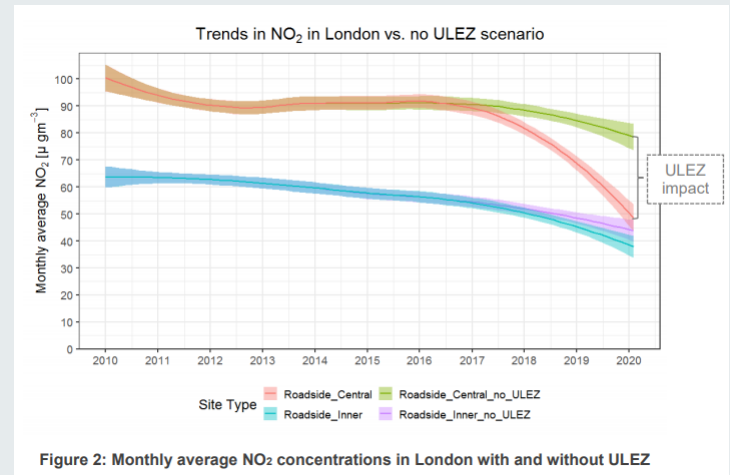
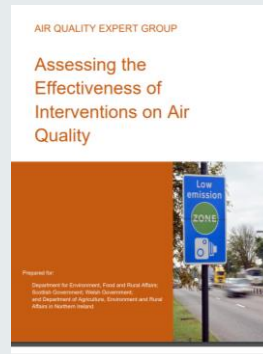
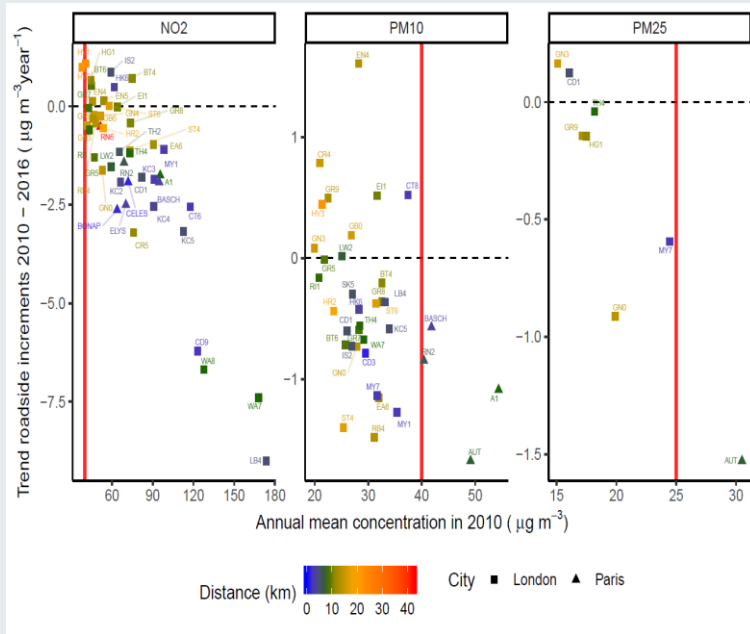
Lower concentrations are approaching measurement uncertainty.

Painting: Claude Monet. London. The Waterloo Bridge. 1903. Oil on canvas. The Carnegie Institute, Museum of Art, Pittsburgh, USA.

Data: Pam Davy and historic reports from Advisory Committee on Air Pollution etc. Louise Mittal and www.londonair.org.uk



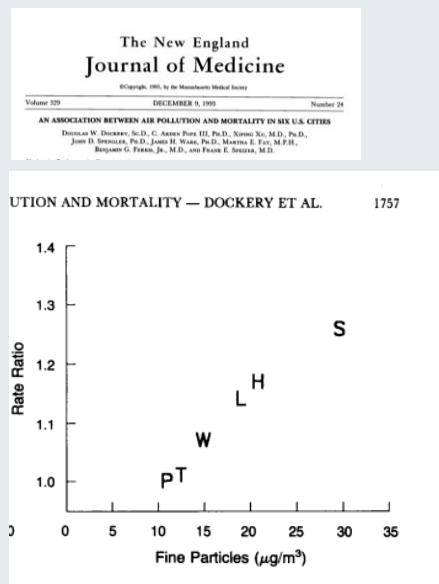
Challenge #3 - long-term measurements - interventions



Most interventions affect air pollution over the longer-term

We cannot continue to focus on quantifying uncertainty relative to short term limit values – we need to quantify instrument performance over years.

Challenge #4 - long-term measurements - health



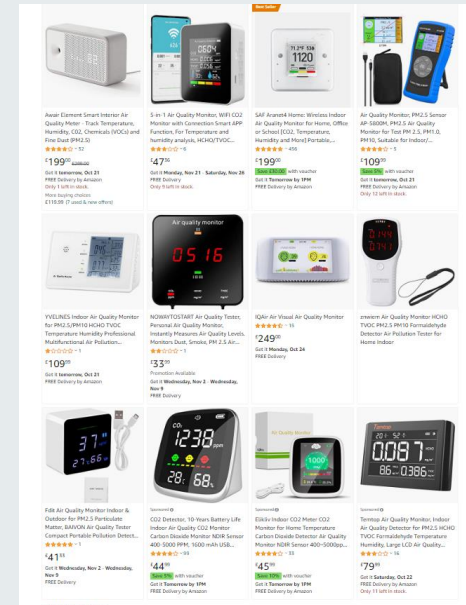
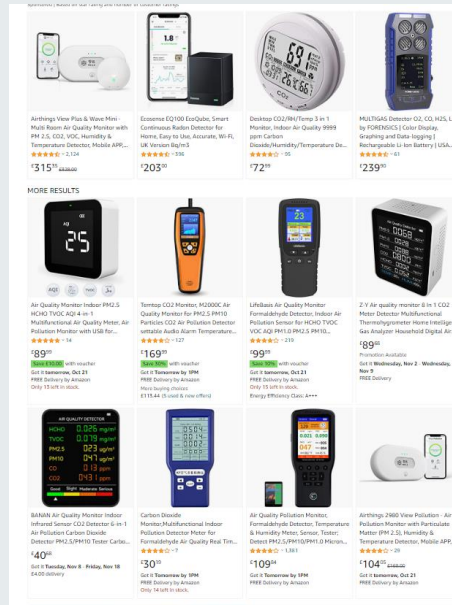
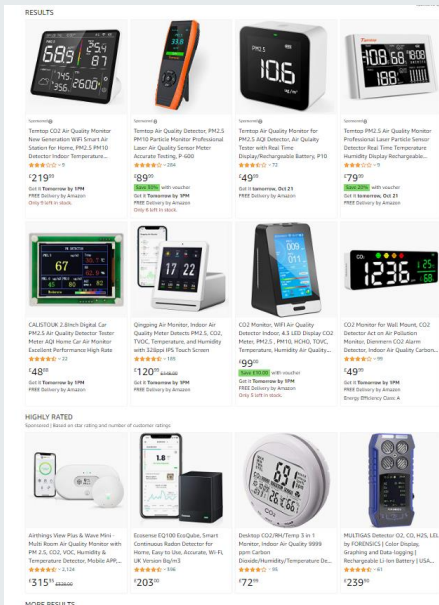
70 years ago the 1952 London smog – short term exposure (days) and mortality and morbidity

29 years ago six cities – mortality and long-term exposure (years).

Today – emerging evidence of life course impacts from exposure over days, years and decades.

We cannot continue to focus on quantifying uncertainty relative to short term limit values – we need to quantify instrument performance over years and set up calibration systems that are consistent over decades.

Challenge # 5 - Small sensors and hybrid measurement systems



An amazon search for “air pollution monitor” 20th Oct 2022 – above is just the tip of the iceberg!

How good are these instruments and how should I use them?

How can we harness and support citizen science and low cost measurement?

Challenge # 5 - Small sensors and hybrid measurement systems

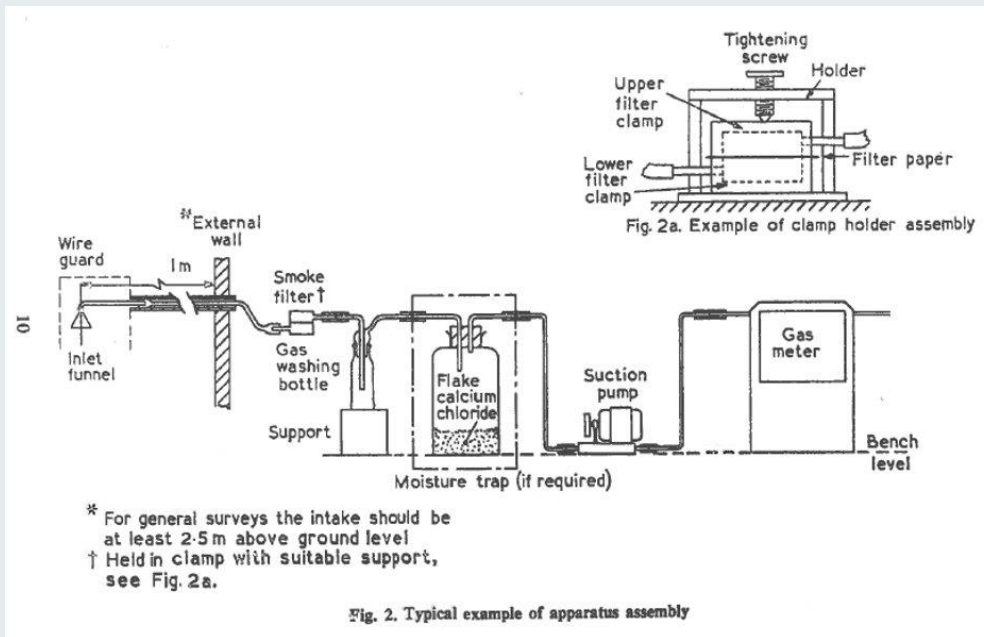
QUANT: Quantification of Utility of Atmospheric Network Technologies

9th February 2021

Share this

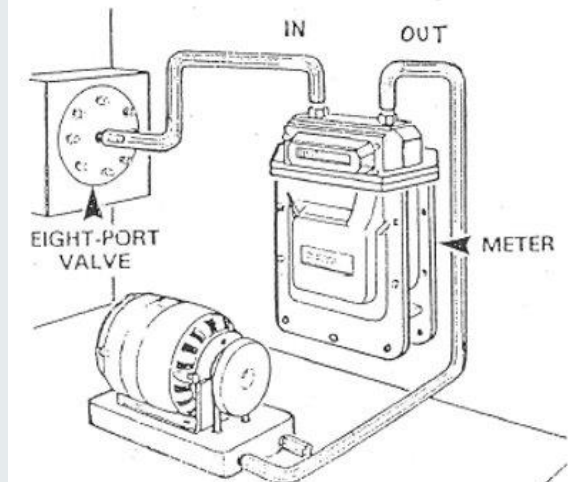
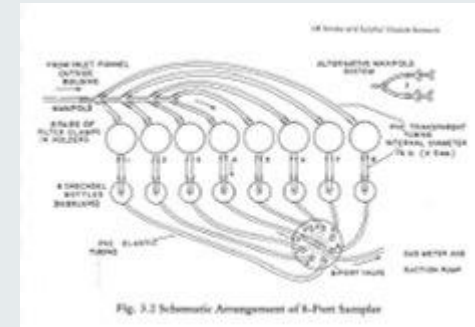


Challenge # 5 - Small sensors and hybrid measurement systems



Instruction Manual:
 UK Smoke and Sulphur Dioxide
 Network

August 1999



Challenge # 5 - Small sensors and hybrid measurement systems

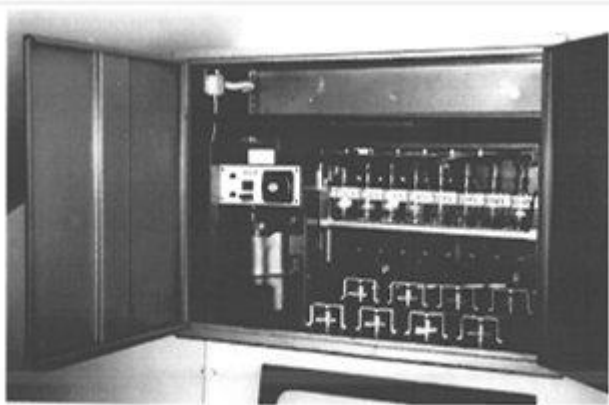


Fig. 3.1d Eccodata 8-Port Sampler
(Reproduced with permission of Kirklees MBC)

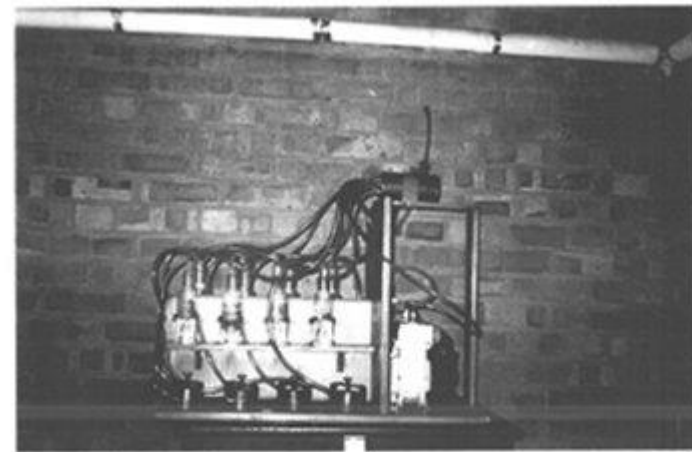
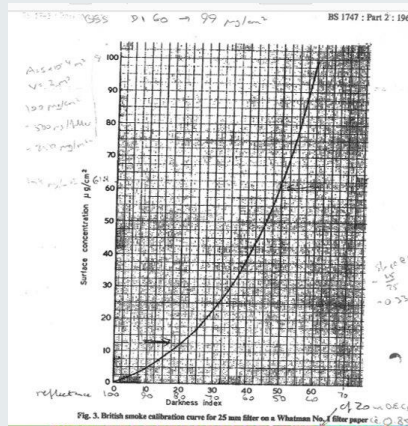


Fig. 3.1e Example of an 8-Port Sampler Constructed from Component Parts
(Reproduced with permission of Walsall MBC)



Challenge # 5 - Small sensors and hybrid measurement systems



Challenges of measuring PM_{2.5} in the next decade

In the 21st century our PM is becoming more volatile.

Lower concentrations are approaching measurement uncertainty.

We cannot continue to focus on quantifying uncertainty relative to short term limit values – we need to quantify instrument performance over years.

How can we harness and support citizen science and low cost measurement?

How do we test hybrid instruments that only fully function as part of network?

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