



Public Health  
England

Protecting and improving the nation's health

# **Environmental Public Health Tracking in England**

## **Report on recent activities**

December 2018

## About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. We do this through world-leading science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

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# Foreword

Dr David Rhodes, Director of Environmental Public Health

Professor Raquel Duarte-Davidson, Head of Chemicals and Environmental Effects Department

Environmental Public Health Tracking (EPHT) involves the ongoing collection, integration, analysis and interpretation of data about environmental hazards, exposure to those hazards and the related the human health effects. PHE's EPHT programme aims to develop comprehensive public health surveillance and environmental health tracking systems for toxic hazards and health effects to provide the essential context for risk assessment. Surveillance of risk factors for disease related to the environment is essential to inform public health interventions targeting a range of both infectious and non-communicable diseases. In an age of increasing complex data and information needs, we need sophisticated information systems to integrate data and provide intelligence about hazards, exposures and diseases.

To this end our EPHT programme is a key function to support the forthcoming PHE Environmental Public Health Strategy. The development of PHE's Environmental Public Health Surveillance System will help to serve information needs of not only PHE staff, but also our stakeholders in the provision of surveillance for environmental public health. We continue to work with our partners both nationally and internationally to develop our programme and ensure we utilise best practice. We also support development of EPHT activities globally, by our involvement in the International Network of Public Health and Environment Tracking (INPHET). This network provides a peer review and support function to measure our activity and develop our projects. We hope you find this report a useful review of current EPHT projects and activities in this field.

# Introduction

## Giovanni Leonardi, Head, Environmental Epidemiology Group

The Chief Medical Officer's 2017 Report on 'Health Impacts of All pollution- what do we know?'<sup>1</sup> stated that prevention of non-communicable disease (NCDs) can be achieved by addressing pollution. The known health effects of chemical and other environmental factors account for between 24% of NCDs globally, 14% in developed countries such as UK, and the plausible overall effect of these factors on the burden of disease is much larger than currently estimated.

There are 2 related agendas: first, of achieving NCD prevention by interventions on the known causal effects of pollutants, and second, of preparing for even further NCD prevention by learning about further causal links including those derived from interaction with nutritional and social factors. Environmental Public Health Tracking (EPHT) is an approach that can contribute to furthering both these agendas.

The first agenda can be supported by public health surveillance as part of a programme that includes governance and policy direction, and related interventions, as well as information systems to monitor and evaluate progress. The second agenda can be supported by public health research as part of a multi-disciplinary programme where for the plausible adverse effects to be documented afresh, an eye is also kept on the choices available for pressing development of activities across all policies that affect health & wellbeing. EPHT can provide a vital component for the success of both agendas.

In supporting prevention interventions, EPHT can propel these to all areas based on recognised evidence regarding air pollution and weather impacts, and several specific chemical effects such as those attributable to metals and asbestos. In supporting research, EPHT can facilitate focus on the value of pursuing one development choice over others across transport, building, agricultural and other sectors. PHE has developed several tools and proof of concept studies illustrating the potential value of the EPHT approach in England. The present report describes several of these developments and urges all readers to remain or become involved, so that NCD prevention can be achieved as fully as possible.

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<sup>1</sup> [www.gov.uk/government/publications/chief-medical-officer-annual-report-2017-health-impacts-of-all-pollution-what-do-we-know](http://www.gov.uk/government/publications/chief-medical-officer-annual-report-2017-health-impacts-of-all-pollution-what-do-we-know)

## Who we are

The Environmental Epidemiology group is part of the Chemicals and Environmental Effects Department, at the Centre for Radiation, Chemical and Environmental Hazards (CRCE), Chilton, Oxfordshire. The team lead the work on Environmental Public Health Tracking (EPHT) in England. The work programme is reviewed regularly by the PHE Environmental Public Health Tracking Board. Delivery of this work is not possible without the support and dedication of other colleagues in PHE and wider stakeholders in the UK and internationally.

The team currently consists of

Giovanni Leonardi- Group Leader

Rebecca Close – Environmental Public Health Scientist (currently on leave)

Helen Crabbe - Senior Epidemiological Scientist

Tayo Owodunni – Project Manager for EPHSS and Tracking

Harriet Gordon Brown - System Development Manager for EPHSS

Tony Fletcher – Consultant Epidemiologist

Rebecca Hams – Field Epidemiology Training Programme Fellow

David Roberts - Field Epidemiology Training Programme Fellow

The team are assisted by Janet Humphreys for administrative support.

The team can be contacted on [epht@phe.gov.uk](mailto:epht@phe.gov.uk)

This document reports on recent EPHT activities in England by PHE. Previous newsletters on EPHT were produced by PHE's predecessor the Health Protection Agency. Copies of these can be found on the Government National Archives webpages.

<http://webarchive.nationalarchives.gov.uk/20140714085639/http://www.hpa.org.uk/ProductsServices/ChemicalsPoisons/EnvironmentalPublicHealthTracking/Newsletters/>

We plan to produce regular reports going forward detailing updates to our projects and development of tracking surveillance in England. Reports will be uploaded to our EPHT webpages: [www.gov.uk/government/publications/environmental-public-health-surveillance-system/environmental-public-health-surveillance-system-ephss](http://www.gov.uk/government/publications/environmental-public-health-surveillance-system/environmental-public-health-surveillance-system-ephss)

# Implementation of the Lead Exposure in Children Surveillance System (LEICSS)

By Dr David J Roberts, Field Epidemiology Training Programme Fellow

## Background

Exposure to lead, even resulting in very low blood concentrations, can result in severe multi-system toxicity. Despite successful primary prevention efforts targeted at reducing the use of lead in paints and fuels, lead concentrations in drinking water and industry emissions; lead is a persistent contaminant, therefore children can still be exposed to lead already in the environment. Timely removal or abatement of the exposure source is the mainstay of case management, and the Lead Poisoning in Children (LPIC) pilot surveillance system (2014-16), a passive laboratory-based system, successfully reduced the interval between laboratory case-detection and case reporting to PHE Health Protection Teams. Surveillance of cases identified by clinicians also offers the only current means of gathering intelligence to guide public health action to prevent further cases of exposure. Therefore, the Environmental Public Health Tracking Board decided to implement LPIC on a permanent footing, and the opportunity was taken to re-configure the system to enable gathering of public health intelligence, in order to meet wider population health aims to reduce the incidence of lead exposure in children.

## System re-configuration and implementation

LPIC has been re-named the Lead Exposure in Children Surveillance System (LEICSS), recognising the new wider aims in terms of reducing exposure at the population level. Coordination of the surveillance system is now based at North East and North Central London Health Protection Team, with epidemiology and system development support from the Environmental Epidemiology Group of the PHE Centre for Radiation Chemical and Environmental Hazards (CRCE), and the Software Development Unit at PHE Colindale. A national steering group including experts in child health, toxicology, environmental hazards, and environmental exposure assessment have overseen system development. Defining sustainable methods for case notification, recording and reporting, and refreshing system governance have been identified as the first priorities. We have also engaged laboratories that already participate in LEICSS, and encouraged new laboratories to join.

## Current impact and way forward

The first LEICSS annual report was published in November 2018, a main finding of which was the wide variation in case notification rates across England, most likely due to variable clinician awareness of children most at risk of lead exposure, variation in laboratory reporting, and of PHE's role in case management and surveillance. The re-configured surveillance system and epidemiology findings were presented at 2 national epidemiology conferences, and at national and regional clinical biochemistry meetings. We intend to take our surveillance findings to national paediatrics bodies such as the Royal College of Paediatrics and Child Health in order to raise awareness of lead exposure in children as a continuing public health issue. Further improvements to the new system are planned. We particularly want to roll out the collation of an enhanced surveillance questionnaire aimed at providing greater intelligence on the sources of lead exposure in children.

### Blood lead concentration ( $\mu\text{mol/L}$ ) of laboratory-detected cases, England 2017 and 2015-2017

Year	Cases with data/total cases	Min.*	Max.	Median	Lower Quartile	Upper Quartile	Mean
2017	38/38	0.48	3.33	0.68	0.52	1.02	0.96
2015-17	90/91	0.48	17.59	0.75	0.55	1.09	1.13

\*Only children with a BLC $\geq$ 0.48 $\mu\text{mol/L}$  were eligible for notification to LEICSS

The report can be accessed here:

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/753020/hpr3918\\_LEICSS\\_2017.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/753020/hpr3918_LEICSS_2017.pdf)

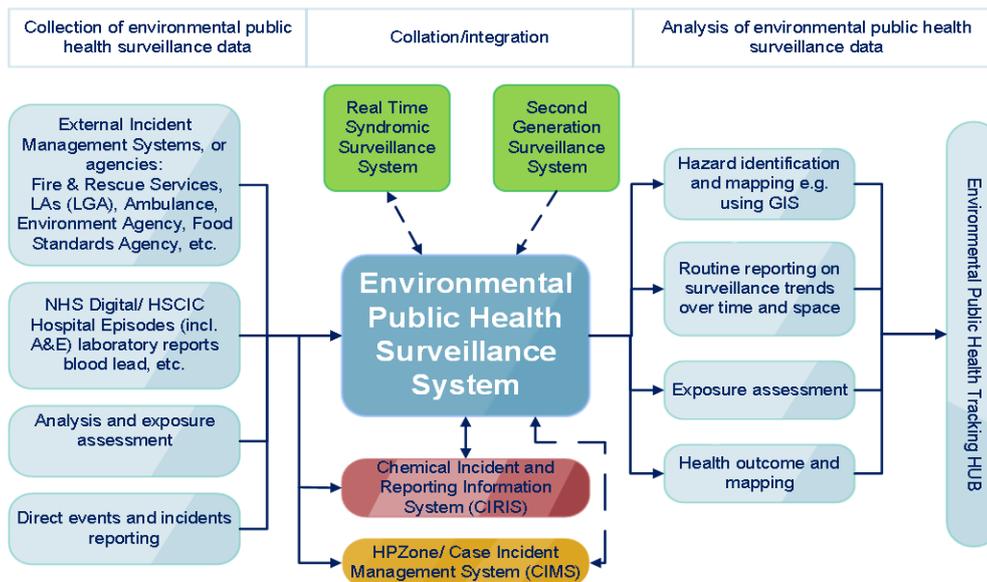
# Development of an Environmental Public Health Surveillance System for England

Tayo Owodunni, Project Manager for EPHSS

Environmental factors are a leading cause of non-communicable diseases (NCDs). Surveillance of environmental exposures is the first step to understanding the burden of acute and chronic environmental effects on health. PHE's Environmental Epidemiology group has led the development of a new, fully functional, web-based surveillance system for chemical and environmental events called the Environmental Public Health Surveillance System (EPHSS).

EPHSS provides a comprehensive surveillance capability that allows PHE and its external partners to interrogate data and intelligence gathered on chemical and environmental hazards and exposures and related health outcomes from a variety of internal and external databases which will support public health practitioners to monitor chemical and environmental risk factors where public health advice and interventions are possible. Data linkages with a few critical databases have been completed. Additional interfaces with other target systems for enhanced data capture from other partnering agencies will be developed in the future.

## Environmental Public Health Surveillance Dataflows

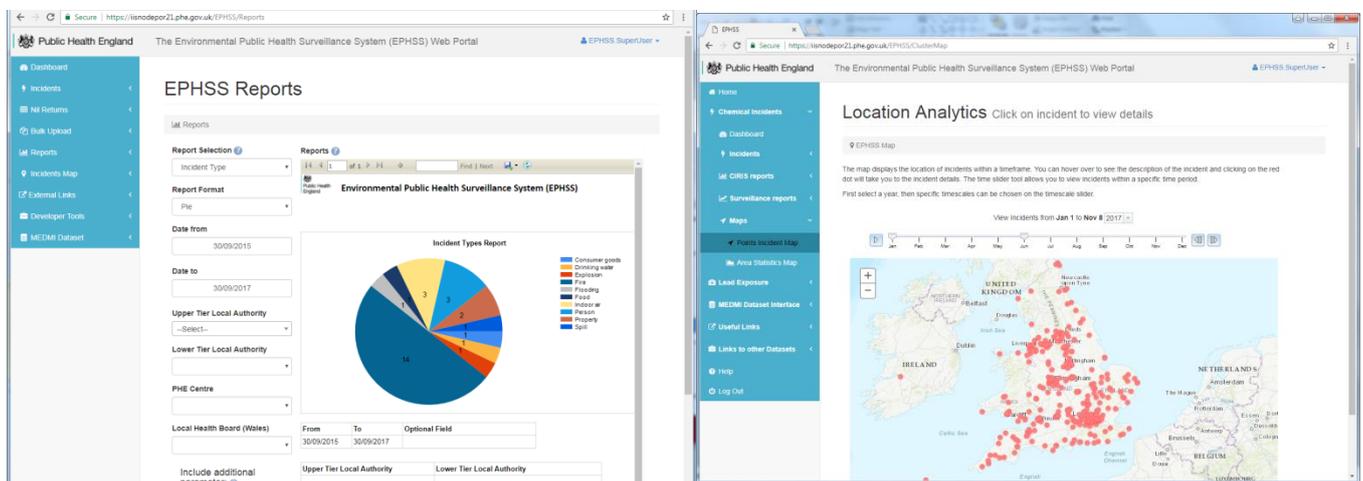


EPHSS provides automated, routine reports, as well as data for user-defined outputs required for public health surveillance purposes. Three pilot modules are to be rolled out this year. They focus on the surveillance of (i) acute environmental events, (ii) Lead

exposure in children and (iii) selected meteorological variables originating from the Met Office. Further work to develop data sharing linkages with relevant information systems of the Local Government Association, the Met Office, and the Food Standard Agency via Applications Programme Interfaces (APIs) are in progress.

EPHSS is developed by PHE's Environmental Public Health Tracking (EPHT) programme led by CRCE in partnership with PHE Centres, Field Services of the National Infectious Service, Health Improvement directorate, PHE's ICT department and the Software Development Unit (NIS). EPHSS is funded by PHE Capital Programme Group.

### Example screenshots from EPHSS on the type and location of acute environmental and chemical incidents that PHE responded to in 2017



To find out more please visit the EPHSS webpage at:

[www.gov.uk/government/publications/environmental-public-health-surveillance-system](http://www.gov.uk/government/publications/environmental-public-health-surveillance-system)

The system is now being tested. We invite public health practitioners, information analysts, researchers and other users of environmental public health data who are interested in participating to test EPHSS, or if you would simply like to find out more about this tool contact the EPHSS team via email: [ephss@phe.gov.uk](mailto:ephss@phe.gov.uk)

# Surveillance of chronic environmental hazards, exposures and health effects

Development of a surveillance system for chronic environmental hazards, exposures and related health effects

By Harriet Gordon-Brown, Systems Development Manager for EPHSS

The Environmental Public Health Surveillance System (EPHSS) currently in development by the team is being extended to include information about chronic hazards, exposures and related health effects. A series of stakeholder consultation activities involving a wide range of different stakeholder groups and constituencies in public health was undertaken. This process began with stakeholder identification and consultation to define user needs and solution designs. Stakeholders identified included a wider range of internal PHE users as well as external users working in the field of environmental public health. Stakeholder mapping exercises were conducted which involved collaborative research, teleconferences, debates and brainstorming discussions. Workshops were held across the country which explored various user needs for data to set priority topics for surveillance. These activities were used to draw up the landscape as well as to identify, analyse and determine the scope of the system. The result was a comprehensive mapping that listed over 200 relevant stakeholders including groups and organisations across the entire environment and health spectrum.

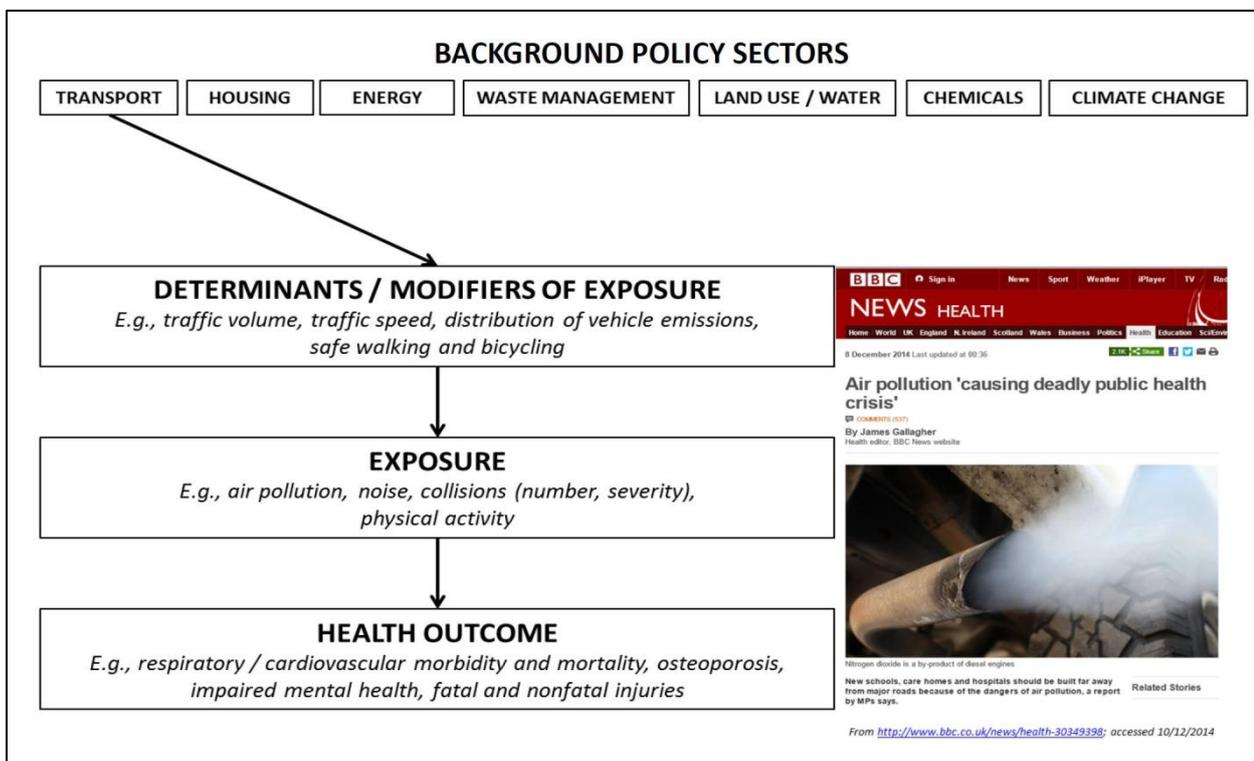
Over the course of 6 months (January to June 2015) a wide range of stakeholders (including environmental health practitioners, public health practitioners, knowledge and intelligence specialists, information managers, surveillance analysts, epidemiologists, other subject matter experts and other interested parties) were consulted through 3 national workshops, an online survey, multiple bilateral and group meetings and teleconferences. The linkage of environmental exposures, interventions or public health actions and health outcomes was identified as being of particular value to local decision makers and politicians. Topmost stakeholders groups identified were: Local Authorities, Directors of Public Health and PHE Directorates. A report (2016) on the findings of the stakeholder consultation was produced.

Furthermore, to contextualise and simplify the applicability of environmental hazards and exposures attributable to health outcomes and disease, various hazards and exposure themes were categorised and ranked according to their relevance to specific policy sector domains. This approach enabled the conceptualisation of practical impacts of environmental exposures and interventions to health outcomes in ways that local decision makers can relate to and value.

The topmost policy sectors and environmental exposures ranked by 106 survey respondents from 32 different organisations, which were predominantly national and local government organisations, included in the following order of priority:

- transport sector (primarily air quality)
- housing sector (indoor air pollution, heat, lead poisoning and other chemical hazards, proximity to green spaces, radon and noise pollution from roads)
- land contamination and use (includes agriculture, food and water supply) - (toxic metals and chemicals (eg arsenic), pesticides, persistent organic pollutants)
- climate change (vulnerable homes, heat waves and cold spells, flooding)

### Policy sectors and components of a tracking system



Several of these topics identified during the consultation process could form part of EPHSS Phase 2- for chronic hazards and exposures. But due to prevailing resource and time constraints, it was essential to prioritise only a couple as proof-of-concept examples. Based on stakeholder feedback and PHE's current overarching strategic priorities, the EPHSS Board selected 2 topics for which undertaking public health surveillance could add significant value and create wide impact. These could leverage on other work streams currently committed and where existing internal and external partnerships could facilitate successful delivery of the surveillance system. The 2 surveillance priority topics selected are:

- air pollution exposure
- weather data, including temperature

Working groups have been convened for both topics. Each working group is responsible for defining the scope of work and setting out the objectives and features of an epidemiological surveillance system in England for each topic. Generally, the membership of these working groups consists of representatives from CRCE departments, National Infections Service (including Field Services), Health Protection Teams, PHE Centres, Health Improvement, ICT, GIS Team, Software Development Unit and PHE Communications department.

In addition, the working groups will each be supported by a steering group that includes representatives from key academic, government and project implementation partners. The role of the steering group will be to advise the working group on the scientific, methodological and academic components of developing, implementing and evaluating the surveillance systems and the outputs from surveillance.

The practical outcomes from the surveillance working groups will be to operationalise the ongoing surveillance of air pollution exposure indicators or metrics, and provision of meteorological data for public health surveillance. The EEG will be supporting both the development and operational phases of surveillance.

# Determining population exposure to chemicals in small domestic private water supplies

By Helen Crabbe, Senior Epidemiology Scientist

PHE is applying Environmental Public Health Tracking methods to collaborate on a multidisciplinary study examining population level exposures to chemicals in Private Water Supplies in England.

## The challenge

Over three-quarters of a million people drink water from Private Water Supplies (PWS) in England. Two-thirds of PWS serve a single domestic household and the water quality of these supplies is not necessarily monitored. Among microbiological contaminants, harmful chemicals can be present in the water and prolonged consumption of water from these sources may cause long term health effects such as cancers and skin complaints.

The extent of human exposure to chemicals in single domestic PWS especially in those areas of geological significance where groundwater quality is likely to be affected is largely unknown. PHE, in conjunction with the British Geological Survey and Cornwall Council, undertook a succession of field studies that sampled over 500 domestic PWS in Cornwall and measured water quality for 65 chemicals, including arsenic, manganese, iron, lead, fluorine and others.

The studies found that up to 20% of single domestic PWS failed health-based safe water guideline values, with 6% of households failing the Arsenic prescribed concentration value, potentially affecting nearly 1500 residents in Cornwall drinking this water.

## Impact

As an outcome of the studies, local householders participating in the study were advised on the quality of their water supplies. Those households with failed water quality standards were advised on possible long term health impacts and given

mitigation advice by Cornwall Council. Furthermore, PHE produced a series of public health advice sheets on water quality to guide local residents<sup>2</sup> against chronic exposure.

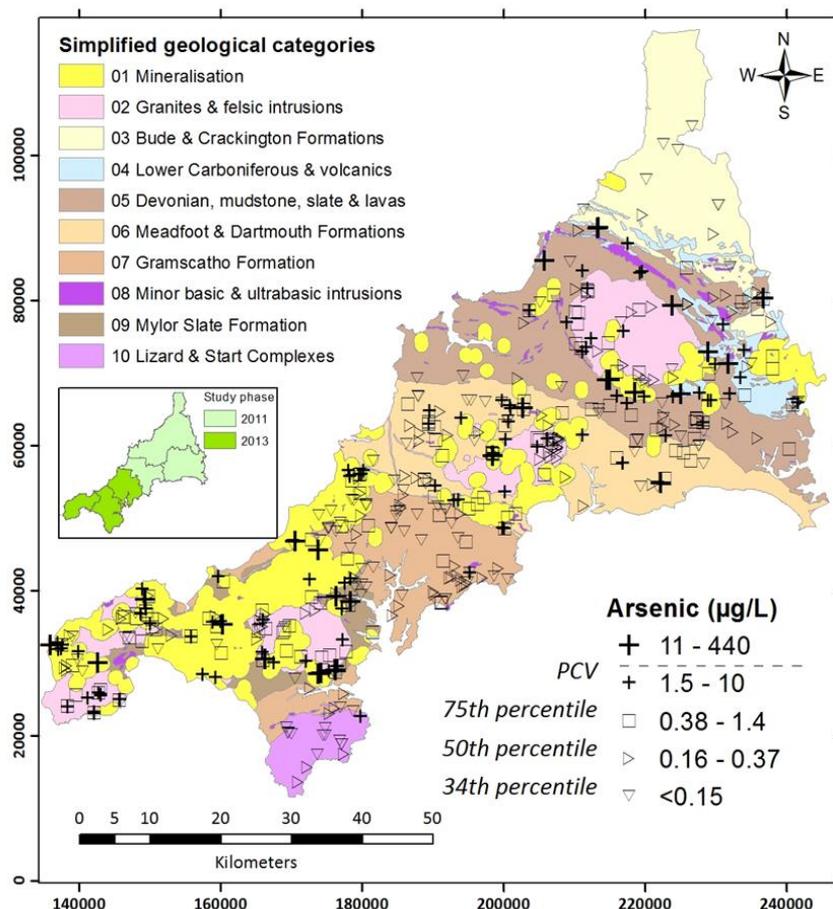
A PhD project with the University of Manchester included a biomonitoring study which effectively confirmed human exposure to arsenic from the use of private water supplies. This study involved taking urine, hair and toenail samples from resident's drinking water from these supplies. Alongside water supplies, other sources of arsenic exposure were also examined, such as exposure through food ingestion, soil and household dust.

A prototype model has also been developed from this study that is capable of modelling the risk of arsenic in private supplies based on bedrock geology. With supplementary investment to further refine this tool, it is our hope that it will be used to provide cost-effective assistance to local authorities in prioritizing areas requiring risk assessment, testing and preventative intervention across England.

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<sup>2</sup> [www.bgs.ac.uk/sciencefacilities/laboratories/geochemistry/igf/biomonitoring/arsenicSW.html](http://www.bgs.ac.uk/sciencefacilities/laboratories/geochemistry/igf/biomonitoring/arsenicSW.html)

## Map of Cornwall showing geology, location and levels of arsenic measured in Private Water Supplies tested



Geological data reproduced with the permission of the British Geological Survey ©NERC. From Crabbe, H., Fletcher, T., Close, R., Watts, M. J., Ander, E.L., Smedley, P.L., Verlander, N.Q., Studden, M., Leonardi, G. (2017) Population Hazard Ranking Method for Arsenic in Private Water Supplies: Relation to Bedrock Geology. *Int. J. Environ. Res. Public Health* 2017, 14, 1490: <http://dx.doi.org/10.3390/ijerph14121490>

### Papers published from the project:

Ander EL, Watts, MJ, Smedley PL, Hamilton EM, Close, R, Crabbe, H, Fletcher, T, Studden M, Rimell A, Leonardi G. (2016) Variability in private drinking water supply chemistry, and the impact of domestic treatment systems on water quality. *Environmental Geochemistry and Health*, DOI 10.1007/s10653-016-9798-0

Crabbe, H., Close, R., Rimell, A, Leonardi, G, Watts, M.J., Ander, E.L., Hamilton, E.M., Middleton, D.R.S, Smedley, P.L, Gregory, M., Robjohns, S., Sepai, O., Studden, M, Polya, D.A., Fletcher, T. (2017) Estimating the population exposed to arsenic from groundwater-sourced private drinking water supplies in Cornwall, UK. Chapter in IWA book: *Best Practice Guide on the Control of Arsenic in Drinking Water*, Polya, D, Bhattacharya, P. & Jovanovic, D (eds), published June 2017.

Middleton, D.R.S., Watts, M.J., Hamilton, E.M., Ander, E.L., Close, R.M., Exley, K.S., Crabbe, H., Leonardi, G.S., Fletcher, T. and Polya, D.A. (2016) Urinary arsenic profiles reveal exposures to inorganic arsenic from private drinking water supplies in Cornwall, UK. *Scientific Reports*,6, Article 25656.

Middleton, D.R.S., Watts, M.J., Hamilton, E.M., Fletcher, T., Leonardi, G.S., Close, R.M., Exley, K.S., Crabbe, H. and Polya, D.A. (2016) Prolonged exposure to arsenic in UK private water supplies: toenail, hair and drinking water concentrations. *Environmental Science: Processes and Impacts*, 18, 562-574.

Middleton, D. R. et al (2017) Arsenic in residential soil and household dust in Cornwall, south west England: potential human exposure and the influence of historical mining. *Environmental Science Processes & Impacts*, v19, pp517-527.

Crabbe, H., Fletcher, T., Close, R, Watts, M. J., Ander, E.L. Smedley,P.L., Verlander, N.Q, Studden, M., Leonardi, G. (2017) Population Hazard Ranking Method for Arsenic in Private Water Supplies: Relation to Bedrock Geology. *Int. J. Environ. Res. Public Health* 2017, 14, 1490;  
<http://dx.doi.org/10.3390/ijerph14121490>

Middleton, D. R. S., M. J. Watts, E. M. Hamilton, J. D. Coe, T. Fletcher, H. Crabbe, R. Close, G. S. Leonardi and D. A. Polya (2018) Surface wipe and bulk sampling of household dust: arsenic exposure in Cornwall, UK. *Environmental Science, Processes & Impacts*. Royal Society of Chemistry. DOI: 10.1039/c7em00463j.

# Water fluoridation in England health monitoring report 2018

David Roberts, FETP Fellow

Dental caries (tooth decay) is largely preventable. Those with dental caries can suffer pain and infection and often have difficulties eating, sleeping and socialising. It is a significant public health problem internationally and in England with 12% of three-year-olds having caries in their primary teeth and 25% of five-year-olds, rising up to half of surveyed five-year-olds in the worst affected local authority areas. Sizeable inequalities in the prevalence of caries exist between affluent and deprived communities, and it is a common cause of hospital admissions in children.

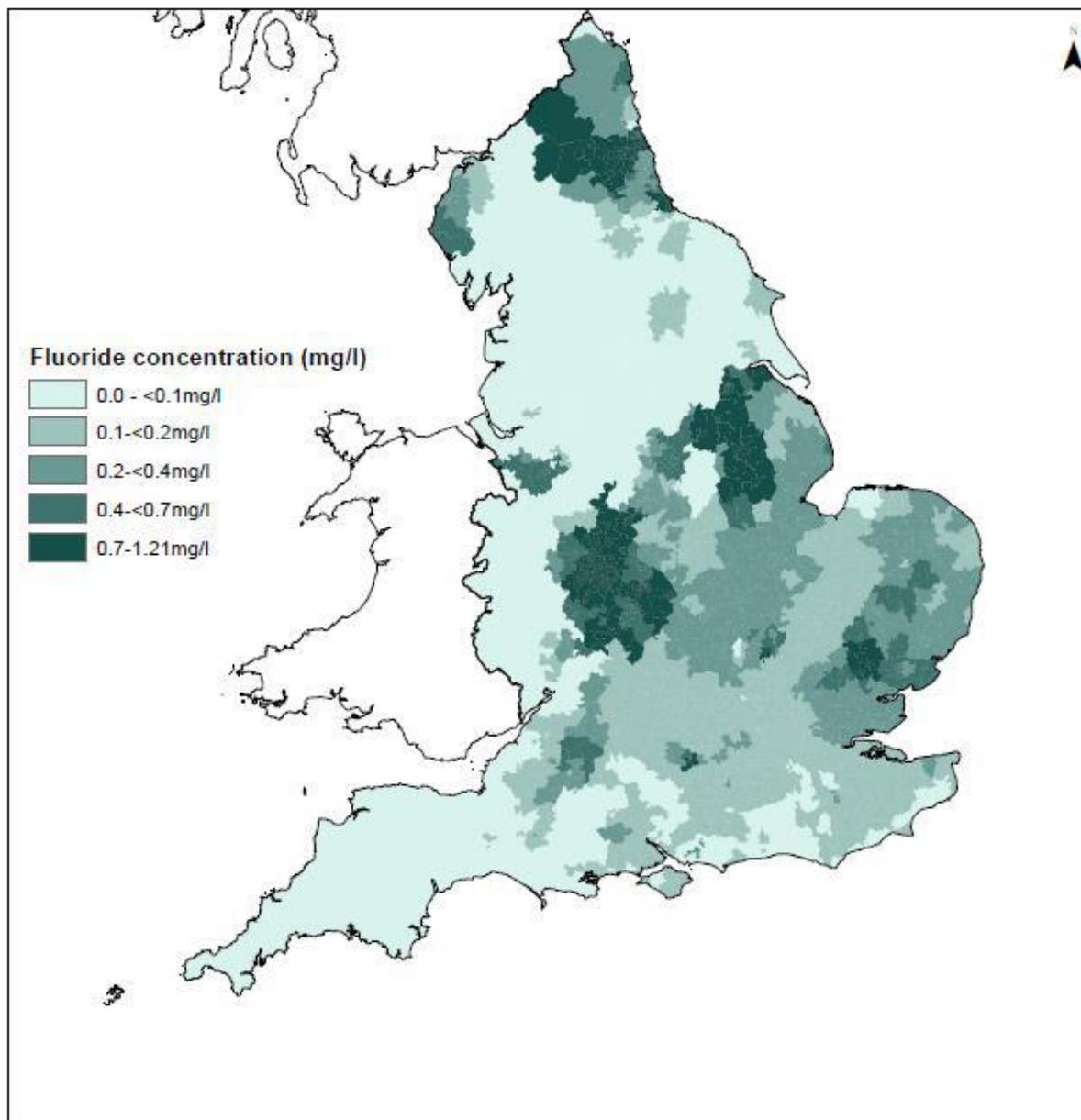
Water fluoridation schemes adjust fluoride levels in community water supplies to around 10% of the England population in an effort to reduce dental caries. PHE, on behalf of the Secretary of State for Health and Social Care, is required by legislation to monitor the effects of water fluoridation schemes on the health of people living in the areas covered by these arrangements, and to produce reports at no greater than four-yearly intervals. The last report was published in 2014, and CRCE's Environmental Epidemiology Group (EEG) is responsible for delivering the 2018 report.

EEG convened a working group of experts in environmental epidemiology, statistics, dental public health, toxicology and communications from across PHE. The working group met regularly to discuss and agree the aims and objectives of the report, the methods used, and the method for dissemination. Writing of the protocol, data acquisition and analysis was performed by the EEG, in consultation with the working group. The final report was written jointly by members of environmental epidemiology and dental public health, with regular comment and review by the other working group members.

The report was published in advance of the statutory deadline in March 2018. It took over 2 years to prepare, and publication involved liaison with the Drinking Water Inspectorate, consultation with affected local authorities, and review by 5 expert external peer reviewers. The report demonstrated that water fluoridation is an effective public health measure to reduce the prevalence and severity of dental caries, and reduce dental health inequalities, and no reliable evidence of harm was found. The report also provides the most comprehensive description of population exposure to fluoride in water at the national level. It will be used by local authorities to help quantify the likely impact of implementing a fluoridation scheme, and provides a foundation for ever more sophisticated monitoring of the health effects of water fluoridation in future reports, and with academic collaborations.

EEG would like to acknowledge the input of the other working group members, PHE departments who provided data, and the Drinking Water Inspectorate, who provided data and advice to support production of the report. The report can be read at: [www.gov.uk/government/publications/water-fluoridation-health-monitoring-report-for-england-2018](http://www.gov.uk/government/publications/water-fluoridation-health-monitoring-report-for-england-2018)

**Figure from the report. Population-weighted mean fluoride concentration (mg/l), England, 2005-15. Mapped at middle super output area level, using 2011 boundaries**



Contains Ordnance Survey data © Crown copyright and database right 2017. Contains National Statistics data © Crown copyright and database right 2017.

# European co-operation in science and technology (COST) Action, Industrially Contaminated Sites and Health Network (ICSHNet)

Rebecca Hams, Field Epidemiology Training Programme Fellow

Three members of the team (Tony Fletcher, Giovanni Leonardi and Rebecca Hams) are participants of the European co-operation in science and technology (COST) Action, Industrially Contaminated Sites and Health Network (ICSHNet). This network was launched in 2015, and currently involves researchers and experts from 32 countries. The network is centred on developing a common European framework for research and response on environmental health issues in industrially contaminated sites, and establishing a European network of experts and institutions involved in assessing the health impacts and/or managing remediation and response. CRCE Environmental Epidemiology staff are members of the core group of investigators for this network and are supported by a staff member from CRCE Environmental Hazards and Emergencies Department.

The network is organised in 4 working groups as detailed below:

## 1. Working Group 1. Environmental and health data

Main task: Identification of needs and priorities to guide the collection and organization of environmental and health data concerning industrially contaminated sites.

## 2. Working Group 2. Exposure assessment

Main task: Identification of needs and priorities on the design of strategies to evaluate exposures to environmental contaminants in populations residing in industrial contaminated areas.

## 3. Working Group 3. Health risk and health impact

Main task: Identification and evaluation of methods and tools to guide health risk and health impact assessment in industrially contaminated sites.

## 4. Working Group 4. Risk management and communication

Main task: Development of guidance on risk management and risk communication on environmental health risks in industrially contaminated areas.

In 2017/18 the team attended the annual meeting in Bonn, hosted by the WHO, and undertook 2 short term scientific missions to collaborate with researchers from Universiteit Utrecht to develop an epidemiological protocol focusing on methods for estimating ingestion exposure to common contaminants and with Escuela Andaluza de Salud Pública, Granada, Spain to produce a manuscript for peer review publication 'Information gap analysis of a national Environmental Surveillance Program as a tool for characterizing health impact of industrially contaminated sites'.

The team were also involved in piloting a questionnaire that was sent to nearly 100 sites identified as being currently or previously contaminated by industrial operations. The results from this effort will help set the direction for the remainder of the project (the action finishes in April 2019).

For further information visit: [www.icshnet.eu](http://www.icshnet.eu)

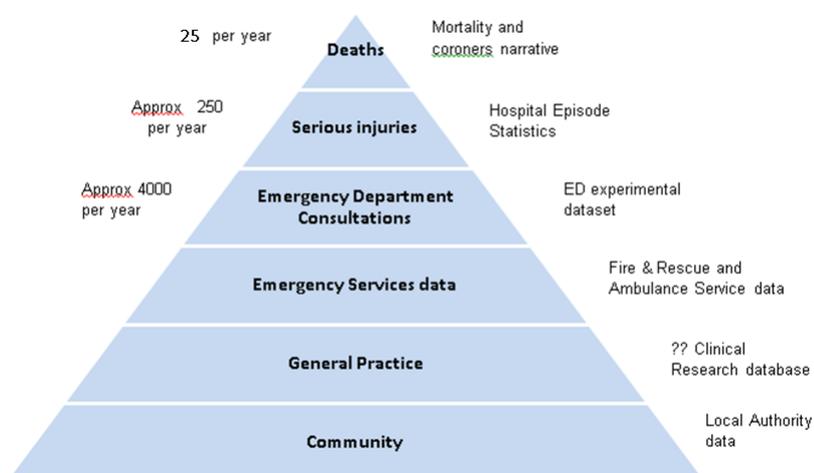
**Group photo from the 4<sup>th</sup> Plenary Conference of the Action, held in Bonn (21-22 February 2018)**



# Burden of disease from Carbon Monoxide poisoning – a tracking approach

By Helen Crabbe, Senior Epidemiology Scientist

Carbon Monoxide (CO) poisoning causes non-specific symptoms that often mimic other common diseases. The severity of these symptoms depends highly on the duration and levels of exposure and/or the physiological conditions of the subjects. This, together with the issue of rapid disappearance of symptoms after removal from the emission source, makes CO poisoning a condition that is easily misdiagnosed.

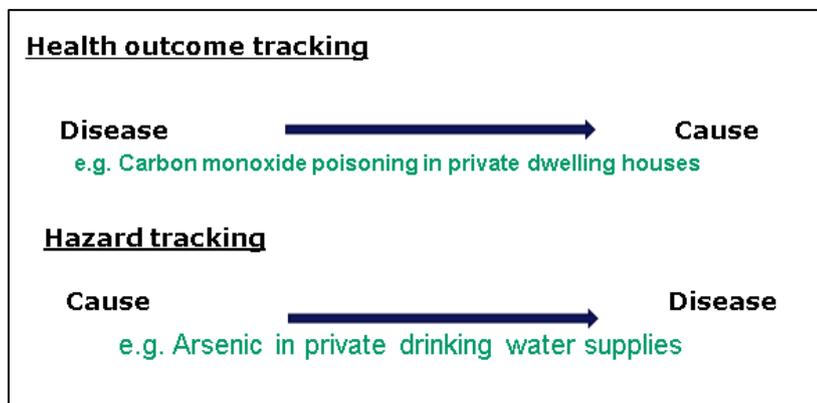


The burden of CO poisoning on mortality and morbidity has not been fully quantified. PHE is using the tracking approach to quantify the effect of CO using information from several different data sources. This diagram shows the effects and severity of CO exposure on the population in England and Wales, along with potential sources of information and current attempts to quantify the burden at each level, based on best current estimates<sup>3</sup>.

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<sup>3</sup> Data taken from [www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/adhocs/009122numberofdeathsfromaccidentalpoisoningbycarbonmonoxideenglandandwalesdeathsregisteredin2017](http://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/adhocs/009122numberofdeathsfromaccidentalpoisoningbycarbonmonoxideenglandandwalesdeathsregisteredin2017) for the number of deaths in England and Wales, 2017. 'Analysis of hospital admissions due to accidental non-fire-related carbon monoxide poisoning in England, between 2001 and 2010', by Ghosh, R.E, et al. J Public Health, 2015 Mar 9. doi: 10.1093/pubmed/fdv026 for Serious Injuries. And the Department of Health Emergency Department experimental dataset for ED Consultations.

The CO project is an example of 'health outcome tracking'. Information on what is known about the disease (morbidity and mortality) is examined to trace and discover the causes of disease or exposures.



Current projects on CO are exploring the potential misdiagnosis and mis-treatment of CO poisoning patients in Emergency Departments which is likely to lead to missed opportunities to reduce exposure and health burden. It is thought that a disproportionate fraction of Emergency Department (ED) attendances are mis-diagnosed, involving diagnosis of symptoms commonly mimicked by CO poisoning occurring until an appropriate diagnosis of CO poisoning is reached.

CO exposure cases admitted to hospital are often discharged without appropriate diagnosis and go home only to be then re-exposed to the emission source leading to the re-appearance of CO poisoning symptoms, then possibly re-admitted repeatedly, until eventually an appropriate diagnosis is reached. These repeat admissions have been examined by our collaborators at the Small Area Health Statistics Units (SAHSU) at Imperial College, London. Aina Roca-Barceló and Dr Fred Piel have been working on a data linkage project to link HES data and A&E attendance data to identify how many CO poisoning attendances occur. The aim was to assess potentially misdiagnosed CO poisoning cases based on symptom patterns at Emergency Departments (EDs) in those who were subsequently admitted to hospital with CO poisoning. They compared reasons for ED attendance in CO poisoned patients to the general population. Early results of this research show that a third of patients admitted to hospital with Accidental Non-Fire Related CO poisoning in England during 2008-2015, had at least 1 previous attendance to ED during the previous 12 months.

This research was funded by the National Institute for Health Research Health Protection Research Unit (NIHR-HPRU) in Health Impact of Environmental Hazards at Imperial College and King's College London, in partnership with PHE. The results are being presented to conferences and written up for publication in peer-reviewed journals.

Previous work to identify the sources of exposure for CO deaths is ongoing. We are working with ONS to examine coroner's text records to extract information on the source of CO and circumstances of deaths in order to inform public health interventions and awareness campaigns.

A PhD project studying CO exposure measurement error by a combination of analytical chemistry and epidemiology methods is currently underway. This is a GST-funded collaboration of PHE with Brunel University and Toxicology Department at Lausanne Hospital, Switzerland, on several aspects of carbon monoxide measurement error. Work undertaken in 2017 focused on errors attributable to variation in forensic chemical analysis, and resulted in a publication relevant to post-mortem assessment of CO. In addition, a review on sources of error in CO estimation has been prepared. The student will move to Brunel University at the end of 2018 to undertake a review of errors in measurement of CO exposure in population surveys<sup>4</sup>.

A PhD project for modelling of CO uptake and elimination started in 2016 with Ke-Ting Pan, a researcher from Taipei supported by a scholarship from Taiwan government, undertaking doctoral studies with supervision by Ben Croxford at Bartlett School of Architecture at UCL, and advice from Giovanni Leonardi of EEG. Initial work examined risk factors for CO poisoning in Taiwan, in collaboration with National Defense Medical Centre investigators. Further work is ongoing on developing improvements to the multi-compartment model of CO distribution in the body currently available, examining variation in CO uptake and elimination by age, gender, and height. The goal is to improve the performance of the CO multi-compartment model and make it more widely applicable to several public health and clinical settings<sup>4</sup>.

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<sup>4</sup> Cross Government Group On Gas Safety And Carbon Monoxide (CO) Awareness, Annual Report 2017/18

# Summary of the mDPSEEA workshop held at CRCE in June 2017

By Tayo Owodunni and Helen Crabbe

PHE's Centre for Radiation, Chemical and Environmental Hazards (CRCE) organised a workshop in June 2017 to explore how the **mDPSEEA** framework can be used to deliver Environmental Public Health applied to the complex topic of e-cigarettes as an intervention in tobacco use.

mDPSEEA stands for 'modified Drivers-Pressures-States-Exposure-Effect-Action' which originated from the WHO and has been used by the Scottish Government to develop their 'Good Places, Better Health' programme as a model for environmental health. It is a strategic tool for examining upstream driving-forces and their respective pressures and states, thereby mapping out environmental public health concerns, risk factors and challenges that bear on a target health topic (eg e-cigarette use). PHE used it to explore environment and health impacts of e-cigarettes by collaboratively mapping available evidence, uncovering current gaps in knowledge and identifying areas for further research as well as possible unintended consequences.

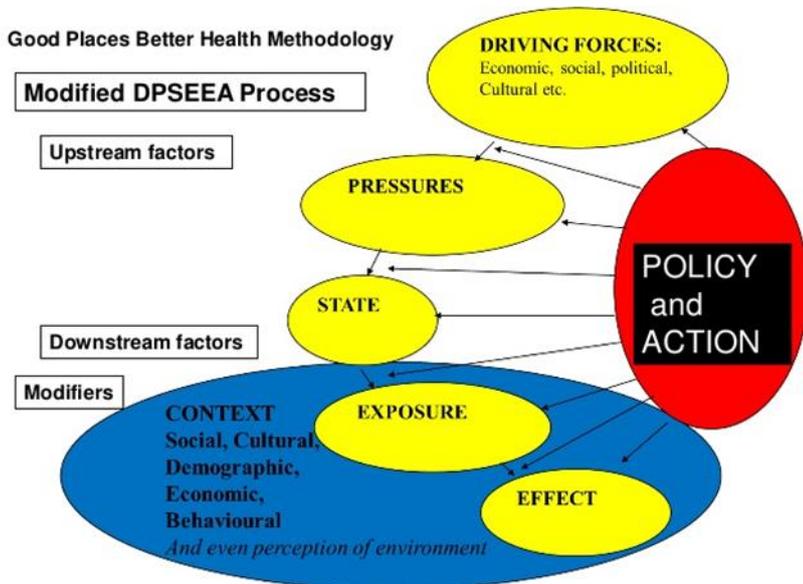


Diagram of the mDPSEEA model by Morris et al, 2006<sup>5</sup>

<sup>5</sup> Available from: [www.cieh-cymruwales.org/uploadedFiles/Core/The\\_region/Regional\\_activity/Presentation\\_archive/Delivering\\_EH\\_excellence/Morris\\_applying\\_strategic\\_EH.pdf](http://www.cieh-cymruwales.org/uploadedFiles/Core/The_region/Regional_activity/Presentation_archive/Delivering_EH_excellence/Morris_applying_strategic_EH.pdf)

The workshop was held on 26 June 2017 at CRCE's Chilton office, and participants comprised of topic-leads/subject matter experts and other representatives experienced with the wide-ranging aspects of environmental public health impacts of tobacco/e-cigarette use. Groups within CRCE involved: the Environmental Epidemiology Group, Chemicals and Environmental Effects department, Toxicology, CRCE Wales and the National Poisons Information Service. Representatives from other parts of PHE included topic leads from Health Improvement's Tobacco Control, Alcohol, and Drug team. The workshop was facilitated by 2 external, independent experts (Prof George Morris and Sheila Beck) who developed the model for Scotland.

The workshop successfully scoped out the environment and health aspects of e-cigarettes as an alternative to tobacco use. The aim of using mDPSEEA within PHE (CRCE in particular) was to apply a holistic and interdisciplinary approach to investigate whether cross-department links can be fostered and framed through the use of mDPSEEA model to promote collaborative working on environmental public health risks.

The CRCE approach was subsequently re-used by the PHE Tobacco Control Implementation Board (TIB) to frame issues relating to heat-not-burn (HNB) tobacco products (also known as 'heated' tobacco products) at their board meeting on 13 December 2017. PHE's Environmental Public Health Tracking Board is considering how DPSEEA and its other derivatives mDPSEEA and eDPSEEA (ecosystems-enriched DPSEEA) can be used to frame other complex, environmental public health issues such as air pollution or the impact of human exposure to plastics and micro plastics.

A copy of the full workshop report is available. Please email [Tayo.Owodunni@phe.gov.uk](mailto:Tayo.Owodunni@phe.gov.uk) for a copy.

# Guidance for investigating non-infectious disease clusters, from potential environmental causes

Developing guidance for public health professionals.

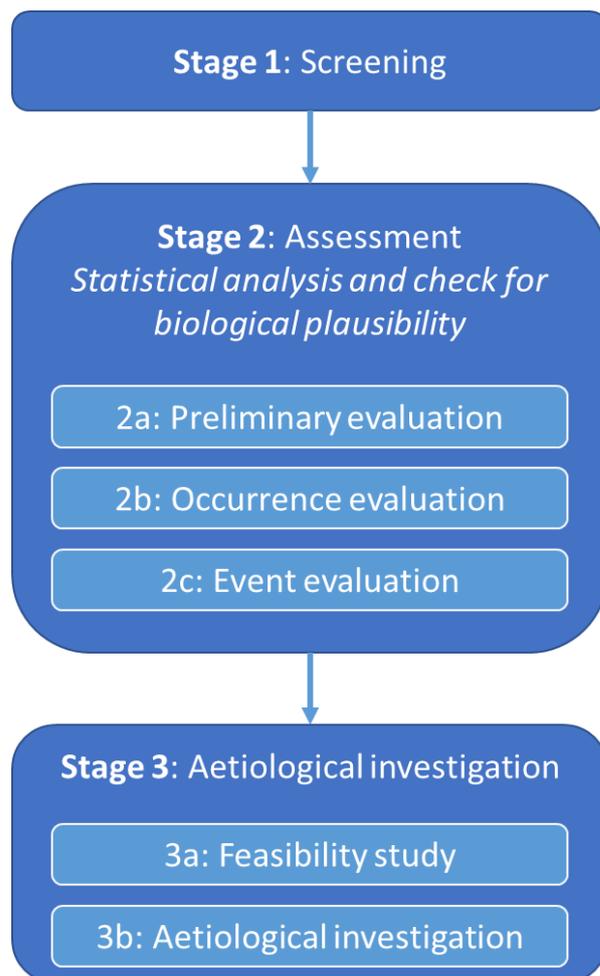
By Helen Crabbe and Tony Fletcher

Clusters of diseases may be identified and reported to Local Authorities or PHE by concerned citizens or health care professionals. Potential clusters may be groups of people or cases with apparent similar cancers, chronic diseases, congenital anomalies or unusual illnesses. The source of apparent disease clusters may be community based infections or could be related to an external source, such as a common environmental exposure related to where people live or spend time at a place.

PHE responds to reports of disease clusters and public health practitioners investigate outbreaks of infectious diseases on a regular basis. This investigation follows a well-established process following national and regional guidance. Specific cluster guidance has been developed for certain situations, eg Legionnaires disease, cancer clusters or congenital anomalies. However, PHE guidelines for addressing other non-infectious disease clusters are needed to assist practitioners and organisations involved in these investigations. The EEG team has been preparing a guidance document that provides a framework for investigating any clusters of non-infectious diseases including clusters of unusual illnesses.

Environmental exposures can be the cause of sickness, ill-health and disease. Exposures to contaminants in the environment may occur from the atmosphere, water, soil, land, or consumer products and can be physical, chemical or radiological in nature. Methods for linking such exposures to potential health effects are outlined.

The guidance is based on a staged approach with comprehensive steps within each stage. The stages begin with the original report of a putative cluster and continue until the final conclusion has been reached. The stepwise approach starts with Stage 1 – a screening process to make a decision on whether the report of a cluster is worth investigating further. Stage 2 involves assessment of both the health outcomes and exposure validation, resulting in exchanging risk perceptions. Stage 3, if reached, involves an aetiological investigation with quantitative analysis of the relationship between the health outcomes and the environmental exposure.



The guidance describes some resources that can be utilised to aid cluster investigations such as computer software packages, mapping and GIS. The importance of regular communication and reporting results throughout the investigation is highlighted and some examples of enquiries show the type of situations where this guidance can be used. The guidance also suggests membership of disease cluster investigation teams, and the various roles and responsibilities of such.

Investigating potential clusters can be difficult and time-consuming and a systematic, integrated approach is needed for responding to such clusters. Reports of potential clusters often require a public health response. In addition to having epidemiologic and statistical investigations, it is important to understand the social dimensions of a cluster: the community's perception of risk, potential legal ramifications and the role or influence of the media. Addressing communication activities at each stage of the cluster investigation and developing and maintaining community relationships and trust will help the credibility and understanding of the investigation.

The guidance was prepared by members of the EEG along with colleagues in the Environmental Hazards and Emergency Department, Field Services (National Infections Service), Knowledge and Intelligence Team (Health Improvement

Directorate) of PHE, also with colleagues from the Small Area Health Statistics Unit, Imperial College. The guidance was published in February 2019 and is available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/781573/INIDC\\_guidance\\_v1.0.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/781573/INIDC_guidance_v1.0.pdf)

We would like feedback on the use and application of the guidance. An online survey is available for feedback at:

<https://surveys.phe.org.uk/TakeSurvey.aspx?SurveyID=IIKImm420#>

# Georgia Twinning: EC funded programme to Strengthen Environmental Health Capability in Georgia

By Helen Crabbe



Giovanni Leonardi and Helen Crabbe from the EEG team, and Eirian Thomas and Raquel Duarte-Davidson, Chemicals and Environmental Effects Department, have been supporting the development of environmental health capabilities in Georgia by working with the National Centre for Disease Control (NCDC), in Tbilisi. The project is funded by the European Commission as a twinning project for knowledge transfer between short term expert missions to Georgia by the project partners - PHE, Istituto Superiore di Sanità (ISS) in Italy and the Nofler Institute, Poland.



The consortium have attended several missions to Georgia to work with NCDC colleagues on the following topics; legislation for water quality, lead poisoning in children surveillance, chemical risk assessment, train the trainer course on health and environment, development of a National Action Plan for Environment and Health (NEHAP). Raquel Duarte-Davidson, Eirian Thomas and Helen Crabbe lead a workshop on development of the NEHAP with other twinning experts and stakeholders of the Ministries of Health, Environment, Agriculture and NCDC in February 2018.

The team will continue to attend future missions to Tbilisi until the project ends in March 2019. Four colleagues from NCDC Environment and Health Team undertook an internship mission to the UK at Brunel University in June 2018. The delegation visited PHE CRCE at Chilton as part of the exchange and met with experts in toxicology, air pollution and chemical incidents.

A two-day tracking workshop in Tbilisi, Georgia, is planned for 31 January to 1 February 2019. Funded by the EC TAIEX programme, objectives of workshop will be to share tracking experiences in Georgia and neighbouring countries in the Euro Asiatic Region. Health and environment administrations are invited, along with EHPT experts to support development of tracking activities in the region.

**Facilitators and participants attending the Train the Trainer course in Environment and Health in Tbilisi, 21-25 May 2018**



# International Network for Public Health and Environment Tracking (INPHET)

By Helen Crabbe



The EEG group help to co-ordinate the International Network for Public Health and Environment Tracking (INPHET). The international EPHT network aims to support the development, implementation and evaluation of national EPHT initiatives. It was born out of meetings of like-minded professionals attending international meetings in tracking and related topics, since 2012.

INPHET provides an international clearinghouse for public health practitioners and researchers on how to monitor and evaluate environmental hazards, exposure and health data. Moreover, INPHET aims to advance and enhance national EPHT capacity through support of systematic analyses of environmental health data. Specifically, how to:

- i. Monitor environmental precursors of disease
- ii. Merge, integrate, analyse and interpret environmental hazards, exposure and health data
- iii. Examine relationships between environmental hazards and diseases
- iv. Identify populations at risk from environmental hazards
- v. Implement and evaluate intervention and prevention strategies
- vi. Inform public health policy makers

Monitoring environmental hazards is critical for the prevention of disease. Environmental Public Health Tracking (EPHT) aims to merge, integrate, analyse and interpret environmental hazards, exposure and health data. EPHT can provide timely, accurate and systematic environmental data to public health decision makers on how to reduce the environmental health burden. By effectively linking environmental health data and translating it into meaningful information, EPHT can help protect the health of the public. Thus, EPHT represents the essence of proactive public health practice, since the ultimate goal of such a system is to guide public health action.

## Benefit to public health

INPHET provides a number of benefits to (public) health professionals, policy makers, local, national and international stakeholders, etc. Specifically, INPHET serves as:

- an established clearinghouse for environmental health data, methods and processes
- a resource with environmental decision support tools for policy and decision makers
- evidence-based information that can be used to guide public health actions in different settings, such as regional and national health departments
- a resource to increase comparability and cross-border surveillance capacity
- a reference point for public health agencies and scientific organisations

Examples of international EPHT network activities:

- co-ordination of international research projects on EPHT (eg pilot initiatives, databases and their use such as congenital anomalies, housing-related hazards to health, environmental drivers of infectious diseases, etc.)
- exchange of experiences/expertise, staff, trainees
- development and exchange of guidelines
- benchmarking
- training and education

## Current activities

INPHET is governed by a Steering Group and Scientific Committee with practitioners across the globe. INPHET regularly organise meetings and interest groups to coincide with major related conferences. For example, members met at symposiums organised to co-incide at the International Society of Environmental Epidemiology conferences and other meetings, in Basel – 2013, Modena- 2014, Rome – 2016, Sydney- 2017, and Ottawa, 2018. There are 4 current working groups that are supporting current issues in the field:

- human biomonitoring
- low and middle income countries co-operation
- tracking Carbon Monoxide
- outdoor air pollution

Twenty countries and over 500 people are members of INPHET. 85 experts have submitted profiles to INPHET detailing their interests and expertise in the field of tracking. To find out more visit [www.inphet.org](http://www.inphet.org) and fill out the online expert survey to join the network.

To find out more about PHE's Environmental Public Health Tracking projects, please email [epht@phe.gov.uk](mailto:epht@phe.gov.uk) or visit our webpages:

[www.gov.uk/government/publications/environmental-public-health-surveillance-system/environmental-public-health-surveillance-system-ephss#environmental-public-health-tracking-epht-and-environmental-public-health-surveillance-system-ephss](http://www.gov.uk/government/publications/environmental-public-health-surveillance-system/environmental-public-health-surveillance-system-ephss#environmental-public-health-tracking-epht-and-environmental-public-health-surveillance-system-ephss)