UK Health Security Agency

NIHR | Health Protection Research Unit in Environmental Change and Health at London School of Hygiene and Tropical Medicine

Climate Change, Chemical Hazards and Public Health Workshop 30 Sept to 01 Oct 2024

Summary report

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This project is funded by the National Institute for Health and Care Research (NIHR) Health Protection Research Unit in Environmental Change and Health (NIHR 200909), a partnership between UK Health Security Agency and the London School of Hygiene and Tropical Medicine (LSHTM), in collaboration with University College London and the Met Office.

Contents

Summary

Climate change impacts human exposure to chemicals. Additionally, extreme weather is likely to increase mobilisation of chemicals in the environment. This document reports on a workshop hosted by the National Institute of Health Research (NIHR) Health Protection Research Unit in Environmental Change and Health (HPRU ECH) and organised in collaboration between the London School of Hygiene and Tropical Medicine (LSHTM) and the UK Health Security Agency (UKHSA) Chemicals and Environmental Effects Department (CEE). The workshop was held to follow up issues, gaps and priorities highlighted in the UKHSA's Fourth Health Effects of Climate Change (HECC) Report (2023).

This was the first HECC report to contain a chapter dedicated to the impacts of climate change on human exposure to chemicals, although exposure to chemicals was considered in the context of environmental hazards, such as flooding and air quality, in previous reports. The HECC report highlighted the need for further exploration of the interactions between chemical hazards and public health.

Scientists from across UK governmental agencies, academic institutions and NGOs were invited to a two-day workshop to discuss needs, gaps and opportunities in relation to our knowledge of chemicals and climate change interaction with human health.

Examples of key gaps identified include limited resources and a lack of understanding of current and changing chemical exposures across populations, along with their resulting health effects. This includes gaps in knowledge about pathways and routes of exposure, such as those arising from new technologies, practices, chemicals and waste streams, extreme events, changing environmental conditions and human behaviours. In addition, there are significant gaps in understanding what impact these changing conditions will have on the interaction between environment and health, when combined.

Key conclusions:

There are considerable gaps in our knowledge and collaboration around the interaction between chemical hazards, climate change and public health.

This is an area of interest for scientists across government departments, health and environmental agencies, NGOs and academia.

Barriers to progress include the broad scope and scale of the nexus and limited resources, while public pressure, political interest and financial resources are key levers for action.

There are opportunities to build knowledge and partnerships in this area.

Priority areas for action include improving leadership and coordination, collaboration, communication and raising awareness of chemical-associated risks

Participants support the establishment a health-focused interdisciplinary and cross-sectoral climate change and chemicals network.

1. Introduction

This document reports on a workshop funded by the National Institute of Health Research (NIHR) Health Protection Research Unit (HPRU) in Environmental Change and Health, and jointly organised by the London School of Hygiene and Tropical Medicine (LSHTM) and the UKHSA Chemicals and Environmental Effects Department (CEE). The workshop was designed to follow up on and expand on the issues, gaps and priorities highlighted in the Fourth Health Effects of Climate Change (HECC) report, December 2023, which included a discrete chapter dedicated to chemicals[1].

Scientists from across UK governmental agencies, academic institutions and NGOs were invited to a two-day workshop to discuss needs, gaps and opportunities relating to our knowledge of chemicals and climate change interaction relating to human health impacts.

The objectives of the workshop were:

1. to bring together those working on and interested in addressing the interaction between chemical human health hazards & climate, to reduce and prevent negative impacts on environmental public health.
2. to support work on the health impacts from climate change and chemical hazards interconnectedness and identify adaptation measures.
3. to review, collectively identify and prioritize key areas of concern and gaps relating to climate change and chemical hazards and public health.
4. to identify funding opportunities.
5. to create a health focused climate change and chemicals network.

The intended outcomes from the workshop were:

1. Produce a workshop report for the HPRU and workshop participants identifying collective understanding of environmental public health priority areas, gaps identified and other outcomes of the workshop.
2. Develop a chemicals and climate change network.
3. Produce a journal article from workshop findings identifying gaps and opportunities created and potential authors identified.
4. Identify potential research and funding opportunities.

This document summarises the presentations, discussions and findings of the workshop.

[1] https://assets.publishing.service.gov.uk/media/65705ea1739135000db03bc1/HECC-report-2023-chapter-12-chemicals.pdf

2. Workshop Overview

The interactions between chemical management, public health and climate policies (adaptation and mitigation) are many. Addressing these issues requires the perspectives of multiple disciplines and policy areas to understand needs, gaps and opportunities.

2.1 Participants

Participants were identified from the academic, public and non-governmental organisation sectors to ensure representation from a breadth of relevant subject matter expertise from different relevant disciplines, with an interest in chemicals and health or climate change or both. Representatives from government agencies were selected primarily based on their role in science and or research within the public sector and to ensure a good breadth of disciplines, particularly environment, human health and animal health. A total of 39 participants were invited and 30 attended the workshop. A full list of organisations represented during the event can be found in Appendix 1. A broad spectrum of participants were invited, including those from governmental, non-governmental and academic institutions. Many others not listed in Appendix 1 were contacted and indicated an interest in attending, but were unable to.

2.2 Workshop content

The workshop comprised PowerPoint presentations, group and plenary discussions, interactive activities using flip charts and props, and the use of the Mentimeter survey tool. Figure 1 provides an overview of the workshop programme. For the full agenda of the workshop, see Appendix 2.

Activity type	**Content**				
Presentations	Climate Change and Chemical Hazards & Public Health	Topic context	UKHSA Health Effects of Climate Change Report 2023	Chemicals, Climate Change and Flooding	Climate Change Risk Assessment 4 (CCRA4) - Evidence report.
Interactive group activities	Chemicals and Climate Change areas of concern workshop. Part 1 – identifying issues and knowledge gaps	Chemicals and Climate Change areas of concern workshop. Part 2 – identifying priorities	Identifying levers and barriers to addressing the interaction between chemicals and human health & climate change Part 1 – discussion of levers and barriers	Identifying levers and barriers to addressing the interaction between chemicals and human health & climate change Part 2 – ranking levers and barriers	

Activity type	Content				
Plenary discussions	Developing a sustainable climate change and chemicals network/community of practice.	Journal Paper	Next Steps		

Figure 1. Summary of workshop content by session type

Presentations

Climate Change and Chemical Hazards & Public Health

UKHSA provided an introductory presentation, outlining the workshop background, its objectives and intended outcomes. The presented need for the workshop included increasing knowledge about the interaction between chemical hazards, climate change and human exposures, and the complexity of those interactions.

Introduction to Topic

This centered around a brief developed by the University of Cape Town (UCT) and LSHTM: *Chemicals and Climate Change Nexus: Interventions to reduce interdependencies and their impacts*. The brief comprises a summary of the problem; relevant climate change policy; ways that climate change can exacerbate health impacts, linked to chemical exposure; and a call for action comprising interventions to reduce the health impacts of climate change-mediated chemical exposure.

UKHSA Health Effects of Climate Change Report 2023

To further explore the relationship between climate change, chemicals and health effects UKHSA presented an overview of the chemicals chapter of the UKHSA HECC report.

A brief summary of each section was provided, including gaps identified and recommended next steps within the chemicals chapter, highlighting the challenges of such a complex topic. The sections within the HECC report were identified based on the topics which emerged through the literature review, specifically:

- Chemical fate and behaviour in the environment
- Chemicals from agricultural settings
- Chemicals from industrial settings
- Contaminated environmental media (land, water etc.)

Discussions after the presentations included suggestions for increasing the visibility of the HECC report in both scientific and policy communities. One suggestion was to create a Parliamentary Office Science

and Technology (POST) note to raise awareness amongst policy makers. It was also suggested that publishing articles on the Chemical Watch and ENDS Report websites could enhance visibility.

Chemicals, Climate Change and Flooding

LSHTM presented a global scoping review on research papers on the impact of flooding on chemical contamination with a risk to human health. The majority of studies found were from North America and Europe, with a considerable number focussed on a single flood disaster (Hurricane Katrina). The review highlighted gaps in evidence regarding the mapping, modelling and monitoring of human exposures to chemicals following a flood event. A small number of epidemiological studies were found that looked at an association between chemical exposure and health outcomes. The review highlights key groups at higher risk of chemical contamination following a flood event, including first responders, children and workers.

Consideration of Chemical Contamination in the Climate Change Risk Assessment for the UK

The UK has a statutory process for undertaking regular assessments of climate change risks to health and infrastructure (as well as natural environment and other sectors). The Third Climate Change Risk Assessment Report (CCRA3) was published in 2021 and flooding is assessed as one of the biggest risk to health and wellbeing from climate change. The evidence report for the 4th Climate Change Risk Assessment report (CCRA4) is currently being drafted by independent scientists. This technical report will be sent to Defra who are responsible for preparing the overarching CCRA document. The national risk assessments are used to inform the national adaptation plan (NAP), which sets out the actions that government departments will take to adapt to the impacts of climate change, in order to ensure a "well-adapted UK".

The CCRA3 report addressed chemical risks in relation to flooding / heavy rainfall impacts on infrastructure; wildfires; drought and water quality; algal blooms; and sea level rise affecting landfills and waste sites on the coast.

Adaptation planning in the UK aims to be effective, economical and equitable. Important considerations were highlighted to be: actions with minimal unintended consequences, and preparing now for outcomes with long lead-times. There are many barriers to adaption, including:

- fragmentation of services (especially in health and social care sectors)
- lack of appropriate governance e.g. co-ordination or integration of efforts between and within national and local authorities; limited links to local communities
- lack of co-ordination with other policies e.g. Net Zero
- lack of knowledge and research to provide greater granularity in flood risk and damage estimates
- low perceptions of risk (heatwaves and floods) in decision-makers
- lack of robust indicators for monitoring improvements in response/adaptation

It was highlighted that the CCRA does not align to the UK National Risk Register but may align with local risk registers.

3. Climate change and chemicals

3.1 Interactive group activities

Chemicals and climate change areas of concern workshop.
Part 1 – identifying issues and knowledge gaps

The purpose of this workshop activity was to collectively identify key threats to public health and information / evidence gaps on the interaction between chemical hazards, climate change and public health. Participants were allocated one of 5 topic groups, as shown in Figure 2.

Participants were also asked to focus discussions on:

- scientific rather than policy considerations
- England as the geographic area
- routes of exposure – both contamination (e.g. air, land, water, food) and human exposure (e.g. inhalation, ingestion, dermal contact)

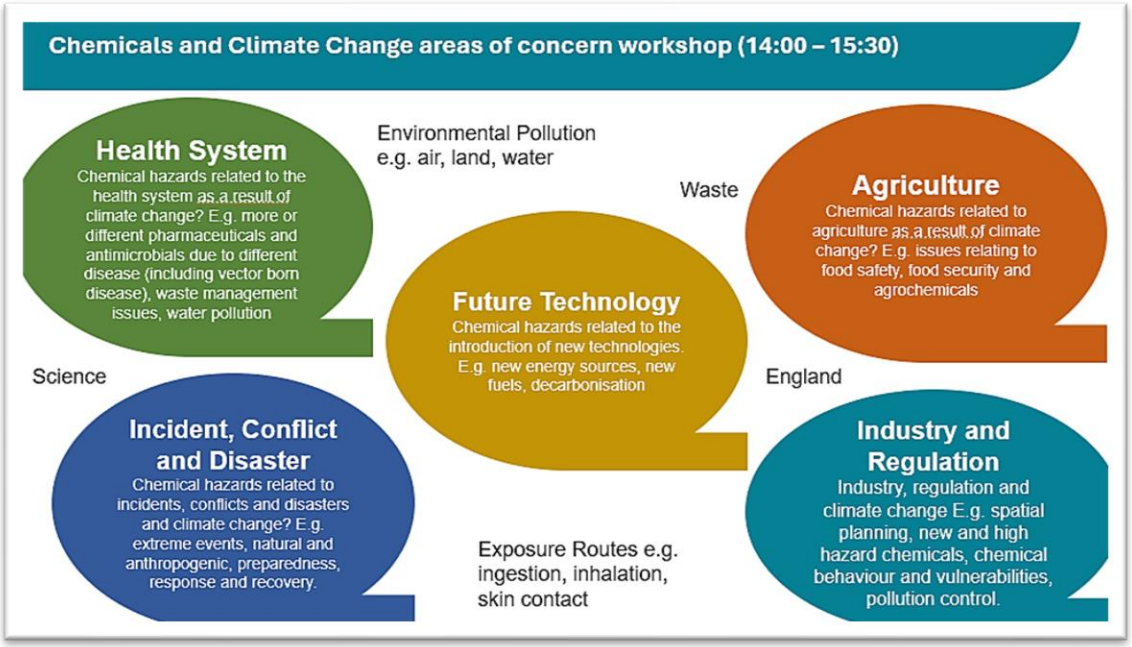

Figure 2. Five themes to stimulate discussion on needs and gaps in relation to chemicals, climate change and public health interaction.

The groups were asked to produce four key gaps, these are summarised in Figure 3 (a complete list of gaps identified by participants can be seen at Appendix 3).

Health System	Future Technology	Incident, Disaster and Conflict	Agriculture	Industry and Regulation
Gap in our understanding of current chemical exposures and if and how these are changing with time and in different population groups.	Gap in our understanding of the impact on health (e.g. fate and behaviour) of new technologies e.g. nanomaterials.	Gap in understanding of pathways to exposure from chemicals (are exposure routes realistic).	Gap in understanding of risk to receptors due to use of pesticides and agrochemicals due to changes in growth seasons and pest dynamics.	Gap in knowledge of combined effects and stressors (improvement in sharing of lessons learnt required).
Gap in understanding of how infectious diseases change chemical exposures.	Gap in our risk assessment knowledge for new technology or new applications of existing technology e.g. maritime fuels, hydrogen in cars.	Gap in understanding on connectivity between environment and health – One Health.	Gap in understanding of presence of chemicals in the human environment and other receptors / pathways e.g. biomonitoring.	Gap in available resources e.g. for regulation, monitoring, attribution, independent research, research translation.
Gap in our understanding of use of pharmaceuticals and their disposal and storage and changes in medical practices and functioning of health system.	Gap in our understanding of risk associated with geo-engineering applications to manipulate weather e.g. cloud seeding.	Gap in understanding of risks in domestic settings (homes and gardens) following floods.	Gap in our understanding of the impact of pesticide use on soil carbon sequestration and soil health.	Gap in understanding of impact of industry on regulation e.g. lack of independent data, misinformation, dilution of health effects, accountability.
Gap in understanding of changing harms including new exposures to chemicals (e.g. relating to our ability to respond to extreme events)	Gap in our understanding of all elements of lifecycles e.g. dealing with novel waste streams.	Gap in understanding of contamination of food following floods and links to food industry.	Gap in post authorisation monitoring of pesticides (e.g. health and effect on various species and environments).	Gaps in information e.g. where they are, what they are, monitoring data/info, industry guidance.

Figure 3. Summary gaps identified by topic groups.

Chemicals and climate change: areas of concern workshop.
Part 2 – identifying priorities

The second part of the “areas of concern workshop” was intended to provide an opportunity to explore the complexity of the topic through attempting to conduct a subjective prioritisation activity for the twenty gaps identified across the 5 topics. Using an online survey tool, participants were asked to rank each gap (using a numerical scale) based on a combination of “public health impact” and “urgency”. The activity highlighted that such simple subjective ranking is not a useful approach to understanding priorities for these gaps, though it did provide valuable opportunity for discussion. Figure 4 presents the output from the survey tool which shows the average ranking of each gap. Most are mapped in the middle due to wide range and variability of answers from individual participants.

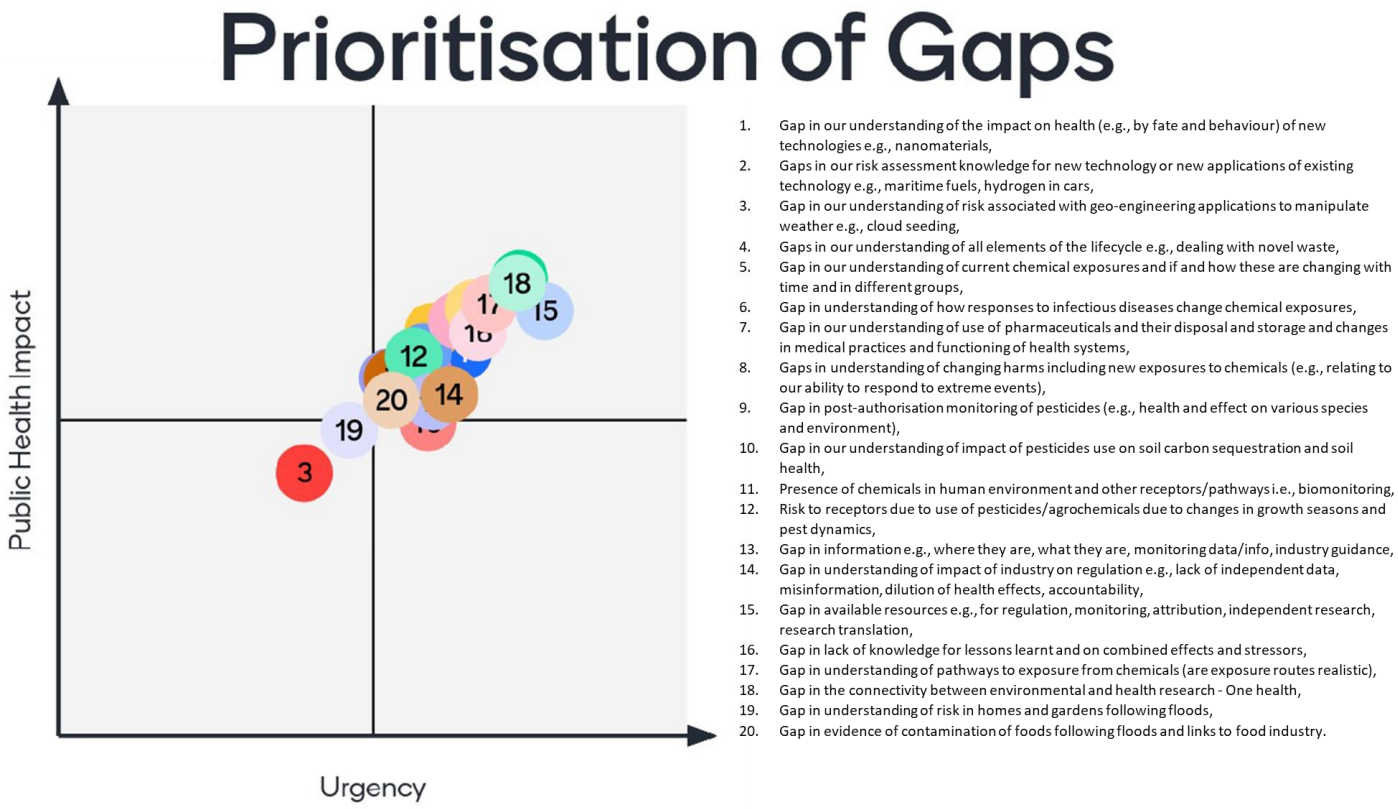

Figure 4. Summary of gap prioritisation activity.

It was suggested that an evidence review / gap mapping exercise (e.g. stakeholders involved to map evidence gaps from each sector, activities around data collection and research) with a more diverse group of people could better prioritise these topics. Some government departments may have already highlighted certain areas as priorities and may therefore potentially give an indication of available funding. In addition, a legislative roadmap looking at milestones over the next 5-10 years to see how policy is likely to develop versus identifying gaps in science. The importance of identifying the easily achievable actions to give answers more quickly was also identified, however more complex issues that take longer to address should not be overlooked, since they may be fundamental in answering some questions.

Identifying levers and barriers to addressing the interaction between chemicals, climate change and public health

This session aimed to identify and discuss levers and barriers to addressing the interaction between chemicals, climate change and public health; as well as potential mechanisms for action to overcome or capitalise on these. In addition, participants were asked to identify (where possible) current ownership of the barriers or levers and / or who should deliver mitigatory actions.

Participants were asked to consider the barriers and levers reported by all groups, select five per working group and rank from 1 to 5, with 1 being the highest impact or priority rank. For the purpose of

prioritisation, similar responses were combined under common themes. Participants were also asked which three barriers should be considered a priority for action.

The broad **scope and scale** of the issue was identified as the greatest **barrier**, with resources available to address the issue being ranked second.

Public pressure and political interest were identified as the greatest **lever**, with financial resources available to address the issue being ranked second. For a detailed list of the levers and barriers, see Appendix 4.

Figure 5 summarises the key themes captured during the plenary feedback session on levers and barriers to addressing the interaction between chemicals, climate change and public health, and their ranking based on the output of the interactive online survey.

Levers *(ranking result)*

1. Public pressure & political interest
2. Financial resources (provision / access to)
3. Regulation (range of existing and potential regulation)
4. Harnessing partnerships and broad engagement e.g. including NGOs
5. Research opportunities, co-benefits
6. Evidence synthesis (inc. new methods)
7. Innovation (e.g. safer alternatives)
8. Simplifying the issues / science and explaining benefits (better communication)
9. Encompassing within and applying an “all hazards approach”
10. Industry action (developing or adopting good practice)
11. The breadth of the topic means there are a number of areas of interest, which could be a lever to enable a range and breadth of research and action
12. Policy drivers e.g. adaptation policies

Barriers *(ranking result)*

1. The broad scope and scale of the issue
2. Availability or access to funding and resources (inc. expertise)
3. Lack of awareness and understanding within broader climate community of chemical risk and hazards
4. Uncertainty regarding governance / ownership of the chemicals and climate issue
5. Siloed working and lack of communication between relevant sectors
6. Limited data - limited access and availability of information
7. Leadership and people organisation – lack of a coordinated approach
8. Conflicting interest
9. Current baseline unknown– regarding chemical presence in the environment and human exposure (see also, limited of data)
10. Reactive approach
11. Different knowledge set and approaches between chemicals and climate change

Figure 5. Levers and barriers identified by participants and collective ranking of importance.

Based on 21 individual results from the ranking activity, the following were identified as the top three areas of action for the group, all of which relate to improving communication and collaboration:

- Leadership and people organisation – coordination
- Communication and information sharing – collaboration
- Awareness and understanding of chemical associated risks among those involved in climate change research – communication

Potential funding opportunities were discussed, including seeking joint proposals and exploring collaboration with agencies such as Defra, DHSC and FSA which could influence UKRI to fund relevant research agendas. Additional funding sources were suggested, including: FERA (Food and Environment Research Agency), the Wellcome Trust, the Bill and Melinda Gates Foundation (focusing on the social aspects of disease and disasters), Royal Society of Chemistry (RSC), with the latter also serving as advocates and champions for this work.

3.2 Developing a network/community of practice

Developing a sustainable climate change and chemicals network / community of practice

This activity was led by LSHTM and was intended to explore views on the need for a network at a global and or national level to address gaps identified through the workshop discussions. The session was designed to pose questions to the participants in groups, inviting views based on the interpretation of the questions and individual and group perspectives. These questions can be seen at Figure 6.

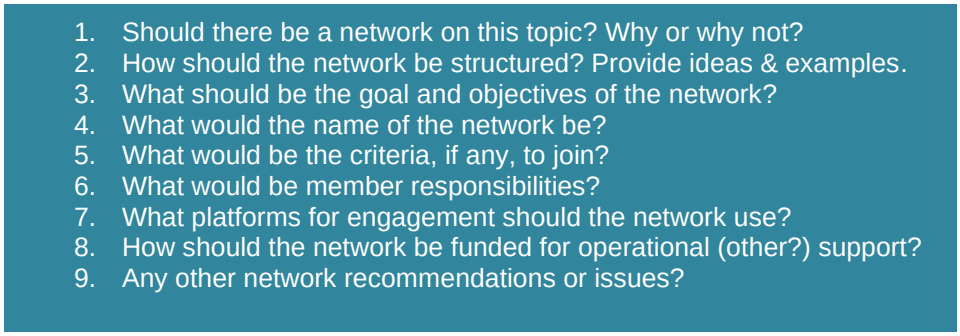

Figure 6. Questions used to guide network group discussion

Each of the five groups deliberated the questions below and were then asked to feedback their views, which were captured, and key comments are presented here.

1. Should there be a network on this topic? Why or why not?
    - Participants generally supported the idea of a network due to the potential to address some of the gaps and levers and barriers identified through this workshop.
    - The need to be clear on both the objectives of the network and the geography were raised as important considerations.
    - UK focussed policy and science colleagues may be interested in a UK network, but not a global network.
2. How should the network be structured? Provide ideas & examples.
    - The need to link the structure of the network to the objectives was raised as important consideration when deciding on the structure.
    - Ideas shared included a UK government managed network, a research-led network and a network where all were welcome (including industry and members of the public).
    - Need for moderators to facilitate engagement across the group
    - Establishing a committee or a steering group to coordinate efforts and create a framework for reporting

3. What should be the goal and objectives of the network?
    - Sharing of subject matter information and knowledge
    - Sharing of research opportunities and interests
    - Improving communication and collaboration
    - Influencing policy
    - Improve working across government to progress action in this area
4. What would the name of the network be?
    - Would depend on objectives and structure etc. but it was suggested to include chemicals, climate change and human health. Other suggestions included reference to Planetary Health, One Health and Health. An example of suggested name included "*Network on the Impact of Chemicals and Climate on Health and the Environment (NICCHE)"*
5. What would be the criteria, if any, to join?
    - Would depend on the objectives of the network. UK government network might not include other sectors. But a broader network could include any sector, depending on the aims.
6. What would be member responsibilities?
    - Would depend on the objectives and structure of the network, but ideas included sharing of information, research opportunities, communication opportunities, providing presentations and contributing to discussions.
    - Potential for different levels of membership
7. What platforms for engagement should the network use?
    - Would depend on structure and purpose of network, but ideas including Teams, WhatsApp, LinkedIn, an email distribution list, a website and newsletters.
8. How should the network be funded for operational (other) support?
    - No immediate specific funding ideas for such a network were provided. Management of a network via a research project or via government grant-in-aid funding may be possible, depending on the purpose and objectives of the network and availability of funds.
9. Any other network recommendations or issues?
    - It was highlighted as important to have clear aims, objectives, outputs and outcomes from the network to ensure it was linked to action.
    - Starting small (e.g. as a closed group) before broadening to key organisations and individuals
    - Partnerships with other, existing networks
    - Network to potentially organise specialist events

An evaluation form was also used to capture individual interest in joining a network. Through the evaluation form, the majority of participants indicated they would be interested in joining a network.

4. Conclusions

The workshop highlighted the need for dialogue and collaboration on the intersection of chemicals, climate change and human health. Hearing viewpoints from different sectors also highlighted the need for increased knowledge to address the gaps and complexities in this area, but also recognised opportunities to build understanding, evidence, awareness and collaboration. This nexus is of interest to scientists and professionals working across government, academia and NGOs.

The workshop met its set objectives by bringing together various stakeholders with interest in the area from government, academia and NGOs to support ongoing work to address issues related to chemicals, climate change and associated health impacts. The group of multi-sectoral stakeholders collectively identified key areas of concern, gaps, barriers and levers related to this nexus.

The workshop provided an engaging and productive platform for participants, who reflected positively on various aspects of the event. Participants particularly valued the richness of the conversations, group discussions and other interactive components of the workshop, which facilitated networking and meaningful knowledge exchange across diverse sectors. Hearing viewpoints from different sectors broadened the understanding of current research, gaps, challenges and opportunities at the intersection of chemicals, climate change and human health, providing a clearer picture for future efforts in this area.

Examples of key gaps identified across the five topic areas (Health System; Future Technology; Agriculture; Incident, Conflict and Disaster; Industry and Regulation) include limited resources and a lack of understanding of current and changing chemical exposures across populations, along with their resulting health effects. This includes gaps in knowledge about pathways and routes of exposure, such as those arising from new technologies, practices, chemicals and waste streams, extreme events, and changing environmental conditions and human behaviours. In addition, there are significant gaps in understanding combined effects and stressors under these changing conditions, as well as a limited understanding of the connectivity between the environment and health.

The simple, subjective, key gap prioritisation activity, whilst providing valuable opportunity for discussion, proved not to be meaningful approach to understanding these priorities due to a wide range of views from stakeholders.

Stakeholders also identified key barriers and levers grouped under these common five themes, and were also prioritised. The broad scope and scale of the nexus was identified as the greatest barrier, followed by the limited resources available to address the issue. On the contrary, public pressure and political interest was identified as the most significant lever, with the availability of financial resources ranked second.

Participants generally supported the idea of establishing a health-focused climate change and chemicals network with clear objectives as a means to collaborate, raise awareness and address some of the gaps, levers and barriers identified during the workshop.

Overall, the workshop was seen as a valuable step forward and most participants are interested in staying engaged and contribute to ongoing and future work in this area, including a journal paper and joining a network.

5. Next Steps

There was strong agreement among participants on the importance of forming a network to raise awareness, foster ongoing collaboration and maintain momentum in this area. To build on the success of this workshop, the diversity of sectors contributing should be widened, including a broader range of groups (such as industry and NGOs) to further enhance knowledge exchange and outcomes. Future meetings and / or workshops should be arranged to ensure sustained progress in this area.

The following were identified as the top three areas of action, all related to improving communication and collaboration: Leadership and people organisation (coordination), communication and information sharing (collaboration), and awareness and understanding of chemical associated risks within the climate change community (communication). Examples of potential next steps discussed included undertaking an evidence review / gap mapping exercise with a more diverse group of stakeholders to better prioritise gaps in this area. Other steps could involve seeking funding opportunities, such as identifying government departments that have already established certain areas as priorities, which may provide insights into available funding and setting up a health-focused climate change and chemicals network. In addition, developing a legislative roadmap to outline milestones over the coming years could help assess how policy is likely to develop in relation to gaps in scientific knowledge. The importance of identifying ‘quick wins’ for short term action, as well as areas with measurable impacts, was also highlighted.

A key outcome of the workshop was to generate context for the development of a journal paper to highlight areas for progression in relation to the topics covered in the workshop. It was agreed that the target for submission of the paper for publication would be February 2025, with an outline being produced by the end of December 2024.

Further Reading

- HECC Full report – https://www.gov.uk/government/publications/climate-change-health-effects-in-the-uk
- HECC chemicals chapter - https://assets.publishing.service.gov.uk/media/65705ea1739135000db03bc1/HECC-report-2023-chapter-12-chemicals.pdf
- HPRU in Environmental Change and Health - https://www.lshtm.ac.uk/research/centres-projects-groups/hpru-ech#welcome
- CCRA3 - https://www.ukclimaterisk.org/

Appendix 1. Participants

Organisations represented at the workshop

Government Organisations
Animal and Plant Agency (APHA)
Department for Environment, Food and Rural Affairs (Defra)
Department of Health and Social Care (DHSC)
Environment Agency (EA)
Health and Safety Executive (HSE)
Maritime and Coastguard Agency (MCA)
UK Health Security Agency (UKHSA)
Non-Government Organisations
Pesticide Action Network (PAN)
CHEM Trust
Academia
Brunel University of London
London School of Hygiene & Tropical Medicine (LSHTM)
University College London (UCL)
Queen Mary University of London (QMUL)
University of Cape Town (UCT)
University of East Anglia (UEA)
University of Reading

Appendix 2. Agenda of the workshop

Agenda

Monday 30th September 2024

Time	**Topic**	**Presenter** (see affiliations below)
10:00 am	Arrive/coffee	
10:15 – 10:45	Ice breaker	Session lead – Andrea Rother Facilitators – Lydia Izon-cooper and May van Schalkwyk
10:45 – 11:15	**Introduction** Purpose of the workshop Workshop objectives and outcomes	Raquel Duarte-Davidson
11:20 – 11: 45	**Topic context** Health and policy issues linked to the interaction between chemicals and human health & climate change.	Andrea Rother
11:50 - 12:20	**UKHSA Health Effects of Climate Change Report 2023** Climate Change and Chemicals overview	Tom Gaulton and Mari Langreiter
12:30 – 12:45	**Chemicals, Climate Change and Flooding** Presenting the Flooding and Chemicals Paper	Filiz Karakas
12:45 – 13:00	Question and Answer session	Session Lead: Sari Kovats
13:00 – 14:00	**Lunch**	
14:00 – 14:30	**Chemicals and Climate Change areas of concern workshop** Overview of topics Introduction of group activity	Session Lead: Lydia Izon-Cooper

14:30 – 15:30	**Chemicals and Climate Change areas of concern workshop** Group activity Part 1 – identifying issues and knowledge gaps	Session Lead: Lydia Izon-Cooper Facilitators: Haydn Cole, Raquel Duarte-Davidson, May van Schalkwyk, Andrea Rother
15:30-15:45	**Coffee Break**	
15:50 – 16:45	**Chemicals and Climate Change areas of concern workshop** Group activity Part 2 – identifying priorities	Session Lead: Andrea Rother
16:45 – 17:00	**Wrap-up** Day 1 summary	Raquel Duarte-Davidson
	Workshop Dinner	

Tuesday 1st October 2024

Time	**Topic**	**Presenter** (see affiliations below)
9:00 – 9:30	Arrive and coffee	
9:30 - 10:00	Overview of Day 1	Raquel Duarte-Davidson
10:05 – 11:00	Identifying levers and barriers to addressing the interaction between chemicals and human health & climate change.	Session Lead: Haydn Cole
11:00 – 11:30	**Coffee Break**	
11:30 – 12:30	**Network, Plenary activity** Developing a sustainable climate change and chemicals network/community of practice. Goals and role of a network	Session Lead: Andrea Rother

	Network membership Funding opportunities Cost Action Funding application	
12:30 – 13:30	**Lunch**	
13:30 – 14:00	**Climate Change Risk Assessment 4 (CCRA4) -Evidence report.** Discussion on how to ensure chemicals are included in the national climate change risk assessment and adaptation planning	Session Lead: Sari Kovats
14:05 – 14:20	**Journal paper** Overview of intention for paper Contributors	Raquel Duarte-Davidson
14:25 – 15:05	**Next steps** Review of workshop outcomes, action plan with timelines and what to expect post workshop	Andrea Rother
15:05 – 15:20	Workshop Evaluation	Lydia Izon-Cooper
15:25 - 15:30	Closure of workshop	Raquel Duarte-Davidson Sari Kovats

Appendix 3. A complete list of gaps identified by participants

Theme	Gaps identified
Health System	• Use of pharmaceuticals and their disposal and storage and changes in medical practices and functioning of health systems • Current chemical exposures and if, and how these are changing with time and for different groups • Changes across groups of chemicals (agricultural, industrial, pharmaceutical, etc.) • Behaviour of less well known and studied sites and chemicals • How responses to infectious diseases will change chemical exposures • Which groups are most vulnerable to chemical exposures • Insufficient knowledge of gaps in current surveillance (such as biomonitoring, environmental and food surveillance) • Exposures due to changes in effords to remain cool • Risks posed by changes in the way medicines behave in people's bodies with changes in temperatures • Changes in the relationship between bacteria and chemicals in the environment • Unknowns associated with changes in exposures as health systems transition to being more sustainable • Changes in human behaviour • Ability to respond to impacts of extreme events and as part of this, changing harms including new exposures to chemicals • Evidence on what is needed, by who and what works and is cost-effective • New exposures due to responses to dealing with emerge of infectious diseases • Risks posed by extreme events → acute exposures and longer-term exposures due to contamination of land, water sources etc. • Risks associated with other practices
Future technologies	• Gap in our understanding of the impact on health (e.g. by fate and behaviour) of new technologies and products e.g. nanomaterials • Gaps in our risk assessment knowledge for new technology or new applications of existing technology e.g. maritime fuels, hydrogen in cars • Gap in our understanding of risk associated with geo-engineering applications to manipulate weather e.g. cloud seeding • Life cycle assessment (e.g. dealing with novel waste) • Where and how to source primary materials (not directly health-related) • Potential regrettable impacts of green chemistry (e.g. bioplastics, batteries, bioremediation) • Desalination in response to wate supply issues • New food sources (e.g. cell cultivated proteins, insects as food) • Research into PFAS alternatives in green transition technology is needed

Theme	Gaps identified
Agriculture	• Gap in our understanding of impact of pesticides use on soil carbon sequestration and soil health • Risk to receptors due to use of pesticides/agrochemicals due to changes in growth seasons and pest dynamics • Post-authorisation monitoring of pesticides (e.g. effects on health and on various species and environment) • Pathways to exposure from chemicals (are exposure routes realistic) • Presence of chemicals in human environment and other receptors/pathways i.e. biomonitoring • Climate impact on pesticide lifecycles (e.g. distribution, predators) • Chemical fate and transport • Impact of climate change to AMR in humans and animals • Increased use of chemicals for cleaning and disinfection in agricultural settings • Growth of vertical farming or cultured / fermented foods could turn diffuse agricultural pollution into controllable point source pollution • Climate change impact on reduced yield, potentially relating to intensification of agricultural chemical application leading to increased runoff and reduced water quality • Use of sewage sludge application
Incidents, conflicts and disasters	• Gap in evidence of contamination of foods following floods and links to food industry • Gap in understanding of risk in homes and gardens following floods • Gaps in understanding of changing harms including new exposures to chemicals (e.g. relating to our ability to respond to extreme events) • What climate information is needed for industry, guidance and site management? • Development of sleeper protocols to have study ready in case of incidents for both health and environment outcomes • Ageing infrastructure → greater likelihood of events due to a harsher environment • Subsurface infrastructure not mapped; heat islands could lead to failure and threaten groundwater • Better mapping of pathways to exposure • Research on enforcement of regulation (risk communication, levers) • Chronic health issues associated with events are often neglected • International dimensions – can our systems detect contamination abroad? • Coastal landfill sites – it is assumed there is no contamination • Routes of exposure – how is at risk? • Evidence on contamination of food following floods – very difficult to identify the source

Theme	Gaps identified
	• Transaction of evidence e.g. on wildfires, chemical risks → need to get into the health literature • Chemical Information Programme (testing of surface water, information publicly available – is there enough sampling and enough chemicals?) • Assessment of industrial sources – which are at risk of extreme weather. Better risk assessments in small companies.
Industry and Regulation	• Impact of industry on regulation e.g. lack of independent data, misinformation, dilution of health effects, accountability • Lack of information e.g. where they are, what they are, monitoring data/info, industry guidanceGap in available resources e.g. for regulation, monitoring, attribution, independent research, research translation • Lack of knowledge and lessons learnt of combined effects (of mixtures of chemicals and mixtures of sources) and climate change related stressors (foresight, planning and modelling – who is responsible?) • Lack of legal action of evidence & information knowledge (e.g. “no data, no market”) • Difficulty of attribution (cost and long time for epidemiological studies) • Need for support to shift burden of proof (who provides proof, how much proof is needed, how to regulate and support regulation for uncertainty) • Need for innovation (e.g. Sustainable by Design) and regulation of them • Need for better monitoring of information regulation • Value chains neglected – lack of baseline • Changing regulation of chemical industry (e.g. demand for fossil fuels) • Net Zero demographic of industry will change (e.g. solar panels) • Insufficient regulation of legacy pollution and regulation on chemical mixtures • Climate change may transfer risks (e.g. dumping waste on UK from EU) • Challenges in monetising environmental harm – need for natural capital approaches • Research to alternatives to harmful and potentially harmful chemicals for industry to transition to • Lack of funding • Frameworks for what can be done and how to achieve something (e.g. stakeholders, benefits, impacts) • Regulation and toxicology gaps for thresholds • Including the cost of inaction in regulation • Gap in the connectivity between environmental and health research. One health approach may bridge this

Appendix 4. A complete list of levers and barriers identified by participants

Theme	Levers and barriers identified
Health System	**Levers** • Political will and public pressure • "disaster politics", the issues that are obvious through big media campaigns • Activism (enhance environmental literacy) • Work with funders – research programme scoping • Opportunities for new collaboration and funding
	Barriers • Transdisciplinary problem (disciplinary silos, specific funding routes) • Ownership of the problem • Scale of the problem – where to start? • Lack of public, political and scientific understanding • Research on chemicals is problematic, very extensive – how to focus? No natural research council
Future technologies	**Levers** • Political interest • Momentum • Good practice guidance (industry) • Increased interest from international community • Co-benefits for public health and industry • Office for environmental protection
	Barriers • Scope and scale of the issue • Unknown / unclear baseline • Lobbying, many groups with vested interest • Challenging evidence-base • Cost / disproportional impact
Agriculture	**Levers** • Stronger policies and regulations, implementation of legislation, regulations and international agreements, especially opportunities post-EU-exit ensuring any regulatory gaps will be filled in, an opportunity to bring in our own regulations in the UK • Better coordination • Generation of evidence-based data to create strong policy, regulation and business cases for funding • Commitment to a global alliance on highly hazardous pesticides • Increasing understanding, which is also a way to get this topic area higher on the agenda (mechanisms to achieve this include advocacy, media,

Theme	Levers and barriers identified
	funding into cross-cutting research), media can act as a tool or mechanism to drive change, influence, or advance progress in this area • More long-term thinking • More holistic risk assessments • Use of precautionary principle • Innovation of safe alternatives • Incentivising industry
	Barriers • Lack of funding and resources • Industry difficulties to turn short-term thinking and reactive action into proactive thinking and action, lack of implementation of best practice • Silo-working and silos of knowledge and expertise and access to that information • Lack of coordination and governance • Lack of profile and awareness of chemicals as part of the climate issue • Lack of commercial interest • Research priorities • Local Councils' lack of information on heavily contaminated sites
Incidents, conflicts and disasters	**Levers** • Public pressure • Drivers and leadership e.g. networks for levers • Ensuring the provision of the right evidence, simplifying and grouping the science to support understanding • The health sector has the potential to serve as a bridging area between chemicals and climate change • Funders taking a more active role in initiating and directing specific projects, initiatives, or research efforts • Adaptation to policies to act as a driver • Evidence synthesis and investment in it
	Barriers • Lack of resources in terms of money, time and expertise within organisations • Funding and scientific disciplines kept in silos • Climate change and chemicals are inherently academically done in different ways, adding to barriers • Need to bridge different areas, e.g. potentially need a specific focus e.g. pesticides, mine wase for lithium, enhanced risk assessments • Lack of public pressure
Industry and Regulation	**Levers** • Cross-cutting research, all-hazards approach could bring it all together and ensuring working all working in same kind of space

Theme	Levers and barriers identified
	• Incorporating sectors, disciplines and partners that are currently not represented • Partnership across sectors, departments and agencies, such as a network to drive this • Policy levers for adaptation • Public pressure • Technology and expertise within the industry sector **Barriers** • Climate change is seen as an 'add-on', an additional task, rather than an integral part of core responsibilities, it can be deprioritised • Lack of leadership, none of the sectors taking leadership • Lack of engagement between different sectors, there is no forum for bridging the sectors • Lack of resources and capacities • Funding models which promote silo working • Cross-cutting benefits not always considered

About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation health secure.

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