UK Health Security Agency

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

# Chemical food safety in the context of food security and climate change

A one-day workshop held in November 2024

## Summary report

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. The views expressed are those of the workshop attendees and not necessarily those of the NIHR, UK Health Security Agency, London School of Hygiene and Tropical Medicine, University College London, the Met Office or the Department of Health and Social Care

The workshop held in person at the UKHSA London office, Canary Wharf, 10 S Colonnade, London

# Contents

# Summary

Climate change will impact on the distribution of chemicals in the environment, and as a result affect population exposure to these chemicals from food. This document summarises discussions held at a workshop organised by the National Institute of Health Research (NIHR) funded Health Protection Research Unit in Environmental Change and Health (HPRU ECH). This HPRU is a collaboration between the UK Health Security Agency (UKHSA) Environmental Epidemiology Team and the London School of Hygiene and Tropical Medicine (LSHTM).

Academics and scientist from within the UK and internationally were invited to a one-day workshop to discuss chemical food safety in the context of climate change and food security. Attendees from government departments, universities and non-governmental organizations were represented at the workshop.

**Key discussions:**

Understanding chemical food safety in the context of climate change is an area of interest for many stakeholders in academia, government, and non-governmental organization. There was a call for a formal network of experts and stakeholders.

Many climate change policies lack a focus on the impact on chemical food safety. This needs to be raised on policy and research agendas to address climate change.

Chemical food safety can be impacted by climate change in a myriad of pathways. These pathways are not clearly mapped, and how these intersect with other pillars of food security is not understood.

There is a need to consider how human behaviour and adaptation to climate change might increase exposures to chemicals from food.

Cross-sector and multidisciplinary collaborations are needed to address this area.

Research gaps identified included an inadequate qualitative and quantitative understanding of the health effects of unsafe food resulting from climate change and need of monitoring and surveillance of population exposure to chemicals through food.

# Introduction

Climate change is recognized as a threat to food security, with effects on food systems and agriculture[1]. Climate change is expected to affect the distribution and concentration of chemicals in the environment and to affect food safety[2,3]. Potential impacts on the distribution of natural contaminants, heavy metals and anthropogenic factors like pesticide use can be anticipated that may threaten food safety and public health. The emerging risks from environmental contaminants in food due to climate change are not well understood and have received little attention from research, policy, and public health communities. The impact of climate change on population exposures to chemicals is an area requiring research, monitoring and active surveillance. A better understanding of those impacts will enable the identification and implementation of mitigation and adaptation interventions.

The UK Health Security Agency (UKHSA) prevents, prepares and responds to all hazards to protect population health and livelihoods. These includes environmental hazards like chemicals that may directly or indirectly threaten health. The UKHSA works in partnership with universities to deliver some of these functions, including partnerships such as the National Institute of for Health and Care Research's (NIHR) Health Protection Research Units (HPRU). This workshop on Chemical Food Safety in the context of Climate Change and Food Security held under the auspices of the HPRU on Environmental Change and Health which is in partnership with the London School of Hygiene and Tropical Medicine.

# Aims of the workshop

The workshop was held to:

1. facilitate discussion among key stakeholders on the need for a better understanding of the interactions between climate change and food systems that include food safety

[1] HECC-report-2023

[2] Health Effects of Climate Change. Impact of climate change on human exposure to chemicals in the UK 2023

[3] Climate change as a driver of emerging risks for food and feed safety, plant, animal health and nutritional quality | EFSA

as well as food security: a secure food system is one that ensures safe and nutritious food is available, affordable, accessible, and sustainable.

2. to bring together stakeholders from diverse backgrounds with expertise both from within the United Kingdom and internationally. This includes stakeholders interested in, or working to, investigate the interactions between chemical food safety and climate change.
3. to identify surveillance, research gaps, needs and priorities.
4. to create a network of stakeholders from within Government Departments, academia and other organizations with interests in, and programmes on, climate change.

# Planned outputs

- An Executive Report
- Publishable paper
- A Multi-disciplinary and Cross-sectoral Network (to be explored)
- A follow-up event

# Participants

Seventy-two participants were identified and invited from government organizations, academia, and non-governmental organizations in the UK and internationally. The choice of participants was based on the need to ensure representation from key stakeholders in climate change and chemical food safety. The workshop deliberately excluded industry stakeholders and those with commercial interests. Twenty-two participants attended the workshop representing a range of disciplines and public sectors (see Acknowledgements). Ten attendees unable to attend, indicated an interest in future collaborations. The workshop held in person and a number of attendees not able to travel to London attended online.

# Keynotes and presentations

The keynote presentation was given by Prof. Erik Millstone of the Science Policy Research Unit, University of Sussex. The keynote addressed food safety in the UK, climate change and chemical contamination and showed how food safety needs to be embedded within a secure food system, with food security being depicted as a sufficient, sustainable, safe, nutritious and affordable supply of food. Prof. Millstone highlighted the impact that contrasting extremes of weather and climate change such as floods and droughts can have on chemical exposures from food and water. The keynote was used to emphasize the need for a collaborative approach to address the gaps in our knowledge that, if filled, could inform policy and action to mitigate the impact of climate change on food safety and security – a collaborative approach focussed on the protection of public health.


*Figure 1: K Parsons, Who makes food policy in England? Food Research Collaboration, May 2020* [4]

An important gap is the prevailing lack of consideration of chemical contamination of food when the impacts of climate change on the food system are considered within the current

[4] Who-makes-food-policy-in-England

policy and research landscape[5]. When food safety is considered, this is often with regards to microbiological hazards and foodborne illnesses, with little or no attention to chemical food safety. Whilst there is recognition that climate change will impact the UK food system, there needs to be more proactive focus on the surveillance of chemicals that may be impacted by climate change.

One of the challenges with tracking chemical exposure is that the resulting health effects are mostly chronic and long term, as opposed to microbiological hazards which overwhelmingly produce immediate or acute health effects that are easily identified, traced and quantified. Consequently, changing patterns of chemical exposures, and their adverse effects, as a result of climate change, could go undetected and unrecognised. This implies a need for active surveillance of a range of possible contaminants, as passive surveillance cannot be relied on to provide the requisite evidence or to quantify adverse effects. There needs to be an official recognition of this gap, clear allocation of responsibilities, accountability, and resources for surveillance, reporting and risk management or mitigation.

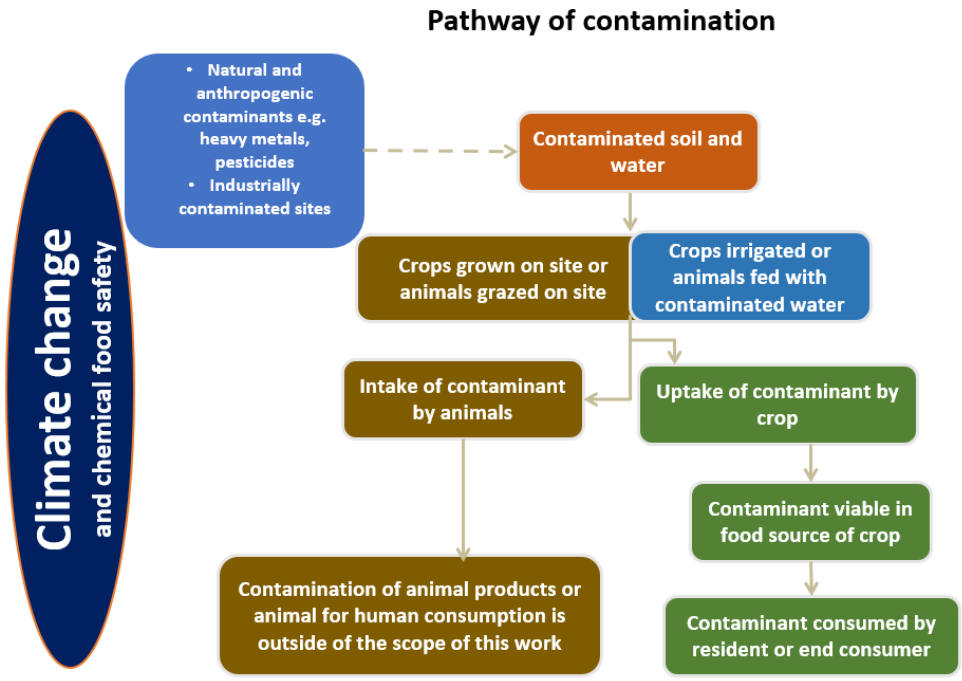


*Figure 2: A pathway of exposure to chemicals through food*

[5] Impact of Climate Change on the UK Food System | Published in FSA Research and Evidence

Other presentations focused on characterising the gaps in policies addressing climate change while ignoring the possible changes to chemical contamination in food. Dr May van Schalkwyk provided an overview of the policy landscape in relation to chemical food safety and climate change. Results of work aimed at investigating the extent to which and how food safety is considered in key climate change policy documents were presented (Figure 3). These showed that a focus on food safety is lacking within major policy reports and evidence reviews that aim to raise the describe and explain significance and implications for food security in the context of climate change.

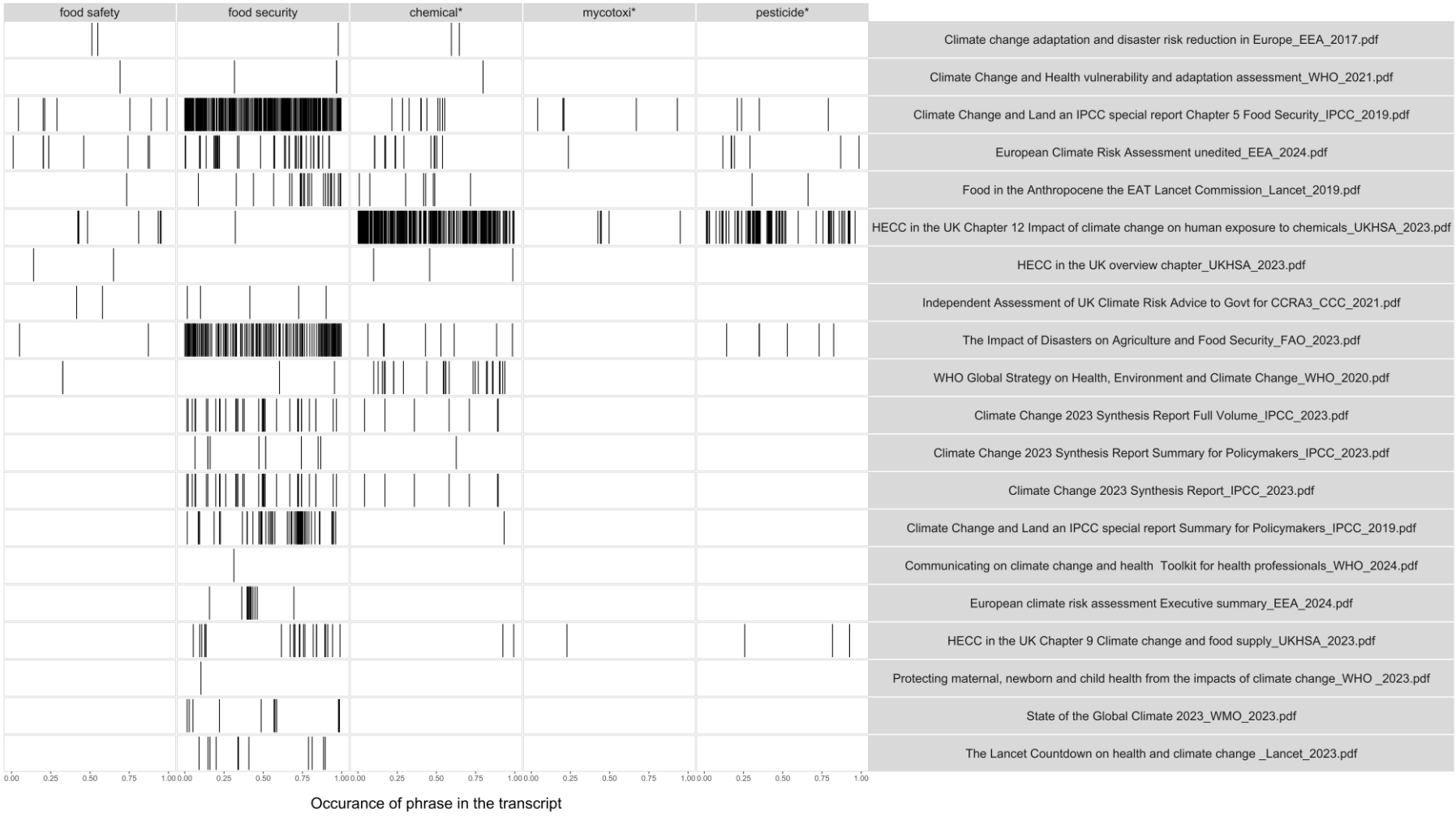


*Figure 3: Occurrence of food safety-related phrase in climate change policy documents. Each black line represents an occurrence in the document with left to right corresponding to earlier and later in the document respectively. The specific phrases a listed across the top of the figure and the corresponding document name is listed in the final right-hand side panel of the figure.*

Dr Valentina Guercio provided an overview of the work of the Environmental Epidemiology Team at the UKHSA in assessing and addressing population exposure to chemicals in relation to food safety, with case studies on lead, arsenic, and fluoride. The presentation was used to highlight UKHSA's responsibility for the Environmental Public Health Tracking (EPHT) function, which provides surveillance of food related incidents and chronic exposures to chemicals and environmental hazards via food, epidemiological investigations of foodborne illnesses and outbreaks especially those with environmental precursors. The surveillance work implemented through the environmental public health surveillance system (EPHSS) was described, including how the tool supports scientists in providing data for the surveillance and management of food contamination with chemical or environmental hazards.

# Round Table Discussion

**Overarching questions**

At the workshop, a number of overarching questions were posed to stakeholders. These included:

- Question1: How is food safety considered in the context of the health effects of climate change?
- Question 2: What relationships, mechanisms and pathways characterize the interplay between climate change and food safety?
- Question 3: What is needed to enable research, monitoring and action on the ways that food safety is affected by climate change?
- Question 4: What can be done to raise the agenda and build the systems needed to ensure food safety in a changing climate?

In addition, a plenary session addressed this question: What would be the most appropriate research response to the limitations of our knowledge about the likely impact of climate change on chemical contaminants in food?

## Food safety in the context of the health effects of climate change

One of the recognised effects of climate change is its impact on food security. Whilst food security encompasses the availability of sufficient, sustainable, safe, nutritious, and affordable food, food safety is often not visible in climate change and food security considerations. Workshop attendees recognised a need for food safety to be considered in the light of the impacts of climate change effects such as droughts and flooding, heat and cold, and consequent changes to supply chains and the food system as a whole, as well as changes in consumers' behaviour. The impacts on food safety also needs to be considered as part of mitigation and adaptation strategies.

Participants identified some challenges with considering the food safety impacts of climate change, highlighting the broad and uncertain nature of the topic. Current regulatory frameworks covering food safety were not designed to address such complex issues, especially given the variety of impacts that climate change could have on food safety. Those could range from changes in the use of pesticides to the release of heavy metals or

increases in mycotoxin levels in food. A more comprehensive approach was suggested, one that could take into consideration the range of possible increases in contamination and address particular chemical contaminants of interest. This could be supported by research and active surveillance on how climate change impacts on the risks from exposures. Contaminants that are more likely to be impacted by climate change, and which are particularly toxic, could be prioritised.

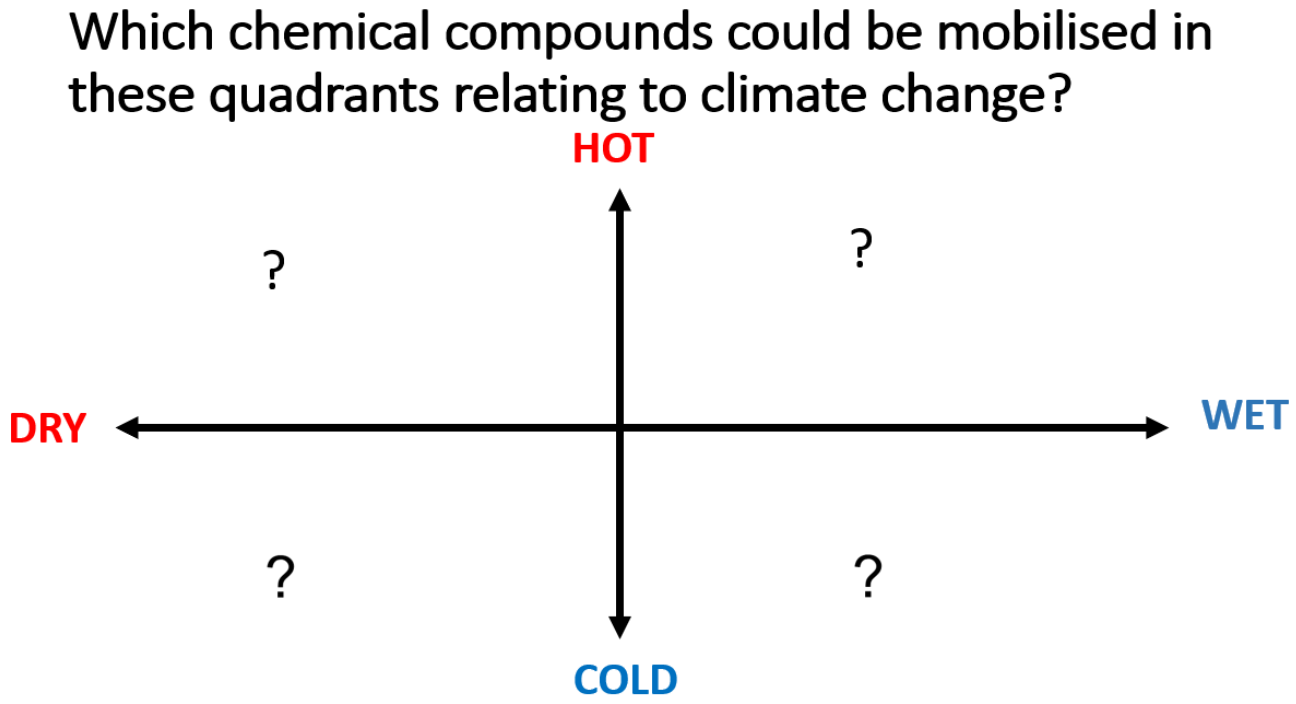


*Figure 4: What chemicals are important and should be prioritised considering four climate change scenarios Source: Professor Erik Millstone, Nov 2024. UK food safety, climate change and chemical contamination.*

Ensuring the safety of food is a continuous responsibility, with climate change expected to complicate the challenges. In order to mitigate the impacts that climate change could have on food safety, it may be necessary to regulate the sources and emissions of chemicals more strictly. The widespread use of chemicals in agriculture and consumer products has led to many chemicals accumulating in the environment, water and soil and consequently those chemicals are entering the food chain. One example is the per- and polyfluoroalkyl substances (or PFAS), which are notoriously persistent, and often referred to as 'forever chemicals'. A precautionary approach that focuses on limiting the release of hazardous chemicals into the environment would help to mitigate the effects of climate change on mobilizing those chemicals into the food chain. Participants recognised the need for many

stakeholder groups to work closely with regulatory bodies responsible for chemicals, for instance with Defra - Department for Environment Food and Rural Affairs and the Health and Safety Executive, UK REACH (UK registration, evaluation, authorisation, and restriction of chemicals) and CLP (classification, labelling and packaging of chemicals) programmes.

Participants highlighted some points to enable enhanced consideration of food safety issues in strategies to address climate change:

- Increased awareness of the links between food safety and climate change need to be made visible to policy makers.
- The links between climate change and chemical exposures, including from antibiotics, are rarely addressed. Decision-making is hampered by insufficient evidence, particularly regarding the burden of chronic diseases linked to chemical exposures. Understanding their combined impact on food safety may be challenging but could lead to improved surveillance and research and contribute to increased attention, prioritization, and action. Establishing a robust evidence base for those interactions will be important.
- There is a need to address how climate change has influenced and will influence the behaviour and toxicity of chemicals, such as pesticides, and the implications of those changes for food safety.

### The relationships, mechanisms and pathways characterising the interactions between climate change and food safety.

It was agreed that the relationships and mechanisms that characterise the interplay between climate change and food security are complex. There are multiple pathways to consider. For instance, multiple climate change scenarios can be expected to affect a variety of chemicals in different ways. The resulting interactions could alter exposures and produce health effects that may affect populations, and sub-groups within those populations, in a range of different ways. Two broad areas were considered for this question:

#### The behaviour of chemicals under different climate change scenarios

There are multiple climate change scenarios, multiple sources of chemicals, and environmental compartments to consider, each potentially influencing chemical dynamics

differently. For instance, climate change may affect chemical levels in food through these scenarios:

- Arsenic absorption increases in rice cultivation under certain conditions such as high temperatures, which exacerbate contamination levels.
- Drought and water scarcity may lead to increased use of groundwater containing high levels of heavy metals for agricultural purposes. Agricultural and industrial pollutants may behave differently under differing climate change scenarios.
- Substances like PCBs and dioxins may exhibit altered behaviour as temperatures rise. Mobilization of chemicals from historically contaminated sites due to flooding could present risks of increased exposures.

These examples highlight the importance of understanding the behaviour of chemicals in various scenarios and their implications for risk assessment and management under changing climatic conditions. It was mentioned that the Environment Agency has been doing some work on climate change and how different chemicals might respond under various scenarios. Whilst it might be beneficial to adopt a comprehensive approach, addressing the complexity of the topic with limited resources would be challenging. Prioritisation may be key to convincing policy makers of the need to prioritise research and surveillance despite prevailing resource constraints.

To initiate work in this area, developing a systems map to illustrate these relationships will be beneficial. This mapping could provide the basis for determining what the key relationships are and how they could be addressed.

**Human behaviour, adaptation to climate change, inequality, and food safety.**

Human adaptation to the effects of climate change including food security is an important pathway to consider. Participants indicated that other component of food security, such as availability and affordability could downplay food safety. The already prevailing issue of food poverty and inequality in the UK could worsen under climate change, increasing concerns that food safety may, explicitly or implicitly, be traded off for food availability and affordability, though this could depend on the severity of food insecurity. For wealthier nations, like the UK, there may be little or no trade off if food is in short supply. Wealthier nations with strict

food standards may easily reject contaminated food, and (or) change trading partners, but only if the contamination is detected and reported. Poorer nations on the other hand may have fewer options.

Human actions to address and mitigate climate change such as adopting increasingly circular economies might contribute to increased exposure to chemicals. This could even be the case for chemicals that have been banned, but which are still present in items, or equipment that get recycled.

## Research, monitoring and informing action on food safety as affected by climate change.

Participants identified the following needs.

1. Appropriate and adequate framing of the need for research, monitoring and surveillance to garner the attention of funders and policy makers. A shared conceptual framework across expert networks is vital. This includes understanding the potential adverse impacts of climate change on food safety, setting objectives, and identifying appropriate indicators.

2. Funding will be crucial. Identification of relevant funding should be accompanied by clear priorities and innovative ideas, as food safety projects, particularly in the context of climate change, often struggle to secure funding.

3. Expertise. Policymakers will need to receive advice from well-informed experts to address the technical and policy challenges. Appropriate expertise will be essential to design and implement research and remediation projects effectively. In terms of near-term action, mapping the relevant stakeholders and experts, as well as building relationship amongst them will be critical. Mapping current partners across England, the Devolved Administrations, and internationally will enable knowledge gaps to be more readily identified, which in turn will facilitate appropriate responses to climate related food safety issues.

4. Multistakeholder collaborations involving the public sector (government and non-governmental organizations), and academia is needed to develop shared goals and

common understanding of the key knowledge gaps. Effective collaboration among diverse expertise and stakeholders will require a shared understanding of terms and challenges like food safety, food security, climate change, and the relevant data requirements. Setting up a working group across government was highlighted as a potential way forwards. New networks and relationships were recognised as necessary to respond to these challenges, alongside a new policy framework to address the issues and challenges.

5. Data. In terms of research, identifying already available data sources that can contribute to answering relevant research questions will be valuable. Participants from the UKHSA highlighted their ongoing work to assess the impact of climate change on baseline arsenic exposures in the UK, using available datasets. FSA representatives highlighted the challenge of identifying longitudinal trends in exposure to chemicals, which will be made worse by climate changes. More collaboration between UKHSA and FSA on data gathering and sharing was highlighted as necessary in this context.

**Some of the research gaps identified include:**

- Qualitative and quantitative health effects of unsafe chemically contaminated foods resulting from climate changes need to be identified and assessed.
- It is important to work across disciplines to build expertise and find solutions, bridging the gap between climate change, food safety, and chemical risk assessment.
- Climate change risk assessments must include currently overlooked chemicals including pesticides, while considering their behaviour under changing climatic conditions.
- A reassessment of research efforts and knowledge gaps is needed to identify current initiatives and unmet needs and to allocate resources effectively.


*Figure 5: Attendees at the workshop*

## Raising the agenda and building the systems needed to ensure food safety in a changing climate.

It was suggested that climate change might not pose novel food safety challenges, but rather that there is likely to be an increase in the frequency and scale of food safety problems. This would imply a need for adaptable processes and responses, as well as new collaborations and networks that will be able to rapidly address food safety issues aggravated by climate change. These processes should enable  accurate risk assessments to be developed quickly (rather than taking months or even years). That framing presupposes that the impacts of increased levels and frequencies of chemical contamination of food are reliably predictable, however, participants contrasted this view with the high levels of uncertainty concerning the

localised meteorological impacts of climate change, some of which could be chaotic with impacts that will be very hard to predict.

A proposal was advanced suggesting that a cross-departmental working group be set up to inform decisions about adapting the roles of agencies and departments to prepare for, and respond to, climate change induced increases in levels of hazardous chemical in the food supply. A key part of those preparations will include identify gaps in knowledge and initiating research to diminish those policy-relevant gaps. A participant from the UKHSA highlighted already existing collaboration with the FSA on emergency issues, citing various examples. Both departments could benefits from identifying, assessing and enhancing their expertise to be adequately prepared to respond when incidents occur at short notice.

The working group would enable a common conceptual understanding across organisations and expert networks, in terms of how threats to food safety in the context of climate change are framed, what will the main be, and which indicators will need to be monitored inform scientific and policy responses. This could be linked with the global work on developing Global Goals on Adaptation and related indicators, led by the FAO and United Nations products of such a working group could be to develop new criteria for safe levels in a wide range of possible contaminants influenced by climate change, taking into account possible changes in the amounts of particular foods consumed, especially in response to food insecurity caused by climate change. For instance, if wheat and/or maize production were curtailed by climate change, an increase in rice consumption may occur to compensate for maize insecurity. This could lead to higher exposures to arsenic.

Participants discussed the need to

1. Identify and map key stakeholders. This should be both national and international experts in agriculture, health, climate change, disaster-risk management; global organizations: WHO, FAO, UNFCCC, UNDRR; statistics community for critical and robust data analysis.

2. Defining the scope and focus of this new agenda: The broad scope of food safety implications of climate change should be understood to include not just microbiological risks, but also toxicological and nutritional ones, and each will deserve particular attention, although an integrating overall perspective will be required. Particular attention will need to be paid to, and by, specific sectors like agriculture and industries such as food processing, retail and food service. Deciding whether to focus solely on health or to broaden the scope further to include social and economic impacts. Studies of food safety should be re-evaluated to determine if current methods are appropriate and adequate, considering multiple routes of exposure and scenarios that may be influenced by climate change. For instance, our understanding of how climate change could lead to increased uptakes and/or bioavailability of chemical contaminants in crops and livestock. Furthermore, currently available sources of data could be identified and critically reviewed to inform further active surveillance studies. Those datasets may include biomonitoring data from biobanks on exposures to chemicals.

3. Assess climate change scenarios: It is essential to examine scenarios of climate change that directly impact food safety. This includes understanding how exposure changes under different climate conditions like flooding, drought, heat and cold, and assessing potential risks to health and food systems.

# Conclusions

The workshop provided an opportunity for stakeholders to discuss the threats that climate change poses to chemical food safety, recognising the many gaps that exists in current knowledge with a consequent need for enhanced surveillance monitoring and research. The keynote and other presentations highlighted gaps in policies addressing the food safety impacts of climate change, recognising that many policy documents lack any acknowledgement of possible adverse effects on chemical food safety.

A key theme that emerged from the round table discussions included the need for a system mapping to illustrate the possible causal interactions between climate change and chemical food safety, including the myriad of chemicals potentially implicated and possible diverse climate change scenarios, while also taking account of anthropogenic factors. Prioritization and the articulation of research questions that are most important will be critical for advancing the discussions on climate change impacts on chemical food safety.

How public health agencies are prepared to respond to changing population exposures under climate change is dependent on strengthening surveillance systems that integrate environmental and health data, and cross-sector and multidisciplinary collaborations.

The need for collaborations was central to the discussions. This was recognised to be crucial for developing a shared understanding of possible risks and gaps in our knowledge, identifying shared goals, research questions and funding needs. Collaboration was identified as important for building a pool of experts to support and ensure appropriate responses to the issues identified.

In terms of getting this onto policy agendas, the complexity of identifying and attributing particular impacts of climate change on increased exposures to chemical contaminants, leading to increased incidence and severity of toxicological consequences may present challenges.  For instance, demonstrating the extra disability adjusted life years as a result of these exposures will be difficult, but should not be impossible. This highlights the need for more data to identify and characterise increasing adverse effects of climate change on chemical food safety.

# Outlook and next steps

It was agreed at the workshop that creating a network of stakeholders and experts was crucial to advancing work on this topic The network would enhance and share knowledge and foster collaborations for research and other actions.  As the stakeholder landscape is not static but evolves with emerging needs and research progress, a continuous review, identification and mapping of stakeholders will be important to ensure a robust a fit-for-purpose network. A future workshop was proposed to sustain the network.

The network will aim to work with knowledge mobilisers or brokers in key research institutions, organizations and government departments who may have a better overview of the strategy and policy landscape with regards to chemical food safety and climate change. This will be critical to mapping and identifying stakeholders, and horizon scanning to identify emerging needs, opportunities, and challenges and to prepare for these.

Another important next step will be to develop a workable well-focussed fundable research agenda that would facilitate collaborations with research universities, the UKHSA, and other government departments responsible for food policy.

# Acknowledgements

With thanks to all the participants and stakeholders for their contributions. The following stakeholder organizations were represented at the workshop. The outputs of this workshop may only reflect the views of the workshop participants.

| Organization | Country |
|---|---|
| Food Standards Agency | United Kingdom |
| UK Health Security Agency/Environmental Epidemiology | United Kingdom |
| London School of Hygiene Tropical Medicine | United Kingdom |
| CHEMTRUST - NGO | United Kingdom |
| United Nations Economic Commission for Europe | Switzerland |
| Georgian National Centre for Disease Control | Georgia |
| University of Sussex | United Kingdom |
| University of Edinburgh | United Kingdom |
| Athabasca University | Canada |
| International Society of Doctors for the Environment | Italy |

# Organizing Committee

Ariana Zeka (UKHSA), May van Schalkwyk (LSHTM), Erik Millstone (University of Sussex)

Scientific Secretariat: Rhoda Aminu (UKHSA)

Scientific Support: Valentina Guercio (UKHSA), Priya Mondal (UKHSA), Neena George (UKHSA)

# Appendix 1: Workshop Agenda

| **SCIENTIFIC PROGRAMME**<br>25th November 2024<br>11:00-17:00 | | |
|---|---|---|
| 11:00 – 11:10 | Registration and Tea/Coffee | |
| 11:10 – 11:15 | Welcome and Introductions | Dr Ariana Zeka |
| 11:15 – 11:25 | Scope of the workshop | Dr Ariana Zeka |
| 11:25 – 11:50 | Keynote | Professor Erik Millstone<br>*'UK food safety, climate change and chemical contamination'* |
| 11:50 –12:05 | Presentation 1 | Dr May van Schalkwyk<br>'*Food safety in the context of food security and climate change: mapping the policy landscape'* |
| 12:05 – 12:15 | Presentation 2 | Dr Valentina Guercio<br>*'Chemical food safety and surveillance for public health'* |
| 12:15 – 12:30 | Questions and Discussion | |
| 12:30 – 13:30 | **Lunch** | |
| 13:30 – 14:20 | Round Table Discussions | Chaired by M. van Schalkwyk |
| 14:20 – 14:50 | Feedback Panel Discussion | Chaired by M. van Schalkwyk |
| 14:50 – 15:05 | **Tea/Coffee Break** | |
| 15:05 – 15:55 | Round Table Discussions | Chaired by E. Millstone |
| 15:55 – 16:25 | Feedback Panel Discussion | Chaired by E. Millstone |
| 16:25 – 16:55 | Outputs discussion | Feedback from all |
| 16:55 – 17:00 | Closing remarks | Dr Ariana Zeka |

## About the UK Health Security Agency

UK Health Security Agency (UKHSA) prevents, prepares for and responds to infectious diseases, and environmental hazards, to keep all our communities safe, save lives and protect livelihoods. We provide scientific and operational leadership, working with local, national and international partners to protect the public's health and build the nation's health security capability.

UKHSA is an executive agency, sponsored by the Department of Health and Social Care.


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